

**Understanding how yoga relates to adults' experiences and their relationships with oneself
and others after gynecologic cancer treatment**

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Thesis submitted to the University of Ottawa
in partial Fulfillment of the requirements for the
Doctorate of Philosophy in Human Kinetics

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Abstract

This dissertation synthesizes findings from four novel studies exploring how yoga relates to adults' experiences and their relationships with oneself and others after gynecologic cancer treatment. *Study 1* (article 1) explored the self-perceptions of adults diagnosed with gynecologic cancer and the role of yoga in altering those perceptions via qualitative methods. The four main themes identified emphasized the complex interplay between body functionality, appearance, and sexual health as well as the potential pitfalls of negative self-perceptions stemming from preconceived expectations and attitudes while practicing yoga. *Study 2* (articles 2 and 3) was a qualitative meta-synthesis that synthesized findings from primary qualitative articles and developed an overarching interpretation of women's experiences participating in yoga after a cancer diagnosis. Two main focal areas emerged, presented in two parts: (1) impact of yoga on women's wellbeing and quality of life (QoL) after a cancer diagnosis, and (2) women's motives, barriers, and program preferences for yoga after a cancer diagnosis. Findings from Part 1 (article 2) demonstrated yoga yields a range of perceived benefits categorized into five broad QoL dimensions that interact: physical, emotional, psychological, cognitive, and social. Findings from Part 2 (article 3) illustrated the individual and situational motivators and barriers to participating in yoga for women diagnosed with cancer. Across the different modes of delivery, supportive and knowledgeable instructors, opportunities to connect with others, and comprehensive yoga classes that focus on more than just movement were identified as preferential qualities of yoga interventions and programs. Drawing on the evidence from *Studies 1* and *2*, *Study 3* (article 4) used a three-phase co-creation approach guided by the Knowledge-to-Action framework to co-create a community-based yoga program for adults with gynecologic cancer and an instructors' manual to guide delivery. End-users (i.e., adults diagnosed with gynecologic cancer, yoga

instructors) facilitated the creation of a 12-week bi-modal hatha yoga program with two weekly 60-minute classes and optional supplemental features. *Study 4* (articles 5 and 6) used a mixed-methods series N-of-1 feasibility trial to assess the feasibility, acceptability, and potential benefits of the yoga program. The findings are presented in two manuscripts addressing distinct objectives. Overall, the yoga program was well-received, and the study methods were moderately successful (article 5). While visual analysis and hierarchical linear modelling showed improvements in QoL, perceived cognitive abilities, sexual distress, negative body image, and perceived stress; however, visual analysis also suggests there may be some variability in participants' responses to the program (article 6). Collectively, the studies comprising this dissertation underscore the value of yoga as a holistic intervention for enhancing QoL and wellbeing of adults diagnosed with gynecologic cancer, advocating for its integration into survivorship care. The findings highlight the necessity of designing yoga programs that are appropriately tailored to address the nuanced self-perceptions of body functionality, appearance, and sexual health, while also considering the motivators and barriers to participation in yoga post-cancer diagnosis. The successful co-creation of a community-based yoga program illustrates the value of participatory design, suggesting that engaging end-users in the development process ensures programs are more aligned with participants' needs, thereby enhancing engagement and perceived relevance. However, the variability in participants' responses to yoga highlights the importance of individualized approaches both in delivering and evaluating programs. As the field continues to advance, a multidisciplinary approach that embraces the benefits of holistic and patient-centered care is imperative.

Acknowledgements

To my supervisor, Dr. Jennifer Brunet:

Thank you for your guidance and your faith in my ability to figure things out. Thank you for each and every new opportunity I had the pleasure to explore within the last seven years, both in my Masters and PhD. Most importantly, thank you for fostering my love for creating and improving, whether it is a new project, an old project, a program/intervention, or a manuscript. I look forward to seeing our partnership evolve in the coming years.

To my committee members, Dr. Leah Ferguson and Dr. Wendy Gifford:

Thank you for sharing your time and your insight – your guidance during my comprehensive exam and the proposal stage ensured the work presented herein was successful.

To my internal and external reviewers, Dr. Sophie Lebel, Dr. Serena Corsini-Munt, Dr.

Kimberly McMillan, and Dr. Melanie Keats:

Thank you for your insightful feedback, rigorous critiques, and thoughtful suggestions. I greatly appreciate the time and effort you invested in reading and evaluating my work. Your support and endorsement of my research have been greatly encouraging, and I am honoured to have had the opportunity to share my work with you.

To the Physical Activity and Health Promotion Lab:

Thank you, Sitara, for your continued support throughout this journey. Although our lab may have been small the last few years, you were an exceptional lab mate. You were a sounding board for ideas, sharing your insights and thoughts, as well as endless encouraging words. Also, thank you for suffering through reviewing more than 6000 titles and abstracts with me.

To the individuals who participated in this research:

I do not know how to thank you enough. At its core, this research would not be possible without the time (significant amounts of time) that each of you dedicated to this process. Your willingness to share, guide, and evaluate made an incalculable impact on the research and my experience. Your belief in the value of yoga for fostering quality of life is a never-ending source of encouragement and reminder of the importance of taking the time to prioritize ourselves. I feel truly grateful to have had the opportunity to meet and get to know each of you.

To my friends:

Thank you, thank you, thank you. Your love, support, encouragement, and much needed distractions you offered were paramount to the completion of this dissertation.

To my parents:

Despite each of you openly admitting, at one point or another, that you do not know what I do, you still willingly read my first few published articles, sharing in my excitement. So thank you, Heather and Aaron Smith, you have encouraged my never-ending curiosity and never once questioned whether I would succeed.

To my husband, Jared Wideman,

You came into this dissertation half-way completed and you showed nothing but unwavering faith in my abilities, a fierce pride in my accomplishments, enthusiasm for listening to me vent, and an uncanny ability to find humor in the way I solve all my problems by talking to myself. I am grateful for your lightheartedness, for brightening my days with your laughter, and for holding my hand when the nerves get the best of me. Thank you (and Pickles) for joining me on this journey - I love you more than words can express.

Reflexivity Statement

As a researcher, my identity and experiences significantly shape my approach to my work and the lens through which I interpret my findings. I am a PhD candidate in Human Kinetics at the University of Ottawa, specializing in the relationship between yoga and women's experiences after gynecologic cancer treatment. My academic journey, from a Bachelor's degree in Human Kinetics with a specialization in Sport Psychology and a minor in English Literature, to a Master's and now a Doctorate, has been deeply influenced by my commitment to understanding and improving health outcomes through physical and psychological interventions.

My identity as a cis-gender woman and my personal engagement with yoga for more than 10 years has undoubtedly informed my research. I primarily began my yoga practice as a form of physical movement but as I have moved through my dissertation and received my 200-hour yoga instructor certification, I have become more acutely aware of yoga's impact on my life, providing me with tools for physical health, mental clarity, and emotional resilience. I recognize the deep, rich history of yoga, which originates from ancient Indian traditions and has been practiced for thousands of years. It is important to honor and acknowledge this heritage while also understanding how yoga is experienced and adapted in contemporary contexts, particularly in Western societies.

I also recognize that many of the participants in my dissertation research look like me; they are cis-gendered women who share similar demographic characteristics (e.g., White, university educated). This similarity can foster a sense of shared understanding and empathy, which can enhance the research process. However, it also requires me to remain vigilant about my own biases and preconceptions. I strive to create a space where participants feel heard and valued, ensuring that their voices and experiences are authentically represented.

It is equally important to acknowledge the lack of diverse perspectives, particularly those of marginalized and Indigenous individuals, within both my research and the broader field of study. The absence of these voices is a significant limitation, and it highlights the necessity for more inclusive research practices that actively seek out and incorporate the experiences of underrepresented groups. This gap underscores the importance of intersectionality in understanding how different aspects of identity, such as race, ethnicity, and cultural background, intersect with health outcomes and experiences with practices like yoga.

In conducting this research, I am committed to upholding the principles of reflexivity, cultural sensitivity, and respect for the diverse backgrounds and experiences of all individuals involved. I acknowledge the privileged position I hold as a researcher and the responsibility that comes with it to contribute to the body of knowledge in a way that is respectful, inclusive, and meaningful. Moving forward, I aim to advocate for and engage in research that amplifies the voices of marginalized and Indigenous individuals, recognizing that their perspectives are vital to a comprehensive understanding of health and wellness practices.

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Overview and Statement of Contribution

I, Jenson Price, was responsible for conceptualizing and executing each of the studies included in this thesis under the supervision of Dr. Jennifer Brunet.

Chapter 1: Literature Review

- Focus: Provide the background for my research program. Throughout this chapter, the limitations of the current literature are underscored to make a case for the significance of this research program. The chapter ends with the overarching purpose of the dissertation and its specific objectives.

Chapter 2: Study 1 (article 1)

- Focus: Presents qualitative results from an interpretative phenomenological analysis exploring the thoughts, feelings, attitudes, and perceptions of adults who have completed gynecologic cancer treatment on their body (appearance and functionality), and how they perceive yoga to affect their thoughts, feelings, attitudes, and perceptions of their body.
- Status: Published
 - Jenson Price & Jennifer Brunet. (2024). Adults diagnosed with gynecologic cancer and their relationship with their body: A study on the supportive role of yoga using interpretative phenomenological analysis. *Body Image*, 49, 101705.
- Roles:
 - Jenson Price: Conceptualization, data collection/analysis/interpretation, drafted and revised manuscript.
 - Jennifer Brunet: Provided guidance for conceptualization, data interpretation, and critically reviewed the manuscript.

Chapter 3: Study 2, Part 1 (article 2)

- Focus: Presents results emanating from a qualitative meta-study meta-synthesis. Due to the breadth of data, results are presented in 2 parts with distinct topic areas. Part 1 is focused on yoga's impact on quality of life for women diagnosed with cancer.
- Status: Published
 - Jenson Price, Sitara Sharma, & Jennifer Brunet. (2023). Women's experiences with yoga after a cancer diagnosis: A qualitative meta-synthesis – Part 1. *Systematic Review*, 12(1).
- Roles:
 - Jenson Price: Conceptualization, developed search strategy and executed search, data analysis/interpretation, drafted and revised manuscript.
 - Sitara Sharma: Assisted data analysis and interpretation, and reviewed drafts of the manuscript.
 - Jennifer Brunet: Provided guidance for conceptualization, data interpretation, and critically reviewed the manuscript.

Chapter 4: Study 2, Part 2 (article 3)

- Focus: Part 2 of the results emanating from a qualitative meta-study meta-synthesis focused on the motives, barriers, and preferences of women diagnosed with cancer for yoga programs/interventions.
- Status: Published
 - Jenson Price, Sitara Sharma, & Jennifer Brunet. (2023). Women's experiences with yoga after a cancer diagnosis: A qualitative meta-synthesis – Part 2. *Complementary Therapies in Clinical Practice*, 51, 101752.
- Roles:

- Jenson Price: Conceptualization, developed search strategy and executed search, data analysis/interpretation, drafted and revised manuscript.
- Sitara Sharma: Assisted data analysis and interpretation, and reviewed drafts of the manuscript.
- Jennifer Brunet: Provided guidance for conceptualization, data interpretation, and critically reviewed the manuscript.

Chapter 5: Study 3 (article 4)

- Focus: Presents the 3-phase approach to the co-creation of a yoga program in partnership with The Ottawa Hospital and the Ottawa Regional Cancer Foundation and in collaboration with end-users (i.e., adults diagnosed with gynecologic cancer and yoga instructors).
- Status: Submitted to peer review journal
 - Jenson Price, Cheryl Harris, Naomi Praamsma, & Jennifer Brunet. Co-creating a yoga program for adults diagnosed with gynecologic cancer: A Consensus Study.
- Roles:
 - Jenson Price: Conceptualization, data collection/analysis/interpretation, drafted and revised manuscript.
 - Cheryl Harris: Supported recruitment, assisted in securing funding, and reviewed draft versions of the manuscript.
 - Naomi Praamsma: Supported recruitment, assisted in securing funding, critically reviewed the manuscript.
 - Jennifer Brunet: Provided guidance for conceptualization, secured funding, data interpretation, and critically reviewed the manuscript.

- Additional acknowledgements: We would like to thank Alice Tate for her dedication in the preparation of study materials and assistance during the consensus meeting and focus groups. We would also like to thank Stephanie Woodward and Patricia Barrett-Robillard for their dedication to the project during their tenure at the Ottawa Regional Cancer Foundation.
- Funding: This research was funded by the Social Sciences and Humanities Research Council of Canada, grant number 892-2021-1002, applicant: Jennifer Brunet.

Chapter 6: Study 4 (article 5)

- Focus: Presents the results of the series N-of-1 trial that assessed the feasibility and acceptability of the co-created yoga program and study methods for adults diagnosed with gynecologic cancer.
- Status: In preparation to be submitted to peer review journal
 - Jenson Price, Brooklyn Westlake & Jennifer Brunet. Evaluating the feasibility and acceptability of a community-based, co-created yoga program for adults with gynecologic cancer: A series N-of-1 feasibility study.
- Roles:
 - Jenson Price: Conceptualization, funding and donation acquisition, data collection/analysis/interpretation, drafted and revised manuscript.
 - Brooklyn Westlake: Assisted in data collection, cleaning, analysis, and interpretation, reviewed drafts of the manuscript.
 - Jennifer Brunet: Provided guidance for conceptualization, data interpretation, and critically reviewed the manuscript.

- Additional Acknowledgments: We would like to extend our sincerest appreciation to Jody Ryan for her dedication and excellence as an instructor, for which without her, the program would not have been as successful as it was. We would also like to thank Gracie Cook, Mila Phongphilack, and Soulene Sabir for their dedication as volunteers during the yoga program to assist the instructor. Finally, thank you to Dr. Cheryl Harris for supporting recruitment and Naomi Praamsma for championing the implementation of the program at the Ottawa Regional Cancer Foundation.
- Funding: This research was funded in part by the North American Society of the Psychology of Sport and Physical Activity, grant number: NA, applicant: Jenson Price.

Chapter 7: Study 4 (article 6)

- Focus: Presents the patient-reported outcomes of the series N-of-1 trial that assessed the co-created yoga program for adults diagnosed with gynecologic cancer.
- Status: In preparation to be submitted to peer review journal.
 - Jenson Price, Soulene Sabir, Brooklyn Westlake & Jennifer Brunet. A series N-of-1 feasibility trial to evaluate implementation of a co-created yoga program for adults diagnosed with gynecologic cancer: Patient-reported outcome results.
- Roles:
 - Jenson Price: Conceptualization, funding and donation acquisition, data collection/analysis/interpretation, drafted and revised manuscript.
 - Soulene Sabir: Assisted in data cleaning, analysis, and interpretation, reviewed drafts of the manuscript.
 - Brooklyn Westlake: Assisted in data collection, cleaning, analysis, reviewed drafts of the manuscript.

- Jennifer Brunet: Provided guidance for conceptualization, data interpretation, and critically reviewed the manuscript.
- Additional Acknowledgments: We would like to extend our sincerest appreciation to Jody Ryan for her dedication and excellence as an instructor, for which without her, the program would not have been as successful as it was. We would also like to thank Gracie Cook and Mila Phongphilack for their dedication as volunteers during the yoga program to assist the instructor. Finally, thank you to Dr. Cheryl Harris for supporting recruitment and Naomi Praamsma for championing the implementation of the program at the Ottawa Regional Cancer Foundation.
- Funding: This research was funded in part by the North American Society of the Psychology of Sport and Physical Activity, grant number: NA, applicant: Jenson Price.

Chapter Eight: Global Discussion

- Focus: Collates key findings and highlights conceptual, methodological, and practical contributions and implications from this dissertation.

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- Appendix B: Published protocol for series N-of-1 feasibility trial (*study 4*, article 5 and 6)
- Appendix C: Relevant Research Ethics Board approval notices for *studies 1, 3, and 4*
- Appendix D: Measurements and assessments for *studies 1, 2, 3, and 4*
- Appendix E: Supplemental data for *studies 2, 3 and 4*

Supervisor and Thesis Committee

Dr. Jennifer Brunet provided insight and guidance from design through to successful completion of each study and critically reviewed the articles contained within this thesis. Dr. Wendy Gifford and Dr. Leah Ferguson provided conceptual and pragmatic feedback on the thesis proposal.

List of Abbreviations

CINAHL: Cumulative Index to Nursing and Allied Health Literature

CLARIFY: Checklist Standardising the Reporting of Interventions for Yoga

CONSORT: Consolidated Standards of Reporting Trials

COREQ: Consolidated Criteria for Reporting Qualitative Research

ENTREQ: Enhancing Transparency in Reporting the Synthesis of Qualitative

KTA: Knowledge-to-Action (framework)

MEDLINE: Medical Literature Analysis and Retrieval System Online

MeSH: Medical Subject Heading

ORCF: Ottawa Regional Cancer Foundation

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

PROSPERO: Prospective Register of Systematic Reviews

QoL: Quality of life

SPIRIT: Standard Protocol Items: Recommendations for Interventional Trials

SPSS: Statistical Package for the Social Sciences

SSRD: Single-subject research design

Note: The formatting (e.g., references, heading levels, table layout, figures, quotations) and spelling (e.g., American vs. British) within this document can appear differently across Chapters due to variations in requirements set forth by journals.

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Chapter 1: Literature Review

Introduction

As treatments for cancer have improved, more Canadians are living with and beyond cancer [1], making post-treatment supportive care programming an important and integral part of healthcare [2]. There is growing recognition of the value in mind-body physical activity programming such as yoga in supporting quality of life (QoL) during and after treatment for cancer [3]. However, advancement in the development and implementation of supportive care services and programs in oncology is challenged by the existing evidence-to-practice gap in this area [4-6]. Traditionally, supportive care programs involving yoga (or otherwise) have been developed by researchers based on their understandings of what end-users need and available resources (e.g., time, financial) [7], which may differ from program end-user wants and often result in poorer enrolment and retention rates [8]. This emphasizes the need to shift approaches to involve end-users. Moreover, while there is a common experience among adults diagnosed with cancer, differences may exist across sub-groups; thus limiting the applicability of current evidence regarding supportive care programming generated mostly from adults diagnosed with breast cancer and focused predominantly on limited QoL outcomes [9]. Based on this premise, this program of research used a participatory-based knowledge translation approach to: (1) explore the role of yoga in cultivating positive experiences with self and others, and (2) determine the feasibility, acceptability, and benefits of a co-created yoga program among adults diagnosed with gynecologic cancer¹. To achieve these aims, 4 interrelated studies were

¹ There is much debate surrounding language use. For brevity, “adults diagnosed with gynecologic cancer” is used to capture the entire cancer trajectory (i.e., from diagnosis onwards); however, when necessary, more specific language is used.

conducted, which collectively have made significant conceptual, methodological, and applied contributions.

The following section overviews the: (1) context of focus (i.e., adults diagnosed with gynecologic cancer, relationship with their body), (2) approach to supporting an improved relationship with the body (i.e., physical activity, yoga, theoretical underpinnings of yoga, motives and barriers to participation), and (3) co-creation as a context for program development, implementation, and evaluation (i.e., models and frameworks, integrative knowledge mobilization [IKM] for program design, implementation gaps and strategies, evaluation approaches). It ends with an overview of the 6 articles (i.e., objectives and research designs) that form this dissertation. Each article in this dissertation also provides a detailed literature review pertaining to its research questions. Note, 2 additional published protocol articles are presented in Appendix A (qualitative meta-study meta-synthesis protocol, *study 2*) and Appendix B (series N-of-1 feasibility trial protocol, *study 4*).

Context of Focus

Gynecologic Cancer

Over 110,000 women will be diagnosed with cancer in Canada each year and over 11% will be diagnosed with a gynecologic cancer (i.e., ovarian, endometrial/uterine, cervical, vulvar, vaginal; [10]). The 5-year net survival rate ranges from 44% (ovarian) to 82% (uterine; [10]). Typically, the treatment for gynecologic cancer may involve a combination of surgery, chemotherapy, and radiation therapy [11]. Surgery often serves as a primary treatment method, aiming to remove cancerous tissues and may include procedures like hysterectomy (i.e., removal of the uterus) or oophorectomy (i.e., removal of one or both ovaries), depending on the type and stage of cancer [11]. Chemotherapy can be administered before or after surgery to manage any

cancerous cells [11]. Radiation therapy is often used to treat the area where the cancer has spread to or to kill any cancer cells before they grow into tumours, except in the case of vaginal cancer where it is often the primary method of treatment [11]. These treatments, while effective in increasing survival rates, come with a host of side effects that can profoundly impact a person's functioning [12-15], ultimately hindering QoL.

QoL

In the context of oncology, QoL is a multi-dimensional concept, encompassing physical, psychological, emotional, cognitive, and social dimensions [16, 17]. It reflects a person's appraisal of their current level of functioning against what they perceive as possible or ideal [18], thereby intertwining with the concept of wellbeing [19, 20]. The physical dimension refers to the state of the body and its ability to perform daily activities which is impacted by physical health, level of physical functioning, presence and management of symptoms (such as pain or fatigue), and the ability to engage in physical activities [16, 17]. Adults diagnosed with gynecologic cancer often experience reduced physical functioning through physical side effects ranging from scarring and weight changes to more severe consequences like reduced mobility, lower-limb lymphedema, urinary incontinence [21], and menopause related symptoms like hot flashes and vaginal dryness [22]. The psychological dimension encompasses how a person perceives their life circumstances and their ability to manage psychological challenges [16, 17]. Adults diagnosed with gynecologic cancer report anxiety, depression, reduced body image, negative self-perception, and high stress [21, 23, 24]. The emotional dimension focuses on the presence (or absence) of emotions, ability to manage and express emotions, and emotional stability [16, 17]. Adults diagnosed with gynecologic cancer report intense feelings of shock, disbelief, fear about the future, the uncertainty of treatment outcomes, concerns about mortality, grief, loss,

anger, and frustration [25]. The cognitive dimension addresses how cognitive functioning (e.g., thinking, reasoning, memory, attention, and problem-solving abilities) impacts daily functioning and the ability to engage in various life activities [16, 17]. One of the most notable cognitive side effects for adults diagnosed with gynecologic cancer is mental cloudiness or fog, characterised by a decrease in concentration and a general sense of cognitive fatigue, making it challenging to focus on tasks, follow conversations, or engage in activities of daily living [26, 27]. The social dimension of QoL is about relationships and social interactions, including quality and depth of personal relationships, social support networks, and the ability to participate in social activities [16, 17]. Adults diagnosed with gynecologic cancer report withdrawal from social activities (often linked to decreased functioning in other areas), a sense of loneliness, disconnection, and isolation [28, 29]. Although women diagnosed with gynecologic cancer report poorer QoL than published norms from the general population [12-15], little research has explored means of improving their QoL [30].

Sexual Health and Functioning

While not often included in traditional conceptualizations of QoL, the aspects of sexual health, functioning, and satisfaction have a notable impact on adults diagnosed with gynecologic cancer [31], with the majority reporting decreased sexual activity [32, 33] and increased sexual concerns post-treatment [21, 34]. This area of health includes an individual's ability to engage in and enjoy sexual activities, experiences of sexual desire and arousal, as well as the capacity to maintain comfortable and satisfying sexual relationships [11, 35]. This dimension also considers the psychological, emotional, and social factors that influence sexual health, such as bodily changes, self-image, intimacy issues, and the impact of health conditions or treatments on sexual function [35, 36]. Sexual health is a persistent area of concern among adults who have completed

treatment for gynecologic cancer [11, 37], necessitating the development and implementation of supportive care programs that can improve this outcome [38].

Body Image

Body image is a multidimensional construct focused on both the body's appearance and function that broadly captures perceptual (i.e., how one sees and describes their body's appearance and function), cognitive (i.e., how one thinks about their body's appearance and function), affective (i.e., how one feels about their body's appearance and function), attitudinal (i.e., how one evaluates or judges their body's appearance and function), and behavioural (e.g., how one behaves based on their perceptions, thoughts, feelings, and attitudes about body appearance and function) dimensions [39]. Scholars have acknowledged that part of cultivating a positive body image is the presence of functionality appreciation and acceptance, which is the admiration, respect, and honour an individual has towards the body for what it is capable of doing [40-42]. The body's capabilities is known as body functionality, a multifaceted construct that captures the body's physical capacities and internal processes (e.g., muscular strength, physical stamina), creative endeavours (e.g., singing, painting), bodily senses and sensations (e.g., digestion), communication with others (e.g., hearing, speaking, body language), and self-care (e.g., showering; [43]). As noted in the previous two sections, adults diagnosed with gynecologic cancer may be particularly susceptible to body image concerns due to changes in appearance and function (physical and sexual; [24]). However, body image research in oncology has largely concentrated on appearance-related aspects, such as weight and shape concerns in individuals diagnosed with breast cancer [44-46]. Whilst there may be an overlap in experiences, exploring the experiences of adults diagnosed with gynecologic cancer is warranted, as their

experiences may diverge from those with breast cancer, where concerns about femininity often overlap with more visible body image changes and societal beauty norms [44].

Approach To Supporting An Improved Relationship With The Body

Physical Activity and Cancer

Psychosocial and lifestyle support is often overlooked within the healthcare system [47]. Holistic support services and patient education and empowerment are vital in improving patient-reported outcomes, yet are frequently underprovided [48]. Physical activity has emerged as a pivotal strategy to mitigate the adverse physical and psychosocial side effects of cancer and its treatments, reduce the risk of comorbidities and secondary malignancies, and enhance patient reported outcomes (e.g., improved cardiovascular health, increased muscle strength, better management of fatigue, elevated mood and self-esteem, reduced anxiety and depression [49, 50]). These benefits are evident within quantitative and qualitative data, providing empirical support for the efficacy and effectiveness of physical activities ranging from dragon boating to aerobic exercise classes [51, 52]. Moreover, research on yoga has proliferated as it aims to cultivate positive feelings, behaviours, or cognitions in addition to conferring an array of general physical and psychological benefits observed with other forms of physical activity. Indeed, unlike other forms of physical activity, yoga emphasises a focus on cultivating a mind-body connection [53, 54], thereby helping participants address varying feelings, thoughts, and behaviours they may exhibit in relation to their body [55]. Thus, for adults diagnosed with gynecologic cancer, yoga may be a form of physical activity uniquely suited to addressing QoL, sexual health, and body image concerns [56].

Yoga and Cancer

Yoga, originating in ancient India, is a comprehensive system of physical, mental, and spiritual practices deeply rooted in philosophical and metaphysical principles [57]. At its core, yogic philosophy espouses the pursuit of union between the individual self (Atman) and the universal consciousness (Brahman), aiming to transcend the physical and mental barriers that prevent this realization. The classical text, Patanjali's Yoga Sutras [58], delineates the eight limbs (Ashtanga) of yoga, which include ethical disciplines (Yamas and Niyamas), physical postures (Asanas), breath control (Pranayama), sensory withdrawal (Pratyahara), concentration (Dharana), meditation (Dhyana), and ultimate absorption (Samadhi). These practices serve not only as a means for physical wellbeing but also as a pathway to spiritual enlightenment, emphasizing self-awareness, mindfulness, and inner peace [59-63]. Modern interpretations and adaptations of yoga have often focused on the physical aspects (Asanas), particularly in Western contexts [64], but the essence of yoga remains a holistic approach to the harmonization of body, mind, and spirit.

Within oncology, participants (who often comprise women diagnosed with breast cancer) report numerous benefits to participating in yoga. While several systematic reviews and meta-analyses suggest that yoga can positively affect QoL, depression, anxiety, fatigue, and sleep disturbances when compared to no intervention or other active interventions [65-68], the evidence is not uniformly conclusive. For instance, a systematic review examining the efficacy of psychosocial and physical activity-based interventions to improve body image among women treated for breast cancer reported mixed results for yoga's impact on body image [69]. In the broader context, empirical studies have shown improved sexual health in women without a history of cancer after participating in yoga interventions [70-72] and two small randomized controlled trials have demonstrated significant improvements in reducing menopausal symptoms in adults diagnosed with breast cancer compared with placebo control groups over periods of 8

weeks to 3 months [73, 74]. These inconsistencies invite a cautious conclusion regarding the benefits to participating in yoga, considering potential methodological limitations and the diverse nature of yoga programs. The variability in outcomes may be influenced by the diverse backgrounds and experiences of participants and the researchers designing the programs, often without direct lived experience. This underscores the potential value of a co-creation approach, which may lead to more consistent and relevant results, particularly in addressing QoL, body image, and sexual health concerns among adults diagnosed with gynecologic, an area where the applicability and benefits of yoga still remains to be established.

Potential Mechanisms Underlying Yoga's Impact

An underlying tenet of yoga is focused on developing a positive relationship with one's body, including movement in accordance with the needs of one's body in the present moment, enhanced body awareness, and promotion of self-compassion [58]. Accordingly, yoga could help promote greater body satisfaction and attunement to the body's internal states and capabilities (i.e., body functionality), potentially encouraging appreciation and acceptance of the body while counteracting the tendency to focus on body appearance [61]. Specifically, research suggests the physical postures in yoga can be physically challenging or gentle, allowing participants to experience empowerment, strength, and/or relaxation, potentially facilitating greater connection to oneself with renewed attention on the body in a gentler, more compassionate and positive manner [59-63]. Moreover, breathwork practices can provide a foundation for the calming of the mind through observation, control, or imagery [59-63], while meditation can help participants meet their present-moment experience with openness, acceptance, and nonjudgment [59-63].

Several theoretical and/or conceptual approaches have also been applied to explain how yoga promotes a positive relationship with one's body, wellbeing, and QoL. The embodiment

model of positive body image [75] identifies participation in embodying activities as a key factor in the development of positive body image through mind-body integration; empirical evidence has shown support for yoga to be an embodying activity among the general population [59]. The biopsychosocial model [76] highlights the interplay between biological, psychological, and social factors, and how they can impact health and wellbeing; empirical support among the general population exists for this model [77]. The social cognitive theory [78], which postulates that learning a new behaviour like yoga through social connection to facilitate observation and development of self-efficacy can foster empowerment and self-regulation skills, and ultimately wellbeing; empirical evidence among at-risk youth exists for this model [79]. As different theoretical and/or conceptual approaches offer insights into the mechanisms at play, a multi- or poly-theoretical approach to understanding yoga's impact on one's relationship with their body can help capture the complex and multifaceted nature of both yoga and QoL, body image, and sexual health.

Motives and Barriers to Participation in Yoga

Many adults diagnosed with gynecologic cancer still do not participate in physical activity, including yoga [80]. It is understandable if programs – mostly developed by researchers without lived experiences – fail to acknowledge or address motives and barriers these adults may have [8, 81]. On the one hand, certain motives (e.g., health benefits, stress management, social interaction, spiritual fulfillment [82, 83]) are hypothesized to lead to greater engagement. Conversely, barriers (e.g., physical limitations, time constraints, lack of access to resources, or psychological impediments such as low self-efficacy) can impede participation [83-85]. Therefore, a thoughtful approach to program design and implementation is imperative so yoga

programs are able to meet the specific needs (including motives and barriers) and preferences of different individuals, enhancing engagement and ultimately leading to desired outcomes.

Co-Creation as a Context for Program Design, Implementation, and Evaluation

Knowledge Translation and Co-Creation

According to the World Health Organization [86], knowledge translation is the process through which relevant end-users synthesize, exchange, and apply knowledge in order to accelerate the benefits of global and local innovation, strengthen health systems, and improve people's health. The primary purpose of knowledge translation is to bridge the know-do gap [87], ensuring that research is utilized by appropriate and/or intended end-users to improve health delivery systems and health outcomes [88, 89]. Knowledge translation is particularly important for the creation and delivery of supportive care programs. A program is defined as a set of deliberate, structured actions with necessary support systems aimed at achieving specific outcomes [90]. The process of program design, implementation, and evaluation is integral to ensure that a program is closely aligned with the specific needs of the target population, thereby maximizing resource efficiency and effectiveness [91, 92]. This tripartite approach, grounded in evidence-based practices, not only ensures the program's relevance and efficacy but also contributes significantly to the body of scholarly research, guiding future programs and policy decisions [91, 92]. It is recognized that frameworks or conceptual models are required to guide knowledge translation and program creation efforts, so that the process is better understood [93-95].

Theoretical Frameworks

PRECEDE-PROCEED Model (PPM)

The PPM is a community-based participatory research model [96] that embodies two aspects of interventions a) planning and b) evaluation. The PPM enables researchers to work collaboratively with the target audience to aid in developing and implementing programs. It uses an ecological approach to health promotion, which means that all aspects of the intended participants' environment are considered as potential intervention targets, including their own needs, perceptions, skills, and behaviour.

The PRECEDE phase (Predisposing, Reinforcing, and Enabling Constructs in Educational/environmental Diagnosis and Evaluation) represents the first half of the model. This phase focuses on the planning aspect. It consists of several assessments to understand the health issues at hand. In Phase 1 (social diagnosis) the ultimate desired result of the intervention is identified. In Phase 2 (epidemiological, environmental, and behavioural diagnosis) priorities are identified and set based on behavioural and environmental determinants and the behaviours, lifestyles, and/or environmental factors that affect those issues. In Phase 3 (educational and ecological diagnosis) the predisposing, enabling, and reinforcing factors that can affect the behaviours, attitudes, and environmental factors given priority in Phase 2 are identified. In Phase 4 (administrative and policy assessment and intervention alignment) the administrative and policy factors that influence what can be implemented are identified. The PROCEED phase (Policy, Regulatory, and Organizational Constructs in Educational and Environmental Development) represents the latter half of the model. This phase focuses on implementation and evaluation. In Phase 5 (implementation) the program is put into action. In Phase 6 (process evaluation) the implementation process is evaluated to determine whether the program operated as planned. In Phase 7 (impact evaluation) the immediate effects of the program are evaluated.

Finally, in Phase 8 (outcome evaluation) the long-term effects of the program are assessed. It is important to note, that while called “Phases,” the above steps do not need to happen linearly or step-wise, as the model is considered iterative. Figure 1-1 outlines the phases of the PPM.

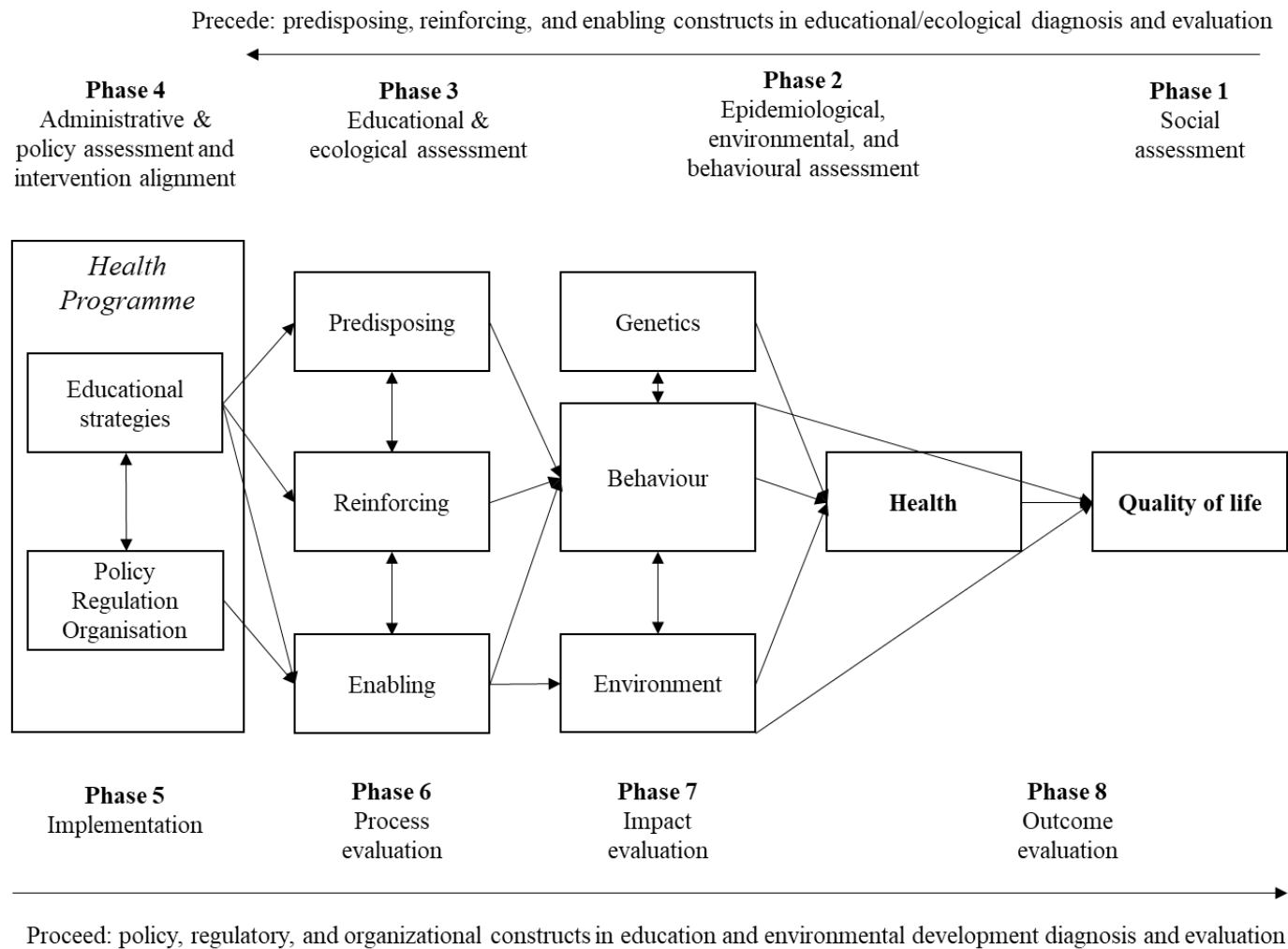


Figure 1-1. PRECEDE-PROCEED Model as conceptualized by Green & Kreuter (1991), *Health promotion planning: An educational and environmental approach*. 2nd ed. Mayfield Publishers.

Knowledge-to-Action (KTA) Framework

The KTA Framework is an influential model in the field of implementation science, serving as a guide for translating research findings into practical actions. The KTA framework was developed in response to the confusing multiplicity of terms used to describe the knowledge to action process [87]. The KTA framework comprises two distinct but related components: (1) knowledge creation (represented by the funnel) surrounded by (2) the action cycle. Each component involves several overlapping phases which can also be iterative. The knowledge funnel represents knowledge creation from knowledge inquiry (i.e., primary studies) to knowledge synthesis (e.g., systematic reviews) to third generation knowledge (i.e., knowledge tools or products). The action cycle outlines a process, representing the activities needed for knowledge to be applied in practice which may be carried out sequentially or simultaneously. The phases are: (1) identify a problem that needs addressing and identify, review, and select the knowledge or research relevant to addressing the problem; (2) adapt the identified knowledge or research to the local context; (3) assess barriers to using the knowledge; (4) select, tailor, and implement interventions to promote the use of knowledge; (5) monitor knowledge use; (6) evaluate the outcomes of using the knowledge; and (7) sustain ongoing knowledge use. Figure 1-2 outlines the KTA framework.

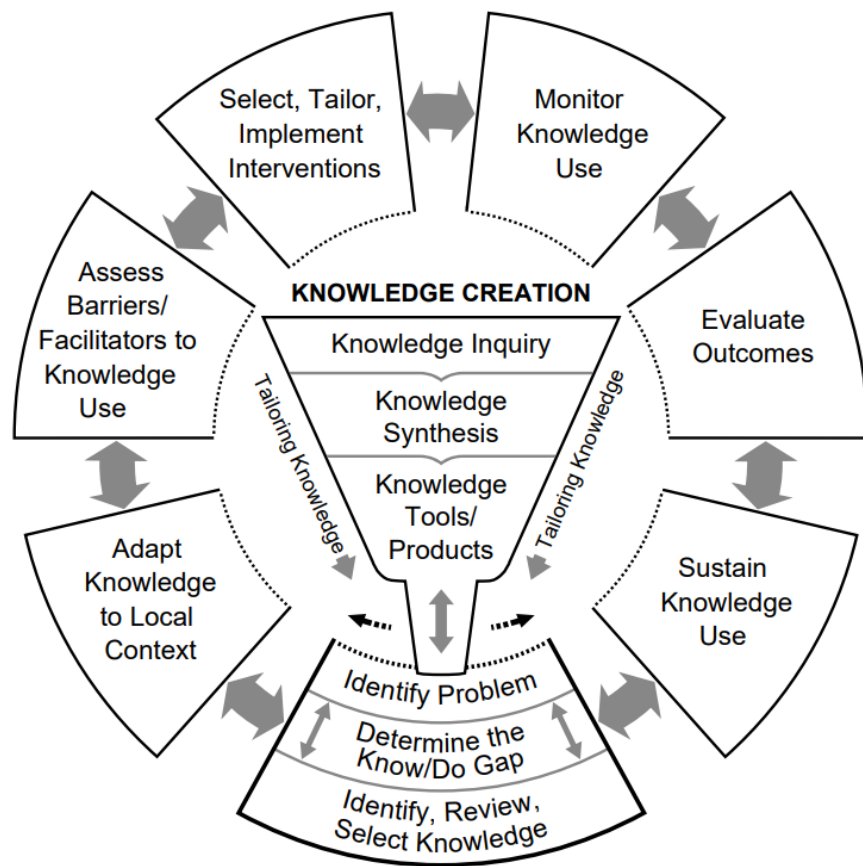


Figure 1-2. Knowledge-to-Action Framework as conceptualized by Graham et al. (2006), *Lost in knowledge translation: Time for a map?* Journal of Continuing Education in the Health Professions, **26**(1): p. 13-24.

Integration of PPM and KTA Framework

The PPM offers a comprehensive structure for program planning and evaluation, focusing on the identification of health issues and the development of strategic interventions [96]. The KTA framework, on the other hand, emphasizes the translation of research findings into actionable knowledge, ensuring that programs are evidence-based and tailored to specific contexts [87]. While either would be appropriate and would suffice to guide development, implementation, and evaluation of a supportive care program, together they may provide a seamless transition from theoretical planning emphasised in the PPM to practical application

emphasised in the KTA framework. Specifically, the KTA framework *Knowledge Funnel* can be bolstered by targeting the creation or synthesis of predisposing, reinforcing, and enabling constructs identified in the *PRECEDE phase* of the PPM. Similarly, the PPM does not provide context or guidance on the integration of these factors into a viable program – as the model shifts directly from the *PRECEDE* to the *PROCEED* overarching phases. Thus, the KTA framework's *Action Cycle* provides the guidance to address the creation of an actual program from the knowledge created during the *PRECEDE phase* of the PPM. Finally, while both model and framework include evaluation, the *PROCEED phase* evaluation steps (i.e., process, impact, and outcome evaluation) of the PPM provide helpful guidance on evaluation objectives that fill in the generalized step of “*evaluate the outcomes of using the knowledge*” in the KTA framework. Thus, utilizing the PPM to guide the collection of pertinent knowledge and the KTA framework to translate that knowledge into a viable program has the potential to enhance the efficacy and sustainability of supportive care programs.

Program Design using IKM

In program design, a significant challenge is the tendency of researchers to rely on their expertise and understandings of what participants need, often neglecting end-user insights [7]. This top-down approach can create a practical disconnect, potentially reducing a program's effectiveness for its intended audience [8]. IKM offers a solution, aligning with the principles of the PPM and KTA framework. IKM is a multidisciplinary methodology that systematically incorporates knowledge from academic research, practitioner expertise, policy insights, and community perspectives to enhance program design [97]. A central element of IKM is end-user engagement throughout the design process, ensuring programs are empirically grounded and

reflective of the target population's needs and values [97, 98]. This approach fosters innovation and effectiveness by creating programs that are evidence-based and contextually relevant [98].

IKM involves several steps, starting with identifying relevant knowledge sources and synthesizing literature through systematic reviews, meta-analyses, or qualitative thematic analyses (the *PRECEDE phase* of the PPM and *Knowledge Funnel* of the KTA framework; [97]). End-user consultation follows, where end-users contribute to interpreting and integrating available knowledge [97]. Then, as active steps are taken to create the program, it is necessary to consider the action cycle of the KTA framework. This can include co-creation, where knowledge is jointly developed rather than merely shared post-research [99, 100]. The International Association for Public Participation outlines a spectrum of public involvement in research, ranging from consultation to empowerment [101]. In deeper engagement phases that align with IKM methodology, a prolonged, flexible interaction between academics and non-academics aids in creating context-specific knowledge and programs [97, 101]. The design process is iterative, with continuous end-user feedback for refinement, evaluation, and eventual implementation [91, 92, 97, 101].

Implementation Gaps

Developing effective programs is only the first step in enhancing population health and wellbeing [102]. Real-world application and sustained delivery of a program involves navigating a complex, multi-phase diffusion process [103]. These phases include dissemination (i.e., spreading program awareness and value to the community), adoption (i.e., a local organization decides to trial the program), implementation (i.e., program execution during trial), and sustainability (i.e., long-term maintenance; [103]). Implementation of a supportive care program often requires a detailed operational plan (i.e., protocol; specifying activities, timelines, roles),

resource management (e.g., financial, human, material), end-user (e.g., funders, staff, and participants) engagement and communication, continuous monitoring (e.g., assess progress and alignment with program goals), and risk management (e.g., identifying potential issues, developing mitigation strategies) [104].

It is important that the potential value of new programs is adequately tested, and this is impossible without attending carefully to the process of implementation [105-108]. However, there is scant literature on implementation outcomes in the yoga literature [109, 110] despite calls for greater reporting on such outcomes [111]. Monitoring and assessing implementation fidelity to the program (and study) protocol is critical for determining both internal and external validity because outcomes hinge on understanding which program aspects were delivered and their execution quality [112, 113]. For instance, poor protocol adherence can result in null or negative results, whereas different-than-intended delivery could yield positive outcomes but be misrepresented in results if not properly evaluated. Moreover, implementation data can also serve to inform theoretical underpinnings of programs by verifying effective administration of key components [104]. Thus, proper documentation and reporting of implementation outcomes is vital for success and sustainability of community-based yoga programming.

Evaluation Approaches

Finally, arguably the most important but often neglected portion of the PPM and KTA framework is program evaluation [114]. Evaluation is essential for assessing the efficacy of the program, participants' satisfaction, and learning outcomes of program resources and activities [87, 90, 96]. While there are several conceptualizations of evaluation [e.g., 90, 96, 115], the PPM prioritizes assessing the implementation process, immediate impact and effect of the program, and long-term outcome effects of the program. The majority of yoga program evaluations focus

on assessing the immediate effects of the program [110]. Thus, essential outcomes are often unreported (or even assessed) and critical insights into the program's practical implementation (e.g., end-user reception, adherence to the intended design) are not incorporated into future iterations of program delivery. Robust evaluations should take into consideration merit (program's intrinsic value), worth (extrinsic value in the broader community), and value (program's relevance in political and social contexts), in addition to individual impact (effect on participants) to provide a full picture and assessment of program implementation [90]. Indeed, prioritizing the assessment of feasibility, acceptability, and fidelity to study methods and program protocol (in addition to patient-reported outcomes) may support a more comprehensive evaluation of a program [116-121]. Feasibility assessment focuses on the practicality of the program (and study methods) within given constraints, such as resources, time, and organizational capacity, thus determining the likelihood of successful implementation [116]. Acceptability evaluation, on the other hand, gauges the extent to which the program (and study methods) is agreeable, palatable, or satisfactory to end-users, including participants, implementers (i.e., yoga instructors), and funders (e.g., tri-council agencies, community organizations [118, 119]). This aspect is crucial in ensuring buy-in and sustained engagement. Finally, fidelity assessment examines the degree to which the program (and study methods) is implemented as originally planned, highlighting potential deviations from the intended protocol [121]. High fidelity is often associated with better program outcomes, making this evaluation vital for understanding not only implementation but potentially the program's effectiveness [120].

Description of Articles

The purposes of this program of research were to: (1) explore the role of yoga in cultivating positive experiences with self and others, and (2) use the co-creation of knowledge through collaboration with adults diagnosed with gynecologic cancer and yoga instructors to determine the feasibility, acceptability, and benefits of a yoga program. This dissertation addresses these purposes via 4 studies (6 articles), which can be found in Table 1-1. The specific objectives addressed in each study and their connections to theoretical/conceptual approaches described in the previous section are outlined below.

Table 1-1. Map of dissertation articles

	Article 1	Article 2	Article 3	Article 4	Article 5	Article 6
PPM/ KTA Phases	PPM: Social assessment; Epidemiological, environmental, and behaviour assessment	PPM: Social assessment; Epidemiological, environmental, and behaviour assessment; Educational and ecological assessment	PPM: Educational and ecological assessment; intervention alignment	PPM: Administrative and policy assessment and intervention alignment KTA: Identify problem; Select the knowledge; Adapt knowledge to the local context; Assess barriers to knowledge use; Select and tailor intervention to promote knowledge use	PPM: Implement; Process evaluation; Impact evaluation; KTA: Implement intervention to promote knowledge use; Monitor knowledge use; Evaluate outcomes of using knowledge	PPM: Implement; Outcome evaluation KTA: Evaluate outcomes of using knowledge
Purpose	Explore the relationship of adults diagnosed with gynecologic cancer with their body and the role yoga might play in shaping this relationship	Part 1: Synthesize qualitative research on the impact of yoga on quality of life among women diagnosed with cancer	Part 2: Synthesize qualitative research on the motives, barriers, and preferences for engaging in yoga among women	Co-create a yoga program for adults diagnosed with gynecologic cancer with an accompanying instructor guidebook	Part 1: Assess the feasibility, acceptability, and fidelity to the co-created yoga program and study methods	Part 2: Assess the potential benefits of the co-created yoga program

			diagnosed with cancer			
Methodology	Interpretative phenomenological analysis	Qualitative meta-study meta-synthesis	Qualitative meta-study meta-synthesis	Consensus panel and phenomenology	Mixed-methods series N-of-1 feasibility trial	Mixed-methods series N-of-1 feasibility trial
Sample	15 adults who had completed treatment for gynecologic cancer and regularly participated in yoga	24 primary qualitative articles exploring women's experiences participating in yoga after cancer	16 primary qualitative articles exploring women's experiences participating in yoga after cancer	Advisory board: 2 adults diagnosed with gynecologic cancer, 2 yoga instructors Consensus meeting: 8 adults diagnosed with gynecologic cancer, 13 yoga instructors Focus groups: 6 adults diagnosed with gynecologic cancer, 11 yoga instructors	20 adults diagnosed with gynecologic cancer, 1 yoga instructor	20 adults diagnosed with gynecologic cancer
Methods	Sociodemographic survey, 2 semi-structured interviews, 30-day journal	Systematic search of 6 databases, thematic synthesis of primary article findings	Systematic search of 6 databases, thematic synthesis of primary article findings	Sociodemographic surveys, Consensus meeting (i.e., large and small group	9-11 surveys (pre-program, during, post-program), semi-structured interview, outcome tracking, audio-	9-11 surveys (pre-program, during, post-program)

discussions),
focus groups

and video-
recordings of
yoga classes

Note: Articles presented in supplementary files were not included in this table as they present protocols for Articles 2 and 3 (meta-synthesis) and Articles 5 and 6 (feasibility trial). PPM = PRECEDE-PROCEED Model. KTA = Knowledge-to-Action Framework.

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Chapter 2: Study 1 (article 1), Interpretative Phenomenological Analysis

Gynecologic cancer survivors' relationship with their body and the supportive role of yoga:

An interpretative phenomenological analysis study

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Published in *Body Image*

Final publication is available from Elsevier:

<https://doi.org/10.1016/j.bodyim.2024.101705>

Abstract

The purpose of this qualitative study was to explore the thoughts, feelings, attitudes, and perceptions of adults diagnosed with gynecologic cancer on their body, and the role of yoga in shaping these aspects. A phenomenological research design was used. Fifteen women ($M_{age}=50.1\pm13.5$ years, range=28-66) who practice yoga $\geq$ once/week completed a sociodemographic survey online, two semi-structured interviews, and a 30-day journal online. Quantitative data were analysed using descriptive statistics. Qualitative data were analysed using interpretative phenomenological analysis. Participants' responses and the authors' interpretations were summarized into four main superordinate themes: (1) internal monologue of the changed body, (2) a balancing act between acceptance and improvement, (3) value of taking time to prioritize oneself by practicing yoga, and (4) transformative catalysts of expectation and mindset on body-related self-perceptions after yoga. Body functionality and appearance, and their sexual health were often deeply interconnected, and impacted participants' self-perceptions and behaviours. Yoga was a vehicle for growth and acceptance; however, participants' expectations and mindsets before and during yoga could lead to negative self-perceptions after yoga. The findings underscore the importance of integrating yoga – a holistic practice – into survivorship care programs, while emphasizing the need to address expectations and attitudes that could hinder positive outcomes.

Keywords: body image, oncology, women, mind-body, yoga

1. Introduction

Body image is a multidimensional construct focused on *both* the body's appearance and function that broadly captures perceptual (i.e., how one sees and describes their body's appearance and function), cognitive (i.e., how one thinks about their body's appearance and function), affective (i.e., how one feels about their body's appearance and function), attitudinal (i.e., how one evaluates or judges their body's appearance and function), and behavioural (e.g., how one behaves based on their perceptions, thoughts, feelings, and attitudes about body appearance and function) dimensions [1]. Body image research in oncology has primarily focused on body appearance, specifically investigating weight and shape concerns among breast cancer survivors [2-4]. In addition, theory, research, and practice dedicated to improving body image has mostly focused on negative body image outcomes (e.g., body shame, body dissatisfaction) under the assumption a lack of negative body image equates to positive body image. However, experts have argued that by only studying the negative aspects of body image there is insufficient understanding of body image and psychological health [1]. While negative body image can be broadly understood as general dissatisfaction with the body [1], positive body image captures an overarching love and respect for the body [1, 5].

Scholars have acknowledged that part of cultivating a positive body image is the presence of functionality appreciation and acceptance, which is the admiration, respect, and honour an individual has towards the body for what it is capable of doing [5-7]. The body's capabilities is known as body functionality, a multifaceted construct that captures the body's physical capacities and internal processes (e.g., muscular strength, physical stamina), creative endeavours (e.g., singing, painting), bodily senses and sensations (e.g., vision, taste, pain), communication with others (e.g., hearing, speaking, body language), and self-care (e.g., showering; [8]). Several

studies have shown that people experiencing changes to their body due to trauma, aging, and/or illness may experience psychosocial challenges and difficulties adjusting to a “new” body [9-12]. These changes can lead to a perceived loss of valuable leisure activities [10], a higher valuation for appearing capable [11], and appreciation of function gains as important for positive body image [12]. Thus, body functionality warrants further attention within populations experiencing changes to their body, such as adults diagnosed with cancer.

Researching body appearance among adults who have completed gynecologic cancer treatment is important as many changes related to appearance occur (e.g., weight gain, scars; [13]), which are often inconsistent with Western appearance ideals. Moreover, researching body functionality in this population is critical because gynecologic cancer and curative treatments affect several body functions including reduced strength and mobility, lower-limb lymphedema, urinary incontinence, and medically-induced menopause [13]. In addition, unmanaged menopausal symptoms like hot flashes, changes in mood, and difficulty sleeping may impact overall quality of life, function, and desire for intimacy [14]. The entire cancer trajectory (i.e., tumour growth through survivorship) of gynecologic cancer can dramatically impact survivors’ sexuality, sexual functioning, intimate relationships, and sense of self [15]. Nearly half of adults diagnosed with gynecologic cancer report less sexual activity than prior to their cancer diagnosis [16, 17], and between 33% and 100% report sexual concerns following cancer treatment [18], including challenges with sexual interest and arousal, orgasm, and genito-pelvic pain [13]. These changes to their body functionality can contribute to several psychosocial side effects, including a loss of femininity and feelings of not being whole or a true woman [13, 19]. Further, an unsupportive intimate partner can exacerbate concerns related to body functionality (e.g., reduced emotional connection due to shame associated with reduced sexual functionality; [20]).

Thus, adults who have completed gynecologic cancer treatment may be particularly susceptible to body image concerns due to changes in appearance and function (physical and sexual; [21]), and living with the impact of cancer; thus, to comprehensively understand body image, the dual experiences in body image needs to be explored further.

Beyond better understanding body functionality, it is crucial to explore strategies for improving the body image of adults who have completed gynecologic cancer treatment and their relationship with their body. There is evidence that supports the notion that yoga is an embodying activity that can improve body image [22, 23]. Yoga is an ancient practice that involves physical movement (i.e., asanas), focused breathing (i.e., pranayama), and meditation (i.e., dhyana; [24]). The practice of yoga addresses, and is aimed at integrating, the physical, mental, emotional, and spiritual aspects of one's being [24]. An underlying tenet of yoga is focused on developing a positive relationship with one's body, including movement in accordance with the needs of one's body in the present moment, enhanced body awareness, and promotion of self-compassion [24]. Therefore, yoga could be helpful in promoting greater body satisfaction and attunement to the body's internal states and capabilities (i.e., body functionality), potentially encouraging appreciation and acceptance of the body while counteracting the tendency to focus on body appearance [25]. However, the majority of research in oncology has focused on testing the effects of yoga on quality of life among women diagnosed with breast cancer [26]. It is vital to explore the experiences of adults who have completed treatment for gynecologic cancer because their experience might differ from that of adults diagnosed with breast cancer, whose concerns about femininity often intersect with more visible changes in body image and societal perceptions of beauty [2]. Though it is possible that adults who have completed treatment for gynecologic cancer experience similar benefits to those reported by

breast cancer and other adults diagnosed with cancer [27], engaging in introspection could further aid in reconciliation with internal bio-psycho-social changes and the restoration of a sense of wellbeing. However, if and how this could occur needs to be investigated. Indeed, whilst a recent qualitative meta-synthesis of women's experiences participating in yoga after a cancer diagnosis revealed that women experience increased positive beliefs about the self, reduced inner critiques, and freeing of oneself from negative perceptions about the body, this synthesis also showed they are underrepresented in research [27].

1.1. Explaining the Relationship Between Yoga and Body Image

Several theoretical and/or conceptual approaches have been applied to explain the influence of yoga on promoting a positive relationship with one's body. For example, the *embodiment model of positive body image* [28] identifies participation in embodying activities as a key factor in the development of positive body image through mind-body integration. Embodying activities encourage body awareness, physical empowerment and competence, and deep absorption in the activity. Yoga has been shown to be an embodying activity; yoga participation was associated with greater positive body image, embodiment, and reduced self-objectification, with the relationship between yoga participation and positive body image being serially mediated by increased embodiment and reduced self-objectification [29]. Another example is the *biopsychosocial model* [30], which advocates for a comprehensive approach to understanding health by considering the interconnectedness of physical health, mental states, and social environments. Proponents of this model suggest that interventions have greater impact on a person's wellbeing when interventions extend beyond the physical body (i.e., biological) and also incorporate or impact psychological and social outcomes [31]. This is the case with yoga as it can impact physiological and psychological outcomes concurrently [27], and it can be

practiced in many ways, such as in group classes. Ross, Bevens [32] offer support for the purported tenets of the biopsychosocial model. In a study exploring the influence of yoga on interpersonal interactions among a sample of 171 men and women from the general population, the authors found yoga practice led to personal transformation, increased social interaction, provided coping mechanisms to weather relationship losses and difficulties, and led to spiritual transcendence. These results support the model's applicability in exploring how yoga can positively influence psychological and social outcomes. As such, yoga—an embodying physical activity—might lead to personal transformations that may support more body appreciation and positive social interactions in adults who have completed gynecologic cancer treatment.

1.2. The Current Study

Gynecologic cancer treatment results in immediate and late appearing changes to body appearance and functionality, potentially impacting interactions with others (sexual or platonic). To better understand the impact of gynecologic cancer on survivors, it is important to investigate the different aspects of body image (e.g., negative *and* positive body image, appearance *and* functionality), and explore the impact of yoga in the real-world. Thus, the purpose of this qualitative study was to: (1) explore the thoughts, feelings, attitudes, and perceptions of adults who have completed gynecologic cancer treatment on their body (appearance and functionality), and (2) explore how they perceive yoga to affect their thoughts, feelings, attitudes, and perceptions of their body. To do so this study comprised two semi-structured interviews and the completion of journals pertaining to the women's yoga practice, body image, and interactions with others.

2. Methods

2.1. Study Design

Study details are reported following the Standards for Reporting Qualitative Research guidelines [33]. A phenomenological research design was used for this study, which was approached from a social constructivism paradigm, adopted a relativist ontology and transactional epistemology, and followed a hermeneutical methodology [34]. Accordingly, the authors' stance is that there are multiple realities in the world, generalizations are partial, conditional, and situated in the context for which they occur. Taking this into account, the authors chose methods that allowed participants to activate their voices and express their realities.

2.2. Research Team

The research team consisted of JP, a PhD candidate in her late-20's, a qualitative research trainee in physical activity and health promotion, and a certified vinyasa yoga instructor and JB, a Full Professor in the Human Kinetics department in her early-40's who has experience conducting qualitative research to understand people's suffering and thriving after cancer diagnosis and treatment. Both authors are White, have no physical disabilities, and have never been diagnosed with cancer, though both authors have had several close family members experience cancer. They collaborated to develop the study materials (e.g., interview guide) and elaborate initial concepts to investigate, which evolved based on participants' responses, as well as to analyse, interpret and report the data. They continuously acknowledged and reflected on their preconceptions, life experiences, and knowledge as they collected and interpreted the data.

2.3. Participants

Participants were recruited across Canada from July to October 2021 through: (1) referral via The Ottawa Hospital staff, and (2) self-referral via letter mailouts to consenting patients at The Ottawa Hospital, recruitment posters distributed around Ottawa (ON), and postings on social

media. Eligible women were: ≥ 18 years, diagnosed with a non-metastatic gynecologic cancer, free of cancer, practice yoga ≥ 1 /week during a typical month, and able to read/understand English. In line with recommendations for interpretative phenomenological analysis [35], recruitment ceased when 15 participants completed interview one because there was redundancy in the experiences being shared.

2.4. Procedures

The Ottawa Hospital (file number: 20210260-01H) and the University of Ottawa (file number: H-06-21-7167) ethics committees approved the protocol for this study. Self-referred individuals ($n=32$) contacted JP or were contacted by JP if staff referred ($n=3$), were screened for eligibility by phone, and were provided with detailed information about the study. During the call, eligible individuals provided verbal consent and had their first interview scheduled. Within 48 hours of their interview, participants were emailed a link to SurveyMonkey (a secure online survey platform) containing a brief sociodemographic questionnaire and asked to complete it prior to their interview. Then, participants were interviewed. The morning following their interview, they were emailed a link to access their 30-day journal online, which was housed on SurveyMonkey. Every seven days, JP emailed participants to prompt/remind them to complete their journal. One week prior to the conclusion of the 30-day online journal, participants were emailed to schedule their second interview within to two weeks of completing the 30-day period (regardless of journal completion rate).

2.5. Data Collection

2.5.1 Sociodemographic Questionnaire

Participants self-reported personal (i.e., age, self-identified gender, annual household income, education attainment, school/work status) and medical information (i.e., cancer

diagnosis and stage, treatment protocol, time since treatment, co-morbid conditions). These data were used to describe the sample.

2.5.2. Interviews

Two semi-structured interviews were conducted to: (1) develop a rapport with women to help them feel a sense of safety while sharing potentially emotionally laden topics, (2) allow for follow-up of content from interview 1, and (3) enable either party to clarify any potentially confusing elements from interview one [36]. Audio-recorded interviews were conducted by JP via teleconferencing technology ($n=17$) or by phone for those who did not wish to use teleconferencing technology ($n=12$)². The initial interview guides were developed by both authors that featured exploratory questions that broadly reflected topics published in the literature [28, 37, 38], probed gaps aligned with the research questions, and were structured based on guidelines for interpretative phenomenological analysis studies [35, 39]. However, consistent with interpretative phenomenological analysis [35], JP attempted to approach each interview as independent from any others, using the interview guide as a ‘guide’ to content, but allowing the conversation to flow naturally. As well, she transcribed interviews, read each transcript several times to achieve a broad understanding of participants’ experiences, and used this information to develop probes for interview 2. She also drew on each participant’s journal entries to form probes pertaining to their yoga practice behaviours (i.e., frequency, location, timing, medium of instruction); thus, interview guides evolved over time to reflect each participant’s responses. Moreover, given the flexibility of interpretative phenomenological analysis [35], participants were encouraged to deviate from the interview guide questions as they wished and discuss experiences that had significant meaning for them.

² One participant dropped out before completing the second interview (reason: unknown). As they did not request to have their data withdrawn, data from their first interview were analyzed for this study.

For interview 1, questions were focused on: (1) participants' value and attitude towards their body appearance and functionality, (2) their sexual and emotional relationships with others, and (3) how they perceive yoga to affect their thoughts, feelings, and perceptions towards their body and interactions with others. Interview one lasted, on average, 80 minutes (range=50-110 minutes). For interview 2, questions (informed by interview one responses, journal entries, and the literature) focused on: (1) their yoga experience over the 30-days, (2) how components of yoga shaped their thoughts, feelings, and perceptions of their body and interactions with others, and (3) value and meaning of yoga to them. Interview two lasted, on average, 65 minutes (range=40-100 minutes). See [Appendix D](#) for the initial interview guides.

2.5.3. Journal

Participants completed a 30-day journal to: (1) facilitate reflections between interviews 1 and 2, (2) gain additional insight into their current yoga practices, and (3) add breadth and depth to the analyses of interviews by triangulating data to explore nuances, discrepancies, and contradictions in the interview findings [40]. Whereas retrospective accounts during interviews are valuable to understand participants' overall perspective of their relationship with their body and role of yoga in their life, it is important to recognize that yoga practice is dynamic; it ebbs and flows over time, which presents challenges if only relying on end-of-study retrospective accounts. Journals were deemed important to investigate dynamic patterns and possibly understand setting- or context-specific information that could be forgotten. Following an event-based response protocol [41], women were asked to write in an online journal after every yoga practice for a 30-day period. A structured journal was set up in SurveyMonkey and contained closed- and open-ended questions to encourage reflections on: (1) yoga characteristics (closed-ended), (2) general thoughts and feelings before and after yoga (open-ended), (3) body-related

thoughts and feelings before and after yoga (open-ended), (4) additional behaviours undertaken during the week to address thoughts and feelings towards their body (open-ended), and (5) interactions with partner (if any) and others (open-ended). A total of 122 completed journal entries were submitted, with participants submitting an average of eight journal entries (range=2-27). See [Appendix D](#) for the journal prompts.

2.6. Data Analysis

Descriptive statistics were estimated for quantitative data in Microsoft Excel. Interview transcripts and open-ended responses from journal entries were deidentified and imported into NVivo (and matched using participant number identifiers) and analysed following recommendations for interpretive phenomenological analysis [42]. JP was primarily responsible for examining and interpreting the data and engaged in the meaning making process with JB. The data analysis was conducted in a structured, four-stage approach to ensure all data contributed to the findings, yet was inherently iterative, allowing for ongoing refinement and validation at each juncture. In *Stage 1*, JP read the first participant's transcript, paying particular attention to semantic content, language use, and explanations. In-depth reading and initial notes were used to produce a comprehensive and detailed set of notes that provided descriptive comments (e.g., keywords, phrases, explanations), linguistic comments (e.g., metaphors used), and conceptual comments (e.g., interpretations of participant's life experiences). Then, JP used these notes to develop emergent themes (i.e., initial patterns in the data). After, she mapped interrelationships, connections, and patterns between emergent themes and grouped similar emerging themes into superordinate themes (i.e., higher-level themes encompassing several emergent themes) in Microsoft Excel (to provide a visual audit trail). JP repeated the above steps for the remaining participants, flagging emergent themes that were recurrent (i.e., shared understandings),

contrastive (i.e., varying understandings), and deviant (i.e., contradictory understandings). For *Stage 2*, JP analysed participants' journal entries. Due to the structured, but open-ended nature of journal entries [43], a categorization matrix was created based on existing literature and the research objectives. Then, responses were coded based on the prompt and whether they described negative or positive experiences. Next, similar codes were combined to form emergent themes. For *Stage 3*, JP repeated the Stage one steps for interview two transcripts. For *Stage 4*, the superordinate themes from the interviews and journal entries were compared to explore similarities and consistencies between participants, highlight instances of marked discrepancies, contradictions, and polarity (when they occurred), to establish main themes (i.e., overarching themes that represent the core insights of the data), and the most articulate or powerful quotations within each theme were chosen for purposes of illustration. Quotations are presented with participant pseudonyms.

2.7. Trustworthiness

Several approaches were taken to establish trustworthiness of the data and findings [44, 45]. First, the interviewer (JP) attempted to suspend her existing knowledge and experience to see the world as experienced by participants during the interview. She has interests in yoga, body image, sexual health, and oncology, and this likely influenced the interpretative level of the analysis, which is encouraged by interpretative phenomenological analysis methodology. Second, the second author (JB) read the findings of JP's analysis at different stages and acted as a 'critical friend' to help JP (re)assess, (re)interpret, and refine themes. They engaged in a critical discussion to understand alternative interpretations of the data and come to mutual agreement of main themes and superordinate themes. Third, JP built rapport with participants to allow participants to openly disclose their experiences and perspectives. Fourth, transferability and

dependability of the findings was enhanced by providing detailed descriptions of participants and their experiences, as well as the research team and study methods. Last, the current study's innovative use of both interviews and journals elicited rich dialogues and accounts, permitting insights into participants' experiences, and in turn sharing of their words to enhance confirmability of the findings.

3. Results

Participants were 15 women who have completed treatment for a gynecologic cancer who were, on average, 50.1 ± 13.5 years of age (range=28-66) and diagnosed 2.9 ± 3.05 years prior to the study (range=0.25-11). Participants were diagnosed with cervical ($n=6$), endometrial/uterine ($n=5$), ovarian ($n=2$), and vaginal ($n=1$) cancers. Most were diagnosed with stage I cancer ($n=8$, 53.3%), married or in a common law relationship ($n=10$, 66.7%), had at least a tertiary education (i.e., college, university, graduate school; $n=11$, 73.3%), worked full-time ($n=8$, 53.3%), and seven (46.7%) had ≥ 1 child. Table 2-1 presents a summary of participants' yoga practices during the 30-day journaling period.

Table 2-1. Summary of yoga practice as reported in the online journal (N=122 entries)

Characteristic	n (%)
Yoga style	
Hatha, Vinyasa, and Power	25 (20.66)
Yin	24 (19.83)
Vinyasa	22 (18.18)
Restorative	8 (6.61)
Hatha	4 (3.31)
Chair	4 (3.31)
Yesudian	4 (3.31)
Power/exercise	3 (2.48)
Yin and Hatha	2 (1.65)
Breathwork	1 (0.83)
Meditation	1 (0.83)
Other (e.g., flexibility, core, Barre)	3 (2.48)
I don't know	21 (17.36)
Length of practice session	

<29 mins	105 (86.78)
30-45 mins	68 (56.20)
46-60 mins	4 (3.31)
>61 mins	6 (4.96)
Location of practice	
Home	114 (94.21)
Gym	2 (1.65)
Someone else's home	2 (1.65)
Studio	1 (0.83)
Swimming pool	1 (0.83)
No response	1 (0.83)
Medium of instruction	
Did not use a guide	49 (40.50)
A mobile app	31 (25.62)
A YouTube video	19 (15.70)
An instructor	10 (8.26)
Online synchronous (e.g., Zoom)	5 (4.13)
A website	5 (4.13)
No response	2 (1.65)
Time of practice	
Early morning (before 9am)	32 (26.45)
Morning (9am-12pm)	28 (23.14)
Afternoon (12-4pm)	21 (17.36)
Evening (4-7pm)	20 (16.53)
Night (after 7)	18 (14.88)
No response	2 (1.65)
Reasons for practicing	
General wellness	32 (26.45)
To gain/increase flexibility	32 (26.45)
Multiple reasons	31 (25.62)
Stress management	8 (6.61)
Physical exercise	7 (5.79)
To gain clarity and/or focus	4 (3.31)
To manage or treat a health condition	3 (2.48)
A spiritual activity	2 (1.65)
No response	2 (1.65)

Participants' responses and the authors' interpretations from the two interviews and 30-day journal formed four main themes that concern participants' relationships with their body and the influence of yoga on their relationship with their body. In the next section, the focus is first on each theme: (1) the internal monologue of the changed body (interview 1), (2) the balancing

act between acceptance and improvement (interview 1), (3) the value of taking time to prioritize oneself by practicing yoga (interview 2), and (4) the transformative catalysts of expectation and mindset on body-related self-perceptions during yoga (journals). It then considers how these themes relate to one another and collectively tell a story.

3.1. The Internal Monologue of the Changed Body

The data from interview one captured the cognitive and affective dimensions of participants' relationship with their body, highlighting how the changes to their body functionality, body appearance, and sexual health impacted their view of themselves and others. Participants were unanimous in noting that their body functionality (i.e., reduced strength and stamina), appearance (i.e., weight gain, abnormal hair growth, scars), and sexual health (i.e., reduced lubrication, vaginal stenosis, reduced desire/interest, urinary incontinency) had substantially changed. They talked about how this influenced their thoughts and feelings towards their body. For some, reduced functionality had more impact on their relationship with their body than their physical appearance because it caused greater disruption to their life, as Sandra (28 years) explained:

I couldn't walk upstairs. Like my legs would just give out [...]. So that's why I don't care if I have scars. I don't care if those things occur, but like I would really like to have the baseline functionality of being able to walk upstairs, being able to walk and do those things which I didn't really have for a long period of time.

This can also be seen in Carol's (56 years) talk about her self-criticism: "Any kind of self-criticism I have is really around the functionality more than the appearance." However, profound sadness towards changed appearance was also a recurrent theme, as can be seen from Tina's (32 years) quotation:

I thought I have a nice-looking body and I was really fit going into the surgery. And now, it's like it [her body] was sutured down to my body raw. So now, it's like an intense struggle looking at that. So, I think of like how flat and nice it was beforehand and then kind of looking at, a little bit of weight that I came from just not being able to do that [physical activity]. I would say I probably miss my old appearance for sure.

As well, it was obvious in the words they used and in their discussions that changes to sexual health and functioning could cause fear, sadness, doubt, or grief over what had been lost, as Carol (56 years) shares:

It [sex] was so painful, it felt like my skin was burned on my insides. So, imagine something scraping against that it was just really, really painful and shockingly painful. I was worried and fearful that it would always be that painful.

This was a challenging experience for many and made it difficult to accept the new reality of their sex lives.

There were several factors that seemed to influence the degree to which participants were concerned about the changes they experienced to their body. The first factor was how they appraised their changed body and suggests that finding oneself worse off in comparison to before treatment made them feel worse about their body. Carol (56 years), who considered her previous self very active for both work and leisure, shared: "It's really about the fact that I can't move like I want to, I'm not as quick, I have pain when I move. [...] I am much more, recently anyway, more aware of my functionality because it's harder." The second factor was how their changed body could evoke self-conscious feelings which made it more likely that participants would feel worse about their body. Linda's (50 years) excerpt demonstrates this: "I'm very conscious of the fact that I weigh more now than I ever have. So, I think that is always kind of in the back of my

mind.” The third factor was how participants viewed the role of appearance in their life. While participants were in-tune with the state of their body, there were a number of instances where participants used language and stories to show appearance was not always a key component of their identity. For instance, Teresa (65 years) explained that learning “a long time ago that I was never ever going to be beautiful by any stretch of the imagination” provided a useful opportunity to re-prioritize what was important “so appearance to me didn’t mean a lot. And appearance for friends doesn’t mean a lot to me either.” This said, she had clearly been impacted by her changed body, which perhaps says that her body appearance still meant something to her. She discussed a very difficult situation of how she was emotionally affected by her changed appearance:

I got up one morning and I looked in the mirror and I said, ‘you’re ugly.’ I burst into tears and I was looking all around the room and going what the heck just happened here? I mean it was so not me. I couldn’t believe that. I think that day was the most negative I’ve ever had about me. About my body.

Many participants discussed that changes to their sexual health changed how they think about their sexual self or identity as a “sexual being”. Notably, they experienced a diminished ability to engage in sexual acts and derive pleasure from those acts. Carol (56 years) explained that her changed body had completely disrupted her sexual patterns and beliefs, and that she now experiences anxiety about her sexual activities:

My sexual pattern was desire, motivation, and then intimacy where now it’s motivation, desire, then intimacy. And that’s not as powerful as it was. So certainly, I have negative thoughts. I have those ‘why isn’t my body functioning like it once did’ and ‘what does it even look like?’ So, I definitely have heightened anxiety now with sex. [...] So, on top of the physical piece of sex, there’s the psychological - ‘can I do it? How much pain am I

going to have? Can I still have an orgasm? Can I please my husband?’ So definitely I have this awareness of my body and its functionality in a way that wasn't present prior to cancer.

Moreover, many participants recognized that their decreased sexual functioning led to deep concerns about their ability to maintain relationships with their partner, and in some cases, intrusive thoughts. The concerns and intrusive thoughts were based on the belief that their partner would be dissatisfied that things were different from the way they were. As Kathleen (62 years) shared:

I think there's an expectation that things should be okay again and back to where they were, or some resemblance of what they were from a physical relationship point of view. And they're not. So, you worry [...] that your partner is going to leave or have an affair because you're not engaged in the same degree of intimacy that you were previously and more than that, you don't care about it [sex]. Except for the fact that you're worried about the stability of the relationship.

Whilst participants had become accustomed to having negative thoughts and feelings about their body, they highlighted the value and impact of several sources on their internal monologue and their relationship with their changed body. Sandra (28 years) felt that physical activity helped her move past negative thoughts and feelings about her body by enjoying a more positive outlook, improving her physical functioning, and enhancing her mental state:

Once I started feeling better about myself, once I started being able to walk, everything got a lot better after that. I was able to actually do some physical activity, so then I was in a better mental state. So, then I had a happier outlook. So, then I felt better about myself, and it was kind of like that cycle.

Life experiences such as pregnancy/ies, menopause, or aging also influenced how participants responded to the changes to their body. Although some recognized that it helped them cope as they already had experience to draw from, for others, this seemed to further contribute to negative self-perceptions. Indeed, the changes to their body triggered previous unresolved concerns and made them more self-conscious and cautious about their health behaviours. Nancy (53 years) reflected:

I would say probably 20 years ago if you'd have asked me that question, I probably would have said I don't worry about it [appearance] and I'm not bothered. But then I was skinny, young, and didn't feel I needed to really look after myself. I could eat what I wanted and not worry about it. But now, having gone through menopause, my body spreading, I can't eat what I want as I put on weight [...]. I would say I am more conscious about how I look now than I ever was.

In addition, participants recognized that being in a committed relationship could ease concerns, explaining that communication, relationship security, and positive affective responses by a partner could offer reassurance. For example, Carol (56 years) shared:

My husband will not get a queen size or king size mattress because he says 'if we do that, I won't find you in the bed, I need to touch you, I need to know that you're there,' so that intimacy I think helps, it's reinforcing that my partner wants to be close to me physically.

Finally, participants also highlighted that society was slowly shifting its perspective on the importance of having the ideal body and found that this allowed them to value other personal traits. Teresa (65 years) reflected: "For me, appearance is not everything. I prefer somebody who's got a heart of gold then somebody who looks fantastic and thankfully, now they're starting to have models that look actually like humans."

3.2. The Balancing Act Between Acceptance and Improvement

The data from interview one captured the perceptual and attitudinal dimensions of participants' relationship with their body, manifested as an internal debate between accepting their new body and trying to improve it. The way in which participants perceived and valued their body functionality, body appearance, and sexual health shaped their attitudes, beliefs, and behaviours towards their body and others. The balance between acceptance and improvement could be swayed one direction or another based on recent and/or long(er)-term intrapersonal and interpersonal factors related to their functionality, appearance, and sexual health. Participants felt their body functionality was paramount to their day-to-day lives because it allowed them to improve their appearance, maintain or improve their mental and physical health, and participate in enjoyable activities (e.g., hiking). Their motivation to improve their body functionality was heightened when their perceptions of the visible elements of their body (e.g., muscle tone, fat) and their ability to complete physical tasks (e.g., cleaning, walking, strength training) fell short of where they wanted it to be. Nancy (53 years) highlighted that single moments could trigger negative judgements about her functionality: "If I go for a walk and I get out of breath and I'm really struggling with this walk uphill – it will trigger me." While Teresa (65 years) shared that she was striving to improve her functionality because she felt her body was not meeting her expectations:

It's capable of a lot more than it is doing right now. I'm working on improving it. I want to be able to go for those long walks when we're traveling. I want to be able to get up and down the stairs without huffing and puffing.

However, other participants were more appreciative of their body and its capabilities, especially when they felt they were in a better physical state than others. As Mary (34 years) shared:

I look at my functionality as something really good because I look at other people my age and see that some people aren't able to do any type of activity and they struggle just to walk down the hall or play with their kids and so I positively know that I can do lots of really good things.

The value of appearance was much more variable – while some participants felt it was moderately important to them and their day-to-day life, others were indifferent or even found it to be inconsequential. Thus, the degree to which they accepted or desired to improve their appearance was dependent on their body insecurities, the opinions and perceived perceptions of others, and their self-evaluation and mood. They considered that improving their appearance – making reference to improving physical fitness as a means to do so – would improve how they felt about themselves. Tammy (66 years) demonstrated this interaction:

I feel that if I can get myself fit, I will look better, so I guess to answer your question, it's more important to get fit because I think how I look and feel about myself will come or will be more positive.

Others, however, accepted their appearance and made no overt attempts to change their appearance. Here, Tina (32 years) explained that feeling comfortable with her partner helped her accept her physical appearance:

I guess now just, growing up and being with my spouse for so long, we've kind of accepted each other and love each other, not have to worry about if we gained a couple pounds or how we look underneath our t-shirts and so on.

Participants also noted that the importance of their sexual health and functioning on their day-to-day life was dependent on how their treatment disrupted their sexual health. Therefore, the degree of difficulty that some experienced as a result of more extensive treatment, longer healing time after treatment, complications caused by treatment, and loss of physical functioning leading to pain during intercourse, reduced pleasure or ability to climax, and a loss of interest/desire in sex made acceptance hard. The balancing act between acceptance and improvement was exacerbated by the acknowledgement that they wanted to improve this element of their life but did not necessarily have the bandwidth to deal with it, as Kathleen (62 years) states:

Well, it causes stress and anxiety pretty much daily I would say, you're worried about it. I don't know how to fix it. It's an issue. If you don't address it, you're just putting your head in the sand, but I already have enough issues to deal with and I don't want to deal with it, but it's a big one.

In addition, participants were of divergent views about the impact of their romantic relationship on their acceptance of their body. Some participants shared that having a partner that was understanding, patient, and compassionate made it easier to accept their new sexual body. Regardless of the benefit that some found from being in a relationship, participants described how having a partner that was apathetic or non-compassionate would lead to anger along with a desire to improve their sexual functioning. As Carol (56 years) explains, her partner's apathy towards her pleasure caused her to feel anger towards her partner:

It wasn't as easy to orgasm, it wasn't as big, and he [husband] wasn't understanding.

He's okay with continuing as we are, and I can't. [...] So, there is some anger I have

towards him for not wanting to change. It would be me forcing the change and I would like for him to engage in the change, but I can't see that happening.

When discussing their cancer experience, participants were able to hold space for both acceptance and a desire for improvement, although it was often emotionally difficult to do so, as Tammy (66 years) explained:

I think with the size of my belly, I can get depressed about it and anxious. My attitude, it's not acceptable. [...] There is some tolerance given what my body is going through right now and that it's attempting to heal, and so I don't want to stress it out. But on the other hand, there is that intolerance, impatience with not being able to get it into shape.

As participants came to terms with their body, their beliefs and experiences evolved as did their ability to accept their body. Mary (34 years) shared that her relationship with her body required time to recover after treatment:

If you would have asked me right after [surgery], then no. I had a really difficult time.

But now two years later, yeah, I have a really good relationship with my body and what it looks like and how it functions.

3.3. The Value of Taking Time to Prioritize Oneself By Practicing Yoga

The data from interview two captured the overarching role and value of yoga in participants' lives as means of supporting their physical and psychological wellbeing by providing them with a space to engage in the type of practice they need to support their psychosocial wellbeing as well as providing motivation to continue to prioritize their needs after yoga. Participants considered yoga to be a core component of their everyday life because it was foundational for self-care and was part of several valuable behaviours (e.g., good nutrition, getting outdoors, connecting with others). Yoga allowed them to feel like they were prioritizing

themselves. When participants practiced before and after their cancer experience, it was clear that yoga was significantly meaningful post-cancer. Participants expressed that yoga allowed them to continue to move their body while living with physical limitations that made other physical activities (e.g., weightlifting, cycling) more difficult. Sandra (28 years, cervical cancer) shared: “It signifies that a little portion of time that I carve out in a day to dedicate to being better, to bettering myself both emotionally and mentally. And I mean definitely physically now.” This quote emphasizes that the real meaning of yoga is that it represented an opportunity to prioritize themselves daily and their desire for growth and wellness. Yoga helped participants create a deeper connection to the world around them and see the “bigger picture”, which allowed them to recentre and (re)discover priorities. For instance, Michelle (31 years) explains:

Yoga, in a way, is about becoming more in tune with that overall energy and I definitely do feel more connected to the earth, nature, and more compassionate in general. And I guess those are goals of spirituality, regardless of whether you follow religion or spirituality, compassion and happiness are kind of the goals of most people. [...] Yoga kind of facilitates that feeling of connection to something beyond the here and now, even though it is very much about the here and now.

Prior to yoga, participants shared feeling tired, frustrated at their low energy, stiff, overwhelmed, and unable to concentrate. Practicing yoga yielded several physical improvements, including fewer aches, improved sleep, increased strength, improved digestion, improved pelvic floor health, and settling of restless energy. Cynthia (59 years) highlighted:

I’m feeling a whole lot stronger than I had been when I finished my treatment in January. I started into some yoga therapy, then I was able to build it to be able to go to a yoga class. But I think, I know, I’m getting better.

Notably, practicing yoga yielded more noticeable psychosocial improvements. Yoga represented a time and space to take care of themselves and cultivate a deeper self-awareness. This self-awareness helped participants shape their practice to meet their psychosocial needs on a given day. Two main types of practices emerged: mental distraction or introspection. When participants used their yoga practice to provide a distraction the intention was to clear their mind and stabilize their thoughts (i.e., stop racing thoughts). Practicing more physically demanding asanas required them to detach from their thoughts and feelings to focus on their body and less on their state of mind. Michelle (31 years) explained:

When I'm getting my heart rate a little bit up, like doing quicker sun salutations or holding like a plank, something that has a bit of physical challenge to it, I will often find that those moments are really good at bringing me out of racing thoughts.

At other times, participants used their yoga practice for introspection because they needed an outlet to delve into and work through a stressful situation or negative states of mind. For some, this type of practice was facilitated by a slower paced practice focused on being more intentional in their movements, breath, and meditation. Giving themselves time and space to process helped participants let go of consuming thoughts and feelings leaving them feeling more at ease and content. Laura (38 years) shared that sitting without distraction was important:

I think so much of that [non-attachment to feelings] came from sitting in the quiet that I get from yoga, when I'm on my mat and sitting in quiet. We so often fill our space with noise and clutter and distractions.

The benefits participants experienced (e.g., feeling calm, relaxed, more positive state of mind) translated to being less negative with others, thus allowing them to be able to better connect with others. They felt more patient, compassionate, and capable of slower, more intimate

interactions that left them feeling more positive towards the state of their body, the state of their mind, and importantly in their relationship with others. This is illustrated by Sharon (62 years): “It’s dumb, but I find if I don’t do yoga, I feel myself getting a little bit moody. I find yoga brings me back to being, I guess, nice to people. So, it just makes me accept my environment better.” Overall, participants believed yoga facilitated more intentionality, helped switch off their fight or flight response, and led to more positive interactions with others. In addition, yoga helped participants regulate their engagement in other self-care behaviours. After yoga, Laura (38 years) experienced a sense of calm and clarity, which offered her a good state of mind to journal: “I would journal because like with that sitting in quiet, things came to me that I felt needed to be reflected on. So, that’s fairly common to journal after my practice.” Others drew on how they felt after yoga to motivate themselves; that is, they made use of their energy to concentrate on work or accomplish tasks that needed to be completed, as Nancy (53 years) explains:

As soon as I’ve done yoga, ‘Okay, breakfast and straight into my list of jobs.’ If I don’t do that, I know I won’t start my day, I need to use that energy that I’ve picked up from the yoga immediately.

In addition, participants valuation of self-care was influenced by the tenets (or teachings) delivered by instructors that emphasised meeting the body where it is, giving room for self-exploration, focusing on the self as opposed to others, acceptance, and openness. As Cynthia (59 years) explains, this mentality motivated her to continue to take care of herself outside of yoga:

I find in my regular daily life it stays in my head, so it provides me with more motivation to look after myself in other ways, like what I’m eating and what I’m doing around the

physical functioning of my body and what I'm doing around my emotions and again, looking at some of the self-care.

3.4. The Transformative Catalysts of Expectation and Mindset on Body-Related Self-Perceptions After Yoga

The data from participants' journals captures the variability in experiences that yoga can evoke among participants. Individual yoga practices could foster either positive, reproachful, or conflicting self-perceptions, depending on their expectations and mindset for their practice and themselves. Notably, these self-perceptions did not stay self-contained but could influence their behaviours and interactions with others. Prior to yoga, a general pattern observed was that participants shared thoughts that admonished their physical appearance and criticized their perceived shortcomings, including slow healing and reduced mobility. For instance, Cynthia (59 years) shared that her physical appearance bothered her: "I didn't like looking at my jiggly thighs in the mirror when getting ready for yoga." Similarly, Michelle (31 years) stated: "I was thinking I was getting old and can't keep up like I used to." After yoga, a general pattern was that participants reflections on their bodies were often kinder and more appreciative of their functionality and body's capabilities (e.g., ability to move, flexibility). Barbara (66 years) reflected on her changed outlook towards herself that encompassed her gratitude and pride towards her body after her yoga practice: "I felt grateful for having a body that carries me through life; that I have a strong, healthy, and beautiful body worth being proud of."

However, attention to divergent experiences revealed that yoga did not always lead to greater body functional appreciation. It seemed to depend on their expectations for their practice and themselves. After certain practices, participants did not report positive shifts in self-perceptions, rather they reported strong emotional responses towards their body including

hopelessness, grief, and frustration, as highlighted by Carol (56 years) when she shared: “I feel hopeless; grieving the changes in my body due to radiation, [...] frustration at my inability to focus.” Indeed, participants’ yoga practices were likely to foster reproachful self-perceptions when they placed expectations on themselves and their bodies’ capabilities, such as not moving as well as they wanted them to and focusing on what they were able to do in their previous yoga practices. For instance, having to use a modification for a pose that they previously did not need one for could be disheartening and frustrating, as Tammy (66 years) described: “I think there’s a momentary kind of frustration, ‘why can’t I do this,’ but I think it’s more about having to do a modification where in the past I haven’t had to.” However, participants’ reproachful self-perceptions were limited to themselves and focused on comparison to themselves ranging from pre-cancer to the previous practice a week before, highlighting that the self-comparison was not time-bound.

In addition, yoga did not always lead to only positive or only negative self-perceptions; at times, participants held conflicting self-perceptions that were both positive and negative views of their body, as they distinguished between the different aspects. For example, Sandra (28 years) stated: “Today’s practice reminded me of my body’s limitations, so there is always a slight bit of sadness. But I also feel warm and invigorated, which makes me feel grateful that my body is still capable of healthy movement.” When participants reflected on yoga practices that evoked negative emotional responses, an open mindset free of expectations buffered against the reproachful self-perceptions that could be triggered by reduced physical functioning because they were also experiencing gratitude and pride towards their body. Indeed, participants’ self-reflections on these practices revealed that they viewed that particular practice as an opportunity to care for and support themselves and their body as opposed to reducing physical limitations.

This mindset was often supported by instructors; participants valued when an instructor taught from a place of acceptance. Specifically, when instructors encouraged participants to listen to their bodies and not fight against their bodies but instead seek to make themselves comfortable and notice the changes that help and hinder. Laura (38 years) shared:

They just give that awareness that you're listening to your body, and it doesn't have to be a struggle, you don't have to be fighting it if you're not comfortable. It's not even about being not comfortable, it's about trusting that it could just be better.

These types of messaging helped participants to feel in control of their bodies and supported in the idea that a yoga practice is their own to build and take what they need from the practice.

Moreover, the self-perceptions fostered during their yoga practice had the potential to impact interactions with sexual partners after the practice. When participants experienced a yoga practice that led to positive self-perceptions, including gratitude and pride towards themselves and their bodies, they felt it also contributed to interacting with others in an open, self-assured manner, and positive emotional responses and self-perceptions during other activities. For instance, Sandra (28 years) reflected that she had an enjoyable sexual experience with her partner because she felt confident in her body after a yoga practice that had highlighted her physical competence:

I thought that my body was finally working for me, and I felt good about my body, [...] I had some really great sex, I felt quite confident in my body. I didn't fixate on my stomach or scars and was able to fully enjoy myself.

However, when participants' yoga practices lead to reproachful self-perceptions and self-criticism that highlighted their perceived physical inadequacies (e.g., more fat in the abdominal

area than before treatment), they also shared concerns about how others perceived them after their practice. Cynthia (59 years) shared: “During yoga I had a fleeting thought about how large my stomach had become. I noticed when I was doing an exercise when I had my hands on my hips and bending over,” she was self-conscious and anxious about her partner’s behaviours: “My husband was in our bedroom when I was undressing, and he was not looking straight at me. I wondered for a fleeting moment ‘why?’ He usually is quite interested when I am undressing.”

3.5. Overarching Narrative

Gynecologic cancer and its treatment had a tremendous impact on participants’ body functionality, body appearance, and sexual health. As a result, participants felt they had a body that no longer resembled or functioned the way it used to. These changes prompted an internal monologue that highlighted the flaws and limitations of their body. The level of negativity of their internal monologue dictated whether their attitudes and self-perceptions swayed more toward acceptance or wanting to improve their body. Participants often found themselves balancing acceptance and improvement wishes based on the value they placed on their appearance, functionality, and sexual functioning. Romantic relationships also played a role, with understanding partners facilitating acceptance, while apathetic partners generated a desire for change. Over time, participants’ beliefs evolved, leading to greater body acceptance.

In terms of yoga, it represented a space for participants to focus on and prioritize themselves to improve their body while also finding acceptance. However, yoga was not a guaranteed method for bolstering positive self-perceptions as practices could highlight the ways in which participants’ bodies had changed. Focusing on the limitations of the body or only seeking to improve the body’s functionality led to reproachful self-perceptions when participants were not able to meet their own expectations. Whereas having an open mindset and practicing

gratitude and self-compassion for one's self could bolster against reproachful self-perceptions, even when a practice did not go the way a participant wanted.

4. Discussion

An in-depth qualitative study focusing exclusively on the experiences of adults who have completed gynecologic cancer treatment, targeting self-selected yoga practice, and adopting a phenomenological approach is lacking in the literature [27]; yet, is needed because it provides much-needed insight into the nuances of self-perceptions and the impact of holistic complementary therapies. The purpose of this study was to explore: (1) the thoughts, feelings, attitudes, and perceptions of adults who have completed gynecologic cancer treatment on their body (appearance and functionality), and (2) how they perceive yoga to affect their thoughts, feelings, attitudes, and perceptions of their body. Participants' accounts support the general consensus that gynecologic cancer takes a toll on the body [46-48], resulting in negative body image [49]. Participants' experiences emphasize that yoga can promote body acceptance and body image improvement or lead to body dissatisfaction and body image deterioration. Based on the findings of a recent qualitative meta-synthesis [27], there is only one other study [50] reporting qualitative findings exploring the experiences of adults who have completed gynecologic cancer treatment. Thus, this study's findings fill a gap in the literature and provide relevant professionals, services, and policymakers with an understanding of the challenges adults experience after having completed gynecologic cancer treatment and the potential role of yoga in facilitating quality of life in survivorship.

The cognitive-behavioural perspectives on body image highlight the significant role of evaluation (i.e., cognitive and affective appraisal) and investment (i.e., cognitive, behavioural, and emotional importance) in body appearance and functionality [51]. Yet, much of the research

to date has focused on negative evaluation (i.e., body dissatisfaction; [1, 5, 52]) and appearance investment [53]. Findings from this study highlight that body investment can moderate the valence of evaluation. Among participants who were more invested in their body, appearance, body functionality, and/or sexual functioning were critical factors in their lives and could lead to more negatively-valenced evaluations. Moreover, findings suggest that among adults who have completed gynecologic cancer treatment, investment in body functionality, particularly their physical capabilities, may be as important as investment in body appearance. Previous research with adults diagnosed with breast cancer [2] and participants' responses herein suggest heightened body investment is perhaps the result of significant changes to their physical capabilities, greater attention to the body's senses and sensations, and the associated impact on their ability to interact with the world around them (e.g., ability to complete necessary tasks, engage in pleasurable pursuits). However, as highlighted in Theme Four, the impact of body investment on evaluation may vary according to one's level of acceptance and compassion. While research in appearance investment has provided insight into the association of high appearance investment and higher body image dysfunction [53], little research has sought to explore the contributors, associations, or variability of functionality investment. Moving forward, it is necessary to explore the nuances of functionality investment and evaluation, including the potential role of shifting investment from one area of body functionality (i.e., physical capabilities) to another (e.g., creative endeavours) and the impact of psychological processes (i.e., acceptance, compassion) to determine if and how they can contribute to positive and negative body image among clinical and non-clinical populations.

In line with extant literature [49], participants expressed a predominance of internal, negatively valenced thoughts and feelings toward their changed body. However, similar to

research exploring older women's experiences of aging [54, 55], participants also expressed a reluctant acceptance of their changed bodies. This reluctant acceptance may have been bolstered by downward comparison and the sense of being "better off" than other real or imagined cancer survivors. The process of downward comparison has been shown to help women diagnosed with breast cancer reframe their understanding of their bodies within the larger context of survivorship, contributing to greater acceptance and reduced self-stigmatization [56]. Moreover, participants identified another strategy for bolstering their positive body-related perceptions during their yoga practice – a compassionate and grateful mindset. This mindset is in line with acceptance and commitment therapy, which focuses on accepting thoughts and feelings as they are, rather than trying to change or avoid them, and committing to actions that align with personal values. Acceptance and commitment therapy has shown promising results in enhancing the psychological and emotional wellbeing of adults diagnosed with cancer [57, 58]. This is pertinent as it suggests that the participants' adoption of this type of mindset during yoga could similarly contribute to improved body-related perceptions and overall wellbeing. Overall, these findings support the notion that adults diagnosed with cancer hold space for both negative and positive evaluations of their changed bodies [59]. Therefore, an important first step to improving positive body image among adults who have completed gynecologic cancer treatment may be to encourage acknowledging changes and embracing the complex thoughts and feelings that come with a "changed body."

Several theories, models, and frameworks exist that shed light on factors that may shape a person's body image. Yet, many of these focus on the physical, interpersonal, and psychological influences on body image [1, 52] and only tangentially on methods for coping with or actively changing body image. However, the embodiment model of positive body image proposes that

engaging in embodying activities that promote competence, interpersonal relatedness, power, self-expression, and wellbeing can help a person experience their body as comfortable, trustworthy, and deserving of respect [28]. In line with this model, findings highlight that participants regarded yoga as an embodying activity that helped them shift their evaluation of their body image to be more positively valenced. As in previous studies with clinical and non-clinical populations [60-62], yoga was seen to foster a sense of agency and empowerment in relation to their bodies and contribute to positive self-perceptions. In addition, findings assert the merit of the biopsychosocial model [30] in aiding to understand the value of yoga in the interplay of physical health, mental wellbeing, and the social environment for improving the body image of adults who have completed gynecologic cancer treatment. Yoga aided in the restoration and recognition of the body's capabilities (biophysiological) and offered a reflective space for processing emotions and cultivating self-compassion for their bodies (psychological), helping them interact with others in an open, self-assured manner (social). These findings are in line with previous research on yoga interventions for adults diagnosed with breast cancer [27], suggesting that self-selected yoga practice may facilitate similar outcomes.

A novel component of this study was participants ability to self-select their yoga practice with no influence from the research team. Participants in this study predominantly practiced yoga at home via an asynchronous video (e.g., YouTube), giving them access to numerous instructor-styles, types of practices, and the ability to end or change their practice as needed. Being able to engage in a yoga practice on their own terms (i.e., where, when, how they wanted) may be valuable for allowing participants to meet their present-moment needs, which could help enhance body functionality and promote body appreciation and acceptance overtime [5, 63]. Moreover, research suggests that the instructor is an influential component of yoga practice – they can

shape the practice for better (e.g., encouraging a compassionate mindset; [27, 64]) or worse (e.g., shaming diverse body types or abilities; [65]). Despite being delivered asynchronously, participants shared that the instructors indirectly encouraged a positive body image by promoting teachings or tenets (yamas and niyamas) related to reduced self-judgment and acceptance of the body's needs. Given that participants were self-selecting their practice, this may indicate that participants chose (intentionally or not) instructors and videos that were positive body image supportive. However, this may be different for novice participants as they may be less comfortable self-adjusting their practice or seeking practices that meet their needs. The majority of yoga interventions offered to adults diagnosed with cancer to date do not include (or report including) yamas and niyamas [27]; as such, there is little evidence testing their effectiveness or the most effective way to teach them. Therefore, it is necessary to determine what and how yogic teachings can influence body image and the role of the instructor in delivering such messaging.

Most studies to date have been focused on the positive impact of yoga on physical and psychological outcomes among adults diagnosed with breast cancer [26, 27]. In this study, practicing yoga had the potential to foster both positive and negative self-perceptions of the body among adults who have completed gynecologic cancer treatment, sometimes concurrently. This finding underscores the importance of considering idiographic experiences and responses that yoga can elicit in relation to body image. There are several methodologies, either quantitative (e.g., n-of-1, single-subject/case) or qualitative (e.g., case study), as well as analyses (e.g., hierarchical linear modelling) that would allow for within-person experiences to be examined in greater depth. Moreover, as findings demonstrated, body image experiences vary temporally and in situational contexts; yet, most research has focused on body image as a cross-situational and stable trait among adults diagnosed with breast cancer and the general population [66, 67]. As

such, employing only brief measures, only using positive or negative measures, creating global scores, and/or short interventions with no follow-up to assess changes might lead to conclusions that yoga interventions are not effective. More robust longitudinal study designs are required to track changes over time to identify temporal patterns and sequences of events. In addition, findings highlight that yoga is not a panacea that is divorced from the impact of investment and evaluation. Thus, there is value in exploring methods or means for aiding women to further reduce their negative body image and improve their positive body image within their yoga practices. It follows then that it is crucial to identify facilitators that can be modified to increase the likelihood of positive evaluations during yoga, as this population can experience heightened investment in functionality due to changes in their physical capabilities.

4.1. Strengths and Limitations

The longitudinal study design is a strength as it allowed for the collection of retrospective and real-time data, which played a vital role in capturing the nuanced dynamics between yoga and self-perceptions. Retrospective data allowed participants to reflect on their experiences and perceptions over time, providing insights into the long-term impact of yoga practice on their body image. Real-time data collection from the journal provided a glimpse into the immediate effects and fluctuations in self-perceptions during and after yoga practice. Similarly, conclusions were drawn from multiple sources of data wherein participants had the opportunity to develop rapport with the first author and allowed for follow-up and clarification of content shared in interview one and the journals to build a more complete picture, adding layers of depth and credibility to the research findings. Finally, the breadth of age range (28-66 years) provides much needed insight into the value and impact of different facets of body image and sexual health across the life course.

It is important to note the limitations of the study. First, besides age, there was limited diversity in the sample, limiting the transferability of findings to White women with tertiary education who typically maintain a regular yoga practice. An important next step is to expand this line of inquiry to compare and contrast the experiences of adults with different backgrounds to understand how they may differ from those reported herein. Additionally, as experience (e.g., novice vs expert) and context (e.g., self-selected vs prescribed type and intensity of a yoga program/intervention) may be important factors impacting the outcomes of yoga, these should be explored in future research. Second, the topics addressed in this research are often considered private and can have stigma attached to them. While participants volunteered for this study, the data collected relies heavily on participants' willingness and ability to share. If participants were not entirely open or lacked introspection, it might have limited the depth of the findings. Drawing on Feminist [68, 69] and Indigenous [70, 71] research approaches, depth of findings may be facilitated in future studies by supporting emotional safety through conscious rapport-building, cultural respect, participant collaboration, safe communication environments, reflective activities, iterative dialogues, and experience validation.

4.2. Conclusions

Findings from this study provide evidence for the impact of investment and evaluation on the relationship between their body and self-perceptions for adults who have completed gynecologic cancer treatment. This study also demonstrates that yoga can have both positive and negative effects on self-perceptions of the body. Engaging in yoga practice can provide opportunities for body empowerment and improvement, leading to positive self-perceptions. However, it is crucial to acknowledge that yoga is not a guaranteed path to positive self-perceptions, and it can also elicit negative self-perceptions when personal expectations are not

met. Future research should further explore the individual differences and mechanisms underlying these varied responses to yoga practice to optimize the benefits and mitigate potential challenges in promoting positive self-perceptions and body image.

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Bridging Study 1 and 2

The purpose of *study 1* was to use a qualitative methodology to explore: (1) the thoughts, feelings, attitudes, and perceptions of adults who have completed gynecologic cancer treatment on their body (appearance and functionality), and (2) how they perceive yoga to affect their thoughts, feelings, attitudes, and perceptions of their body. Participants' relationship with their body was influenced by their body functionality and appearance, and their sexual health; these concepts were often deeply interconnected, and impacted participants' self-perceptions and behaviours. Yoga was a vehicle for growth and acceptance; however, participants' expectations and mindsets before and during yoga could lead to negative self-perceptions after yoga. The combination of retrospective and real-time data collection provided a broader perspective on participants lived experience while also enabling immediate, contextualized information to provide a more comprehensive understanding of participants' relationship with their body after gynecologic cancer treatment and the potential value of yoga as a supportive care resource to promote quality of life. Building on the findings from *study 1*, *study 2* was designed to gain a broad and comprehensive understanding of the impact of yoga on women's QoL after a cancer diagnosis and the potential facilitators as well as their motives, barriers, and preferences for engaging in yoga to provide direction for *studies 3* and *4*. Due to the breadth and depth of the data extracted from the primary articles in the review, it was necessary to present the findings in two separate manuscripts (articles 2 and 3).

Chapter 3: Study 2 (article 2), Meta-Synthesis Part 1

Women's experiences with yoga after a cancer diagnosis: A qualitative meta-synthesis – Part 1

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Published in *Systematic Reviews*

Final publication is available from Springer Nature:

<https://doi.org/10.1186/s13643-023-02350-x>

Abstract

Background: Qualitative research on women's experiences participating in yoga after a cancer diagnosis is growing; systematic synthesis and integration of results is necessary to facilitate the transfer and implementation of knowledge among researchers and end-users. **Methods:** Using meta-study methodology, six electronic databases were searched using a sensitive search strategy in November 2020 and replicated in October 2021, supplemented by scanning reference lists of relevant articles in August 2021. Two reviewers independently screened titles/abstracts and full-texts to determine eligibility. **Results:** The search yielded 6,804 citations after de-duplication. Data from 24 articles meeting eligibility criteria were extracted, and results, methods, and theoretical approach(es) were analyzed. This paper synthesizes and integrates data focused on women's wellbeing and quality of life (QoL); it is Part I of a two-part meta-study meta-synthesis. Five overarching categories emerged: (1) yoga can support improvements in multiple dimensions of QoL in women diagnosed with cancer, (2) women diagnosed with cancer experience an interaction between QoL dimensions, (3) elements of yoga that support improvements in QoL dimensions, (4) breathwork and meditation are integral elements of yoga, and (5) yoga practice may support lifestyle behavior change. The articles reviewed had notable limitations related to: (1) reporting about instructor(s), content of the intervention, and environmental characteristics of the setting, (2) identifying and incorporating optimal features in the intervention design, (3) incorporating theory and real-world considerations into the study procedures, and (4) including positive and negative conceptualizations of QoL as an interconnected and multidimensional concept. **Conclusion:** Moving forward, it remains critical to identify the ideal structure and content of yoga programs for promoting wellbeing and QoL among women diagnosed with cancer, as well as to explore barriers and facilitators to sustainable program implementation.

Registration: Prospero; registration number: CRD42021229253

Keywords: Mind-body; Oncology; Yoga; Female; Review

1. Background

Globally, over eight million women are diagnosed with cancer each year (1), exerting tremendous physical, emotional, and financial strain on individuals, families, communities, and health systems (2). The overall survival rate for cancer has improved in high-income countries due to accessible early detection, improved treatment, and better survivorship care. Similar to other developed countries (3), the 5-year overall survival rate for women in Canada is 65% (4). However, many who survive the disease report short- and long-term adverse effects that may be visible (e.g., scarring, deterioration of muscle mass and strength, reduced mobility; (5, 6)) or nonvisible (e.g., hot flashes, nausea, depression, anxiety, fear of recurrence, negative body image, cognitive dysfunction; (7-9)). Indeed, due to symptoms and adverse treatment effects, women diagnosed with cancer have qualitatively reported reductions in their quality of life (QoL) and wellbeing, including feeling lost, uncertain, and angry about their situation and future (10, 11), as well as incapable of participating in their everyday lives with family, friends, and work (7, 12). Evidence suggests that QoL and wellbeing may be protective factors for health, reducing the risk of physical illness, and promoting longevity among women diagnosed with cancer (13-16); therefore, it is necessary to identify strategies to help women diagnosed with cancer self-manage unavoidable symptoms and treatment effects and ameliorate their QoL and wellbeing.

Definitions of QoL are diverse and can encompass a range of dimensions including physical (e.g., outcomes related to one's ability to perform basic and instrumental physical activities related to daily living, leisure, and occupations), psychological (e.g., outcomes related to one's thoughts, feelings, and self-perceptions), emotional (e.g., outcomes related to one's emotional experiences and ability to manage their emotions), cognitive (e.g., outcomes related to

mental processes involved in attention, language, perception, learning, memory, understanding, awareness, reasoning, and judgment), and social (e.g., outcomes related to one's appraisal of their social relationships, how others react to them, and how they interact with social institutions and community) (17, 18). In the oncology literature, QoL can be understood as a multi-dimensional concept that "refers to patients' appraisal of and satisfaction with their current level of functioning compared to what they perceive to be possible or ideal" (19). Previous research lends support to the view that greater wellbeing is associated with greater QoL, and that QoL and wellbeing are separate concepts that can and should be fostered. Wellbeing refers to life evaluation (i.e., people's thoughts about the quality or goodness of their lives), hedonic wellbeing (i.e., everyday feelings or moods as captured by both positive and negative adjectives), and eudemonic wellbeing (i.e., judgements about the meaning and purpose of life) (20, 21). In this sense, wellbeing assessment carries unique information about a person's status and enables development fundamental to QoL (and vice versa). Thus, the issue of maintaining both QoL and wellbeing in women diagnosed with cancer has become a key societal aspiration. Given the variable and expansive conceptualizations of QoL and wellbeing, the literature reviewed herein is discussed using a comprehensive lens and focuses on QoL as a global construct that encompasses wellbeing as a state of positive physical, psychological, emotional, cognitive and social functioning that contributes to QoL.

Evidence has emerged that yoga can ameliorate QoL in women diagnosed with cancer (22-25). Yoga is a form of complementary and alternative medicine (26) practiced for approximately 4,000 years (27). Although yoga originally evolved as a spiritual practice, its contemporary practice often features physical postures (asanas), breathing techniques (pranayama), and meditation (dhyana) in North America, Europe, and Oceania (28). Among

women diagnosed with cancer, several systematic reviews (22-25) and meta-analyses (29-32) have summarized the results of studies exploring yoga's positive effects on outcomes such as health-related QoL, depression, anxiety, fatigue, and sleep disturbances. Notably, women diagnosed with cancer have also reported that yoga may help with self-management of symptoms and treatment effects by improving capacity to cope with these (33-35) and reducing adverse physical effects (e.g., pain, numbness (36, 37)). Although research on the underlying psychosocial mechanisms that may explain these positive effects is underdeveloped in the oncology field, research in the fields of body image and eating disorder suggest that the focus on moving, stretching, and balancing through a series of poses, awareness of breath, and cultivating the connection between mind and body may address both physical and psychological concerns. Specifically, the physical postures in yoga can be physically challenging or gentle, allowing participants to experience empowerment, strength, and/or relaxation, potentially facilitating greater connection to oneself with renewed attention on the body in a gentler, more compassionate and positive manner (38-40). Breathwork can provide a foundation for the calming of the mind through observation, control, or imagery (38-40). Meditation can help participants meet their present-moment experience with openness, acceptance, and nonjudgment (38-40). However, it remains unclear whether these underlying mechanisms proposed to support QoL and wellbeing among other clinical and non-clinical populations translate to women diagnosed with cancer. Therefore, it is necessary to understand if and how physical postures, breathing, and meditation support QoL among women diagnosed with cancer.

Qualitative methods (e.g., interviews, focus groups) are optimal to gather knowledge on the benefits of yoga for women diagnosed with cancer and provide insight into *how* and *why* yoga is beneficial. Qualitative studies offer a consideration of the contextual information when

observing and interpreting participants' explanations and meanings of a phenomenon (i.e., a thick description; (41)). In addition, qualitative studies attempt to document the complexity and multiplicity of individuals' experiences (42). Yet, systematic reviews and meta-analyses are usually carried out with quantitative studies. Given that primary qualitative studies are rarely used on their own to contribute to practical knowledge (43) and that decision making ought to be based on *all* the evidence available (i.e., quantitative and qualitative), methods to synthesize evidence from single qualitative studies have been developed to facilitate the transfer and implementation of knowledge emerging from qualitative studies. For example, qualitative evidence syntheses have been used to understand participants' experiences, both comprehensively due to the qualitative approach and broadly due to the integration of studies from different contexts and participants on various topics (e.g., fear of cancer in the general population (44); experiences of adult children of parents with mental illnesses (45)). Despite a rise of primary qualitative studies on women's experiences participating in yoga after a cancer diagnosis, an analysis, synthesis, and interpretation of the collective findings is lacking.

Synthesizing results from qualitative studies relating to yoga for women diagnosed with cancer is central to understanding results more broadly and addressing important limitations of quantitative syntheses. Thus, a meta-study meta-synthesis using standardized, rigorous methods was conducted to synthesize the literature and address specific research questions about yoga for women diagnosed with cancer. The objectives of the meta-synthesis were to: (1) integrate findings from qualitative studies, (2) compare and contrast findings to elucidate patterns or contradictions in conclusions, and (3) develop an overarching interpretation of women's experiences participating in yoga after a cancer diagnosis. The current paper reports on findings

focused on women's wellbeing and QoL; it is Part I of a two-part meta-study meta-synthesis. Part II reports on participants' evaluations of yoga programs and interventions (46).³

2. Materials and methods

The protocol for this review was registered in PROSPERO (registration number: CRD42021229253) and was published (48). To complete this meta-study meta-synthesis, six distinct overlapping steps outlined by Paterson et al. (43) were undertaken (as described below). Reporting follows the enhancing transparency in reporting the synthesis of qualitative research (ENTREQ; (47)) guidelines in lieu of PRISMA as initially planned.

Step 1: Formulating the research questions

Before conducting the literature search, two specific research questions were established: (1) what are the experiences of women who have participated in yoga after a cancer diagnosis? and (2) what elements of yoga contribute to participants' positive or negative experiences?

Inclusion Criteria

Inclusion criteria emerged directly from the research questions, were set a priori, and were developed to be as broad as possible to allow for a breadth of experiences to be captured in the synthesis and potentially contribute to a better understanding of different responses to yoga. To be included, articles must have: (1) been primary studies conducted with women⁴ ≥ 18 years diagnosed with cancer, regardless of type of cancer, disease stage, and timing (e.g., at diagnosis, during treatment, post-treatment, or during palliative care), (2) used qualitative methods to collect data (e.g., interviews, focus groups, observations, journaling, open-ended survey questions), (3) reported on participants' experiences engaging in yoga of any type and dosage

³ In the context of this manuscript, interventions refer to structured interventions designed by researchers and programs refer to community programs or classes.

⁴ Female (sex)/woman (gender) were often used interchangeably in the articles; for brevity, woman/women is used in this manuscript.

(frequency, length, duration), and (4) comprised original research published in English language in a peer-reviewed journal. No restrictions were placed on year of publication or study design (e.g., observational or experimental).

Exclusion Criteria

Mixed methods studies in which qualitative findings were not presented were excluded, as were grey literature (e.g., conference abstracts/posters/proceedings, unpublished theses/dissertations, websites, other unregulated sources), books, opinion pieces, and reviews. Moreover, studies with a sample consisting of >50% men were excluded. This decision was made to ensure that the sampling method did not introduce bias in the analysis and interpretation of the entire corpus of data published (49, 50) and has been used in other health-related reviews focused on women's experiences (51-53). Indeed, excluding articles with samples comprising <50% men would have meant that women included in 9 articles would not have had equal chance to have their experiences considered in the synthesis.

Step 2: Selection and appraisal of the primary research

Step 2a: Systematically search and identify relevant articles

Articles were retrieved by searching six electronic databases: Medical Literature Analysis and Retrieval System Online (MEDLINE), Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsycINFO, Scopus, SPORTDiscus, and Web of Science. With the help of a university librarian, a sensitive search strategy was developed by drawing on Medical Subject Heading (MeSH) terms and keywords used in published reviews (e.g., 54). The chosen MeSH terms and keywords covered the population (i.e., women diagnosed with cancer) and terminology associated with yoga (e.g., yoga, mindfulness, physical postures, breathing exercises, meditation). To support breadth of the search, the search strategy did not include

MeSH terms and keywords covering data collection methods. The search strategy was pilot-tested and finalized in MEDLINE (see [Appendix D](#)) before being translated for use in the five other databases. An initial database search for articles was completed in November 2020 and results were exported into Covidence, a systematic review online platform. A supplemental search of the reference lists of relevant articles retrieved during the electronic database search (i.e., reviews and included studies) was conducted in August 2021 to ensure all relevant articles were identified. The database search was replicated in October 2021 to retrieve citations published during the previous 11 months. Covidence was used for automatic removal of duplicates and to store, organize, and manage citations.

Step 2b: Study selection

After the removal of duplicate records, the titles and abstracts of remaining citations were independently reviewed in a single step by two authors (JP and SS) using broad screening criteria. This was followed by full-text review of retained citations against eligibility criteria; each full-text was independently reviewed by JP and SS. During both steps, the third author (JB) made the final decision when disagreements arose to avoid a hierarchy between screeners. Cohen's kappa was calculated to measure inter-coder agreement at both screening steps and can be interpreted as follows: 0-0.20=none, 0.21-0.39=minimal, 0.40-0.59=weak, 0.60-0.79=moderate, 0.80-0.90=strong, >0.90=excellent agreement (55).

Step 2c: Data extraction

The following data were extracted using a template housed on Covidence: (1) study information (i.e., authors, country of data collection, year of publication), (2) study characteristics (i.e., study design, sampling methods, sample size, methodology, data collection methods, analysis methods), (3) sample characteristics (i.e., age, percent women, type of

cancer(s), disease stage, timing), (4) reported yoga background and practice characteristics (i.e., dosage [frequency, length, duration], location, style of yoga, social setting, mode of delivery), (5) conceptual/theoretical approaches, and (6) qualitative findings. If information presented in the primary article was unclear or missing, corresponding authors were contacted via email to obtain clarification or missing information (for a maximum of three attempts). To ensure completeness and accuracy in extraction, after JP and SS independently extracted data from all included articles, validation checks were conducted, and JP and SS met to discuss any differences before proceeding to critical appraisal and analysis.

Step 2d: Quality assessment

Following the relativist perspective outlined by Sparkes and Smith (56), JP and SS independently appraised the trustworthiness, theoretical considerations, and practical considerations of each study using the Consolidated Criteria for Reporting Qualitative Research (COREQ) 32-item checklist (57). The checklist was used to assess the quality of included articles based on inclusion of information pertaining to the research team and reflexivity, study design, and analysis and findings. Article quality was not an exclusion criterion; instead findings were used to furnish the meta-method analysis and provide insight into elements of qualitative research that may not be commonly reported in this area of study (58).

Step 3: Meta-data analysis

For the meta-data analysis, a thematic synthesis approach (58) was carried out by JP and SS. First, JP and SS independently and inductively coded the extracted data that were presented in the Results/Findings section of articles line-by-line without any restriction to a prior framework; this was done using concise descriptions that reflected the language used in participants' quotes or primary authors' interpretations. Subsequent articles were coded into

these codes and new codes were created when deemed necessary. Second, JP and SS met to review the descriptive codes and act as ‘critical friends’ to reflect and explore alternative interpretations and explanations (56), with JB acting as an additional ‘critical friend’ as required to help refine codes. Once codes were agreed upon, JP, SS, and JB sought to create analytical sub-themes. Specifically, the descriptive codes were inductively grouped together based on whether they represented a larger concept or idea related to an aspect of women’s lived experiences. These sub-themes were then grouped together into main themes and categories reflecting broader concepts in the literature. Finally, main themes pertaining to Research Questions 1 and 2 were compiled and a narrative summary was prepared.

Step 4: Meta-method analysis

For the meta-method analysis, data pertaining to the methods used were compared within and across articles (43). The goal was to determine frequency of use and identify potential patterns of use. Intervention and program characteristics were also compared within and across studies and are presented briefly in this manuscript for context, with detailed results presented in Part II.

Step 5: Meta-theory analysis

For the meta-theory analysis (43), data pertaining to theory were examined to identify paradigms or ontological approaches that have informed the authors’ theory selection. Potential limitations, strengths, or ambiguities that may influence the use of theory and interpretation of findings pertaining to women’s QoL and wellbeing after participating in yoga following a cancer diagnosis, and what may have contributed to their experiences, were summarized herein.

Step 6: Meta-synthesis

By selecting, critically appraising, summarizing, and combining qualitative findings, new

interpretations were formed to create an overarching narrative of women's experiences participating in yoga after a cancer diagnosis, as pertaining to Research Question 1 and 2. As well, collating data across qualitative studies enabled conclusions pertaining to: (1) the various methods that have been used to collect and analyze data, and (2) potential gaps in knowledge that may be a result of methodological choices in the primary studies.

3. Results

3.1 Search results

The database searches identified 12,115 references; 5237 references were identified as duplicates. Using Covidence, 6,878 titles and abstracts were reviewed, 74 full-texts were deemed potentially relevant (Cohen's kappa=0.83). These 74 and an additional 2 full-texts identified during the manual search were screened, of which 24 met eligibility criteria; the remaining 52 were excluded for the following reasons: did not look at women's experiences participating in yoga after cancer diagnosis ($n=33$), did not present qualitative findings ($n=10$), full-text was not available ($n=6$), not a primary study ($n=2$), and duplicate ($n=1$). Cohen's kappa at the full-text screening stage was 0.90. The PRISMA diagram of this process is provided in Figure 3-1. Characteristics of articles included in the meta-synthesis are presented in Table 3-1.

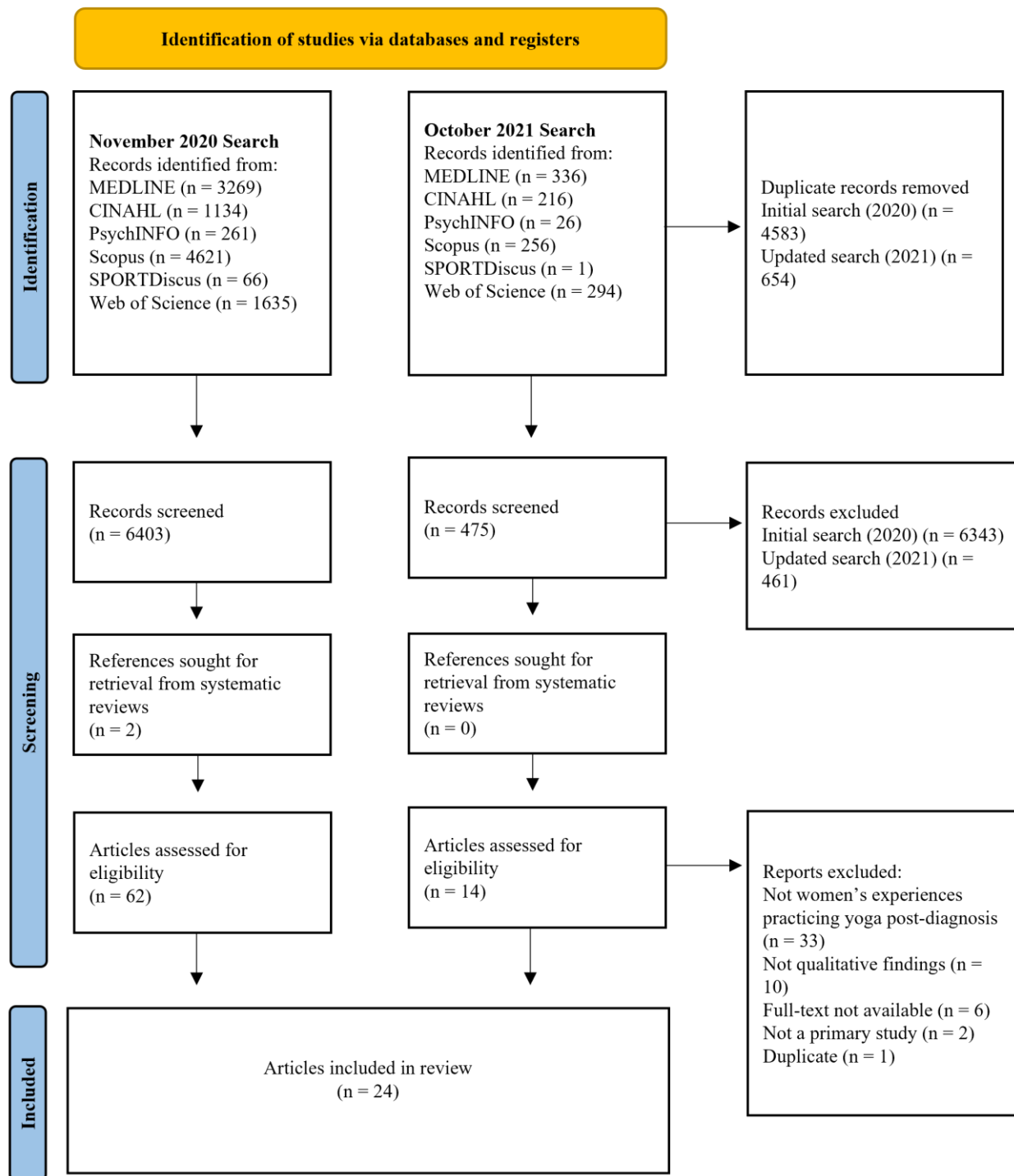


Figure 3-1. PRISMA flow Diagram

Table 3-1. Characteristics of articles included in the meta-synthesis (n=24)

	First author and year	Country	Sample^a	Intervention	Data Collection Methods	Design	Analysis Methods	Theoretical and/or Conceptual Orientation
1	Addington 2018	USA	6 women Treatment status: On-treatment Cancer type: Breast Age range: 41-76 years Mean age: 59 years	12 weeks, Integral yoga, group-based, synchronous videoconferencing	Program evaluation forms and telephone interviews	Quasi-experimental	NR	NR
2	Archer 2015	UK	16 women Treatment status: On-treatment Cancer type: Cervical, endometrial, ovarian Age range: 31-79 Mean age: 60	10 weeks, Hatha yoga, in-person	Focus groups	Experimental	Interpretative phenomenological analysis	NR
3	Bryan 2021	USA	7 women, 1 man Treatment status: NR	10 weeks, Gentle yoga, group-based, in-person	Semi-structured interviews	Observational	Content analysis	Biopsychosocial-spiritual model

			Cancer type: NR Age range: 52-74 Mean age: 61					
4	Carr 2016	CAN	3 women Treatment status: NR Cancer type: Breast, lymphoma Age range: 60-69 Mean age: NR	3 weeks, Kripaula yoga, 1-on-1, in- person	Open-ended survey questions	Quasi- experimental	Grounded theory approach	NR
5	Danhauer 2008	USA	51 women Treatment status: On- and off- treatment Cancer type: Ovarian, breast Age range: 34-82 Mean age: 58.9	10 weeks, Restorative yoga, group- based, in- person	Semi- structured interviews	Quasi- experimental	Categorical aggregation/it erative process	NR
6	Duncan 2008	CAN	23 women, 1 man Treatment status: On- and off- treatment	Community program that was 10 weeks, Iyengar yoga, group-based, in-person	Interviews	Quasi- experimental	Ethnographic content analysis	NR

			Cancer type: Breast, gynecologic, lymphoma Age range: NR Mean age: 49.3						
7	Evans 2017	NR	3 women, 1 man Treatment status: Off- treatment Cancer type: Hodgkin lymphoma, lymphoma, neuroblastoma , breast, osteosarcoma Age range: NR Mean age: 26.5	8 weeks, Iyengar yoga	Journal reflections Weekly phone calls	Quasi- experimental	Content analysis	NR	
8	Flanagan 2021	USA	35 women Treatment status: Off- treatment Cancer type: Breast Age range: 29-77	4 weeks, mindfulness- based yoga, self-guided, online asynchronous	Semi- structured interviews	Quasi- experimental	Reflective thematic analysis	Power as knowing participation in change	

			Mean age: 56.17					
9	Galantino 2012a	USA	10 women Treatment status: Off- treatment Cancer type: Breast Age range: 50-71 Mean age: 58	8 weeks, group-based, in-person	Semi- structured interviews	Quasi- experimental	Grounded theory	Social Cognitive Theory
10	Galantino 2012b	USA	4 women Treatment status: On- treatment Cancer type: Breast Age range: 44-65 Mean age: 54.75	12 weeks, Iyengar- inspired yoga, group-based, in-person	Semi- structured interviews	Experimental	Thematic analysis	NR
11	Huberty 2018	USA	34 women, 5 men Treatment status: On- treatment Cancer type: myeloprolifera tive neoplasms Age range: 47-83 Mean age: 60	12 weeks, Hatha and Vinyasa yoga, self-guided, online asynchronous	Semi- structured interviews	Experimental	Iterative- thematic approach	NR

12	Kligler 2011	USA	38 women, 37 men Treatment status: On- treatment Cancer type: NR Age range: NR Mean age: 54.4	1-on-1, in- person	Structured interviews	Quasi- experimental	Thematic analysis	NR
13	Kvillemo 2011	SWE	18 women Treatment status: Off- treatment Cancer type: Breast, lymphatic Age range: 31-65 Mean age: 54	8 weeks, Hatha yoga, group-based, in-person	Open-ended survey questions	Experimental	Inductive reasoning approach	NR
14	Loudon 2017	AUS	15 women Treatment status: Off- treatment Cancer type: Breast Age range: 36-66 Mean age: 55.2	8 weeks, Satyananda yoga, group- based, in- person	Semi- structured interviews	Observational	Thematic analysis	NR

15	Mackenzie 2014	CAN	18 women Treatment status: NR Cancer type: Breast, other (not stated) Age range: NR Mean age: 53.97	1 session, 1- on-1, in- person	Open-ended survey questions	Quasi- experimental	Symbolic interactionism, ethnographic, mindful inquiry, phenomenolog y	Effort-Related Attention Model, Circumplex Model of Affect, Dual- Mode Theory of Affective Responses to Exercise, Neurovisceral Integration Model
16	McCall 2015a	CAN	11 women, 4 men Treatment status: On- treatment Cancer type: Tongue, breast, Colorectal- lung, prostate, abdomen, colorectal, skin, brain, blood Age range: 33-72 Mean age: 51.3	Arm 1: 1 session, pranayama- based yoga, group-based, in-person Arm 2: 2 weeks, Restorative yoga, group- based, in- person and 4 weeks, mixed yoga, asynchronous website Arm 3: 4 weeks,	Semi- structured interviews and journals	Experimental	NR	NR

				Restorative yoga, group- based, in- person				
17	McCall 2015b	CAN	7 women, 3 men Treatment status: On- treatment Cancer type: Breast, prostate, bone marrow, skin Age range: 44-71 Mean age: 60.1	Community program with no set number of weeks, Restorative yoga, group- based, in- person	Focus groups	Quasi- experimental	Constant comparison technique	NR
18	McDonnell 2020	USA	16 women, 10 men Treatment status: Off- treatment Cancer type: Lung Age range: NR Mean age: 66.5	8 weeks, Hatha yoga, group-based, in-person	Focus groups	Quasi- experimental	Interpretative phenomenolog ical analysis	NR
19	Taylor 2018	USA	26 women Treatment status: Off- treatment	8 weeks, Restorative yoga, group- based, in- person	Focus groups	Observational	Thematic analysis	NR

			Cancer type: Breast Age range: 33-64 Mean age: 53.75					
20	Thomas 2011	CAN	10 women Treatment status: On- and off- treatment Cancer type: Breast Age range: 36-70 Mean age: 52	6 weeks, Iyengar yoga, group-based, in-person	Open-ended survey questions	Experimental	NR	Feminist theory
21	Thomas 2014	CAN	13 women Treatment status: NR Cancer type: Breast Age range: 51-66 Mean age: NR	8 weeks, Iyengar yoga, group-based, in-person	Open-ended survey questions	Quasi- experimental	Content analysis	NR
22	Van Puymbroec k 2011	USA	18 women Treatment status: Off- treatment Cancer type: Breast Age range: 33-84	8 weeks, Hatha yoga, group-based, in-person	Open-ended survey questions	Quasi- experimental	Summative content analysis	NR

			Mean age: 56.67						
23	Van Puymbroec k 2013	USA	18 women Treatment status: Off- treatment Cancer type: Breast Age range: 33-84 Mean age: 56.67	8 weeks, Hatha yoga, group-based, in-person	semi- structured interview guide	Quasi- experimental	Thematic analysis	NR	
24	Van Uden- Kraan 2013	NLD	25 women, 4 men Treatment status: NR Cancer type: Breast, colorectal, lung, kidney, brain, endometrial- non-Hodgkin lymphoma Age range: NR Mean age: 53.8	Community program with no set number of weeks, Hatha and Healing yoga, group-based, in-person	Semi- structured interviews	Quasi- experimental	Thematic analysis	NR	

Notes. NR: Not reported. ^a female (sex)/woman (gender) were often used interchangeably in the articles; for brevity, woman/women is used in the table.

3.2 Quality assessment

Domain 1 (research team and reflexivity practices) was the least reported domain; in this domain, the most reported item was who conducted the interview/focus groups ($n=10$; 55.6%) and no articles reported on interviewer/facilitator gender and biases or participant(s) knowledge of interviewer/facilitator. Domain 2 (study design) varied in the level of reporting; in this domain, the most reported items were sample size ($n=24$; 100%) and sampling procedures ($n=24$; 100%) and use of field notes was the least reported item ($n=2$; 11%). Domain 3 (analysis and findings) reporting was often high; in this domain, the most reported item was consistency between findings and conclusions ($n=23$; 95.8%) and participant checking was the least reported item ($n=1$; 4.2%). See Figure 3-2 for an overview of current reporting practices as per the COREQ.

3.3 Meta-methods results

3.3.1 Study information and characteristics

The 24 articles were published between 2008 and 2021. Of the 22 (91.7%) articles that reported on country where data were collected, seven (29.2%) were conducted in Canada, 11 (45.8%) in the United States, one (4.2%) in the United Kingdom, one (4.2%) in the Netherlands, one (4.2%) in Sweden, and one (4.2%) in Australia. For parsimony, study designs were classified into one of the following three categories using the information provided in the articles: (1) quasi-experimental (i.e., delivered an intervention but did not have a comparison group, and/or did not randomize participants), (2) experimental (i.e., delivered an intervention, had a comparison group, and randomized participants), or (3) observational (i.e., did not deliver an intervention, natural observation without any attempt to create change). Where explanations of study designs were unclear, a reasonable level of inference was used to identify the most likely

study design used. Seventeen (70.8%) articles were quasi-experimental studies, four (16.7%) were experimental studies, and two (8.4%) were observational studies. Also, one (4.2%) article aggregated data from a quasi-experimental feasibility trial and an experimental pilot randomized controlled trial.

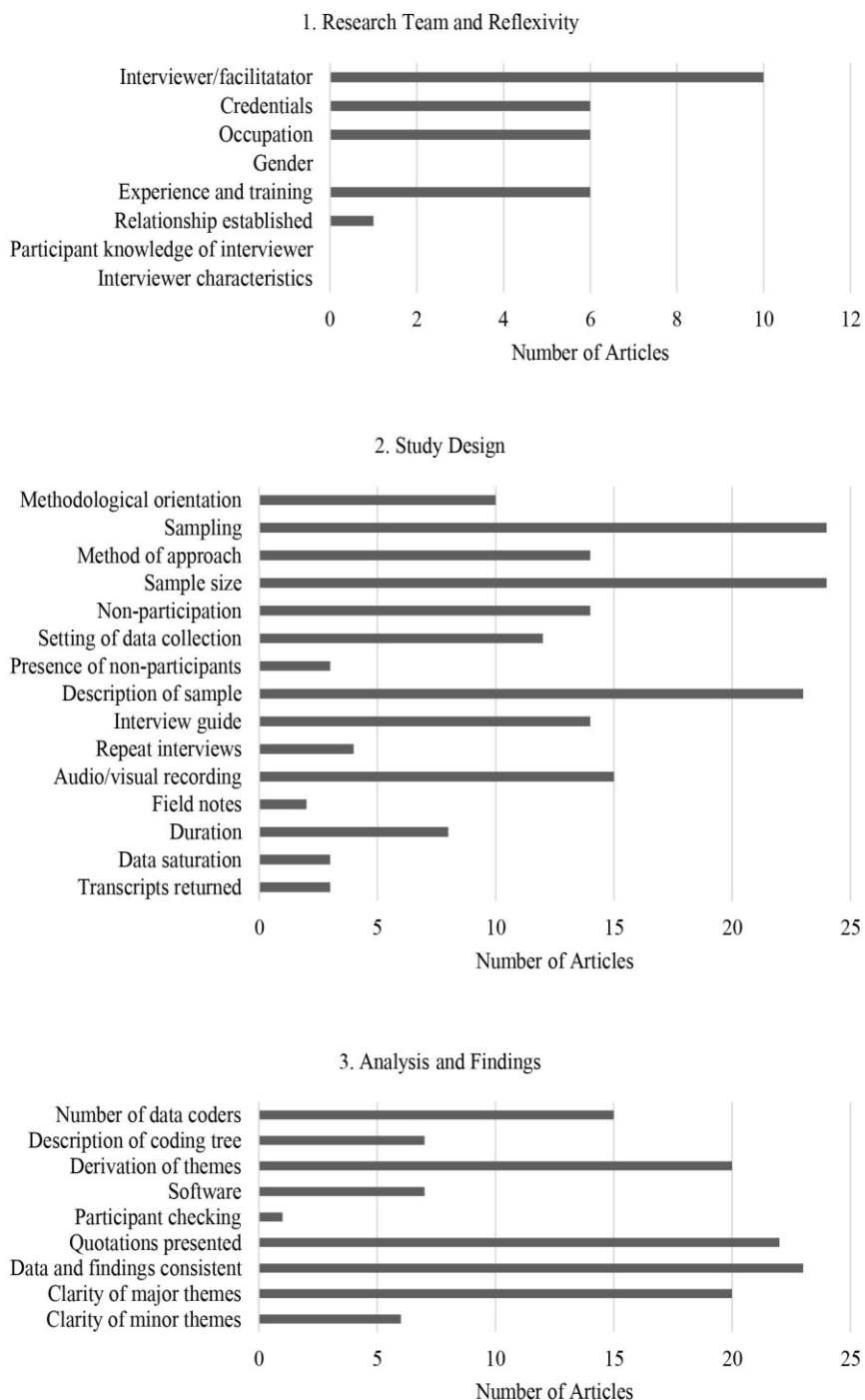


Figure 3-2. COREQ assessment

3.3.2 Sample characteristics

In total, 490 participants were included across the 24 articles, with sample sizes ranging from three to 74 ($M=20.4$, $SD=16.4$). The average age of participants ranged from 26.5 to 66.5 years. All articles specified when participants were recruited; six (25.0%) included participants post-diagnosis (without specification of participants' treatment status), one (4.2%) post-surgery (without specification of participants' treatment status), six (25.0%) on-treatment, eight (33.3%) post-treatment, two (8.3%) either on- or post-treatment, and one (4.2%) receiving palliative care. Twenty-two (91.7%) articles reported on type(s) of cancer; 11 (45.8%) mixed diagnoses, 10 (41.7%) breast cancer, and one (4.2%) lung cancer. Thirteen (54.2%) articles reported on cancer stage; eight (33.3%) focused on stages 0 to 3, four (16.7%) on stages 0 to 4, and one (4.2%) on stage 4. Cancer stage was not applicable in one (4.2%) article as it included women with myeloproliferative neoplasms.

3.3.3 Yoga intervention and program characteristics

Of the 24 articles reviewed, 23 (95.8%) articles reported results pertaining to a yoga intervention or program. Specifically, 18 (75.0%) articles described one single yoga intervention being investigated, one (4.2%) described three separate yoga interventions being investigated within a single study (i.e., participants received one of three interventions), three (12.5%) described different structured community yoga programs investigated within three single studies, and two (8.3%) described an identical intervention investigated with two single studies (i.e., two articles were published based on the same dataset). Therefore, the final number of yoga interventions or programs described is 25, which was used as the denominator below.

Twenty-four (96.0%) intervention descriptions included mode of delivery; one (4.0%) intervention or program was delivered via synchronous videoconferencing technology, one

(4.0%) via a single asynchronously pre-recorded video online, one (4.0%) via asynchronously pre-recorded videos on a website, 12 (48.0%) in-person, and nine (36.0%) in-person with materials to support *supplemental* self-guided practices at home. For studies that included *supplemental* self-guided practices, four (16%) prescribed dosage (i.e., frequency, length, duration) and five (20%) did not prescribe dosage for at-home practices. Not including interventions or programs that provided *supplemental* self-guided practices at home, the social setting of 23 (92.0%) interventions or programs (92.0%) was described, wherein 18 (72.0%) were delivered in a group (i.e., multiple participants with one interactive instructor), three (12.0%) were one-on-one (i.e., one participant with one interactive instructor), and two (8%) were self-guided only (i.e., one participant, no interactive instructor). Details about the location the interventions or programs were delivered (not including *supplemental* self-guided practices at home) were provided for 22 (88.0%) interventions or programs; 14 (56.0%) were delivered in the community, one (4.0%) at participants' homes, three (12.0%) online, three (12.0%) at a university, and one (4.0%) at a hospital. Interventions and programs lasted one to 12 weeks ($M=7.3$), lasted 20 to 120 minutes ($M=69.1$), ranged from one to seven times per week ($M=2.5$), yielding a total of one to 56 sessions ($M=15.1$). The type of yoga delivered was described for 24 (96.0%) interventions or programs; four (16.0%) delivered Iyengar, one (4.0%) Iyengar-inspired, four (16.0%) Hatha, one (4.0%) Hatha and Vinyasa, one (4.0%) Hatha and Healing, 1 (4.0%) Integral, one (4.0%) Kripaula, five (20.0%) Restorative, one (4.0%) Satyananda, one (4.0%) mindfulness-based, one (4.0%) gentle, and one (4.0%) focused primarily on pranayama.

3.3.4 Epistemology, methodology, and methods

Philosophical viewpoints were stated in two (8.3%) articles and consisted of a pragmatist epistemology in one (4.2%) prospective follow-up study using a one-group, pre-post, sequential-

explanatory mixed methods design and an interpretivist and feminist epistemology in one (4.2%) quasi-experimental study. Of the 10 (41.7%) articles that specified the qualitative methodology used, two (8.3%) cited interpretative phenomenological analysis, two (8.3%) descriptive, one (4.2%) instrumental case study, one (4.2%) mixed-methods, one (4.2%) neurophenomenology, one (4.2%) interpretive description methodology, one (4.2%) community-based participatory research principles, and one (4.2%) a combination of symbolic interactionism, ethnography, mindful inquiry, and phenomenology. Across the 24 articles, 11 (45.8%) used interviews, four (16.7%) focus groups, six (25%) open-ended survey questions, and three (12.5%) a combination of the aforementioned methods as well as program evaluation forms, journal reflections, and weekly phone calls to collect data. Data analysis techniques included: thematic ($n=6$; 25%), content ($n=3$; 12.5%), grounded theory ($n=2$; 8.3%), interpretative phenomenological ($n=2$; 8.3%), constant comparison ($n=1$; 4.2%), ethnographic content ($n=1$; 4.2%), summative content ($n=1$; 4.2%), categorical aggregation/iterative ($n=1$; 4.2%), iterative-thematic ($n=1$; 4.2%), inductive reasoning ($n=1$; 4.2%), reflective thematic ($n=1$; 4.2%), and a combination of symbolic interactionism, ethnographic, mindful inquiry, and phenomenology ($n=1$; 4.2%).

3.4 Meta-theory results

Five (20.8%) of the 24 articles reported using theory or models. One used the Social Cognitive Theory to inform their yoga intervention, situating yoga as a means of simultaneous source of social support and physical activity. Another employed a multi-theory/model approach using the Effort-Related Attention Model, the Circumplex Model of Affect, the Dual-Mode Theory of Affective Responses to Exercise, and the Neurovisceral Integration Model to explore affective and physiological responses of yoga; these were used to frame the study, inform data collection, and guide interpretation of the data after inductive thematic analysis. A third stated

that their data analysis was informed by Feminist Theory, though did not explain why or how the theory was used in the quasi-experimental study. A fourth used the Power as Knowing Participation in Change to frame the study, inform data collection, and guide deductive qualitative description analysis of data. A fifth used the Biopsychosocial-Spiritual Model to guide interpretation of the data after inductive thematic analysis.

3.5 Meta-data results

Across the 24 articles, a total of 210 individual codes were generated representing distinct statements. Codes were aggregated into 15 main themes (sub-headings marked in italics) with 48 sub-themes (marked in italics in-text). Main themes were further coalesced into five overarching categories (sub-headings marked in bolded, italics) to organize dominant ideas. Participants viewed yoga as positively impacting their wellbeing. Moreover, participants' experiences provide insight into the interconnected and dynamic nature of multiple QoL dimensions and offer understanding into the contextual considerations that may influence QoL dimensions. In addition, participants' accounts indicate that breathwork and meditation are crucial components of yoga for facilitating QoL. Finally, a small selection of articles provided a starting point for exploring the potential of yoga prompting lifestyle behavior change. Due to the differences in purposes and study designs across articles, not all articles are represented in each category, theme, and/or sub-theme. Below, the categories are presented, along with a description of each theme and sub-theme pertaining to Part I. An overview of the themes is presented in Table 3-2 and supporting data are presented in Table 3-3.

Table 3-2. Summary of categories, themes, and subthemes identified in the articles included in the meta-synthesis (n=24) related to changes in dimensions of quality of life.

Themes	Sub-themes
<i>Category 1: Yoga can support improvements in multiple dimensions of QoL in women diagnosed with cancer</i>	

Regain the ability to perform basic and instrumental activities of daily living	Improved physiological functions of body systems Improved physical fitness and body alignment Improved execution of tasks or activities Improvements in fatigue and energy Reductions in pain, numbness, and cancer-related symptoms
Let go of negative emotions and thoughts while embracing inner tranquility	Increased emotional regulation Increased experiences of positive feelings, emotions, and mood
Connect the mind and body to gain a deeper self-appreciation and understanding of oneself	Increased mental strength and resilience Increased connection to, and awareness of the body, behaviours, and capabilities Improved coping Increase in positive beliefs about the self Increased feelings of acceptance, reduced inner critiques, and freeing oneself from negative thoughts, feelings, and beliefs Increased understanding of self and increased feelings of empowerment and self-advocation of needs
Quiet the mental chatter to focus on the present	Improved outlook and mindset Increased focus Increased attention Increased feelings of mindfulness
Find contact and connection for emotional support and companionship	Increased sociability Feeling connected to others
<i>Category 2: Women diagnosed with cancer experience an interaction between QoL dimensions</i>	
Greater control over emotions coupled with more positive emotions supports functioning of body systems, positive self-evaluations and coping methods, and connection with others Improved fitness supports positive self-beliefs, sociability, and emotional regulation	
<i>Category 3: Elements of yoga that support improvements in QoL dimensions</i>	
Being in a group of others who share common experiences Detailed and tailored instruction Physical postures, turning inward, and breathwork	
<i>Category 4: Breathwork and meditation are integral elements of yoga</i>	
Separate strategies that can be used in daily life Facilitation of inner tranquility, connection to internal states, awareness of body, and decreased rumination on the external	
<i>Category 5: Yoga practice may support lifestyle behaviour change</i>	

Category 1: Yoga can support improvements in multiple dimensions of QoL in women diagnosed with cancer

Main theme 1: Regain the ability to perform basic and instrumental activities of daily living

In 22 articles (91.7%), participants described how yoga positively impacted their physical functioning, which in turn improved overall physical wellbeing. Participants indicated *improved physiological functions of body systems*, explaining that they felt that yoga contributed to lowered blood pressure (34), improved circulation (59), improved respiration (33, 59, 60), expanded lung capacity (61), decreased shortness of breath (62), reduced constipation (62), and improved arm morbidity for women experiencing lymphedema (37). Participants also discussed *improved physical fitness and body alignment* as yoga helped them feel more physically fit. Indeed, participants described improvements in flexibility (33, 34, 59, 61, 63-68), mobility (33, 65), balance (33, 64, 67), stamina (35, 59, 68), strength (33, 59, 65-70), fitness (64, 67, 70), weight loss and toning (71), and posture (37, 65, 67), and stated that it counteracted physical deterioration (34) and helped them move their muscles (61). In terms of *improved execution of tasks or activities*, participants described how yoga improved their ability to carry out day-to-day activities (61, 65, 67, 72), engage in other forms of physical activity (35, 68), and return to normal more quickly (60). *Improvements in fatigue and energy* were reported; participants felt that yoga reduced fatigue (59, 60, 62), increased energy (33, 35, 59, 61, 64, 65, 68, 72, 73), increased feelings of restfulness (68), improved sleep (33-35, 59, 68, 69, 74), decreased insomnia (62), increased evening sleepiness post-yoga (73) and morning/afternoon wakefulness post-yoga (73). Also, participants reported feeling physical invigoration (70), rejuvenation (61), and improved vitality (74) post-yoga. Finally, with respect to *reductions in pain, numbness, and cancer-related symptoms*, participants were specific about how yoga alleviated adverse physical

disease and treatment effects; namely it helped through pain relief (33-37, 59, 62-64, 67, 69, 74), reduced numbness (37), reduced stiffness (60, 69), reduced achiness (60, 68), reduced joint pain (68), physical tension relief (70), and eased physical symptoms (67). More generally, participants described how yoga helped in their recovery from cancer treatment/cancer-related symptoms (33, 34, 59, 60, 65, 66, 75). However, in one (4.2%) article, participants expressed experiencing pain and discomfort during yoga and found the sequences tiring (59).

Main theme 2: Let go of negative emotions and thoughts while embracing inner tranquility

In 15 articles (62.5%), participants described how yoga positively impacted aspects of their emotional functioning and wellbeing. *Increased emotional regulation* was a prominent sub-theme; participants felt that yoga allowed them to feel and release negative emotions resulting from the cancer experience (33), increased their emotional stability (68), and improved their ability to manage stressful situations (33, 34, 59, 65, 66, 68, 69, 74), their worries (33, 74), anxiety/anxieties (33, 74), and intrusive thoughts (74). Also, participants reported that yoga helped decrease stress (35, 64, 67, 68, 74) and feelings of distress (68), and encouraged them to let go of tension, stress, or the need to control a situation (33). Moreover, in terms of *increased experiences of positive feelings, emotions, and mood*, participants reported increased feelings of relaxation (33-35, 59, 60, 64, 65, 73, 76), hope (34), calm (33, 35, 64, 65, 67, 68, 73, 74), happiness (33, 59), peacefulness (67-69, 76), optimism (34), pleasure (34), tranquility (34, 68), positive affect (73), and benevolence (65). Participants in two (8.3%) articles spoke more generally about how yoga helped improve their mood (59, 72). However, one participant in one (4.2%) article felt inadequate during yoga and found it stressful (59).

Main theme 3: Connect the mind and body to gain a deeper self-appreciation and understanding of oneself

In 16 (66.7%) articles, participants described personal development of positive psychological attributes through their participation in yoga that contributed positively to their overall psychological functioning and wellbeing. Regarding *increased mental strength and resilience*, participants described increased mental strength (33, 67), resilience (33), and mental stability (33), as well as feeling more mentally charged/balanced (33). Participants discussed an *increased connection to, and awareness of the body, behaviors, and capabilities*; participants described a greater connection with the body (37), a mind-body connection (33, 34), feelings of interconnectedness (70), and a restored sense of balance between both sides of their bodies (37). In addition, participants reported enhanced awareness of body signals (33), physical capabilities (33), bodily awareness (37, 69, 76), understanding of their body (37), awareness of unconscious behaviors (65), and self-confidence to engage in activities of daily living (33). In terms of *improved coping*, participants described an improved capacity to cope in general (64, 70) and with specific issues (i.e., cancer and treatments (33, 34); cancer-related outcomes (35)). Further, there was an *increase in positive beliefs about the self* with yoga as participants described increased self-efficacy (35, 70), self-confidence (33, 35, 59, 61, 65), self-worth (59), sense of self (65), and belief in the importance of self-care (70, 76). Also, participants reported that yoga helped bolster their self-image (59), self-esteem (33), and (re-)connection to their spiritual self (34, 68), and spiritual strength (68). Another sub-theme was *increased feelings of acceptance, reduced inner critiques, and freeing oneself from negative thoughts, feelings, and beliefs* as participants reported greater bodily acceptance (37), feeling kinder to oneself (33, 74), self-acceptance (34), acceptance of ‘what is’ (69) and cancer-related limitations (33, 37), as well as

reduced self-criticism (65), rumination of aches and pains (35, 61, 65), negative body image (65), anxiety symptoms (62, 68), and depressive symptoms (59, 65). Moreover, as for *increased understanding of self and increased feelings of empowerment and self-advocation of needs*, participants reported that yoga helped them feel more empowered (34, 64, 70), facilitated a process of ‘turning inwards’ to reflect on their needs (33, 76), helped them become vigilant about their personal needs and encouraged taking steps towards addressing them (65), including being more assertive about their needs (37) and empowered to stand-up for their needs (33).

Participants reported feeling more in control of their health/illness (59, 64) and engaged in self-healing (64) with yoga. Finally, participants reported an *improved outlook and mindset* based on having a more positive mindset (34, 59, 61, 65), an improved outlook (62), a better frame of mind (68), feeling more open (61), increased beliefs about survival probability (33), motivation to engage with life (60, 65), and feeling accomplished post-yoga (59).

Main theme 4: Quiet the mental chatter to focus on the present

In seven articles (29.2%), participants described how yoga positively impacted their cognitive functioning and wellbeing. With respect to *increased focus*, participants reported that yoga increased their mental focus (33, 65, 70, 73), concentration (33), and ability to think clearly (36, 61). Participants discussed *increased attention* during yoga; they felt their attention shifted away from dissociative attention (e.g., focusing on non-exercise-related stimuli and diverting attention away from internal sensations and present exercise experience) to associative attention (e.g., focusing on internal feedback including breathing rate and muscle soreness) during yoga (73). Also, participants reported increased attention to their breath (73) and mental awareness (65). Regarding *increased feelings of mindfulness*, participants reported that their mind stopped wandering during yoga (73), and that they experienced a quieting (70) and calming of the mind

(33). However, some participants in one (4.2%) article did not feel they experienced any improvements in their cognitive functioning (60) and some participants in one article (4.2%) reported difficulties maintaining focus during yoga (73).

Main theme 5: Find contact and connection for emotional support and companionship

In 12 (50.0%) articles, participants described how group-based, in-person yoga positively impacted their social functioning and wellbeing. In terms of *increased sociability*, participants felt that yoga facilitated interaction with group members outside of yoga sessions (69), improved relationships with others (e.g., partners, friends, co-workers)(35, 65), and led them to feel more sociable (35, 65). Also, participants reported *feeling connected to others* (68) because group-based yoga (especially when practiced with other cancer survivors) helped them feel recognized (33), understood (33, 63, 64, 74), emotionally supported (33), not alone in their emotions (76), less intimidated to share (67), open to sharing (65), accepted (63, 64, 67, 74), like they belong (65), and less socially isolated (63, 64, 74). In addition, participants believed that group-based yoga contributed to sense of co-regulation (74) and camaraderie (60, 61).

Category 2: Women diagnosed with cancer experience an interaction between QoL dimensions

Main theme 1: Greater control over emotions coupled with more positive emotions supports functioning of body systems, positive self-evaluations and coping methods, and connection with others

Participants provided insight into the potential pathways and connections between the different QoL dimensions and how improvements in one dimension might facilitate wellbeing in another. In six studies (25.0%), participants' improvements in emotional wellbeing supported psychological, social, and physical wellbeing. Participants felt that increased emotional

regulation in the form of stress reduction helped them develop a more positive mindset (35, 64) and improved their sleep (35, 65). Experiences of positive feelings, emotions, and mood were reported to help increase self-confidence and sociability (65), improve relationships (59, 65, 74), help to connect to their body and spirituality (34), help lower blood pressure, direct attention away from pain, and rebound from cancer treatment (34). Still, being unable to control one's thoughts during yoga did give rise to negative feelings, emotions, and mood for some participants in one article (4.2%) (74).

Main theme 2: Improved fitness supports positive self-beliefs, sociability, and emotional regulation

In nine (37.5%) articles, participants reported that improvements in their physical wellbeing and functioning supported improvements in their psychological, social, and emotional wellbeing and functioning. Indeed, participants felt that the physical improvements fostered positive beliefs about the self, including increased self-confidence (37, 63, 65, 67, 71), self-efficacy (37), and treatment-related acceptance (71). Also, participants reported that physical improvements helped them feel better about themselves (34), decreased perceived stress and anxiety symptoms (61), and contributed to improved body image (36, 71). Similarly, participants described that physical improvements enabled more attention and awareness of their bodies, behaviors and capabilities, resulting in increased feelings of capability/competence (37, 66, 67), feelings of comfort in their bodies (67), and mind-body connection (34). Additionally, participants reported less fear to engage in activities (37), feeling better able to challenge preconceived beliefs about their personal limitations (67), and felt more sociable (65) as a result of physical improvements. Finally, participants reported that improvements in mobility helped them to be more open and relaxed in a safe environment (61).

Category 3: Elements of yoga that support improvements in QoL dimensions

Main theme 1: Being in a group of others who share common experiences

In seven articles (29.2%), which were all focused on group-based yoga, participants described the presence of others who share common experiences as important for facilitating improvements in wellbeing. Their presence allowed for sharing their experiences and offering encouragement which supported feelings of acceptance (33, 63, 64, 66, 74), understanding (33, 63, 64, 66, 74), belonging (65), and openness (65). In addition, seeing others cope with cancer helped participants feel like they could survive their own diagnosis (33) and increased self-awareness of physical abilities (61).

Main theme 2: Detailed and tailored instruction

In two articles (8.3%) wherein the intervention was delivered in-person, participants reported that the instructors' communication style (i.e., language and approach to explaining physical postures) facilitated physical and psychological wellbeing. Participants felt their improved balance and flexibility was a result of specific and detailed instruction (64). Moreover, individual-level instruction and the props used in the Iyengar style of yoga were considered to be instrumental in allowing participants to perform postures properly and experience greater self-efficacy (70).

Main theme 3: Physical postures, turning inwards, and breathwork

In five articles (20.8%), participants reported specific elements of yoga that contributed to their cognitive, psychological, and emotional wellbeing. Participants identified the first supine position (i.e., Shavasana or 'corpse' pose) of yoga as contributing to a mental shift (i.e., more focused, attentive, and mindful) because it was associated with sleep states; one participant compared this pose to a "power nap" (73). Participants were able to relax during the supine

meditation and felt re-energized and more awake immediately following this pose (73). While focusing on the movement and alignment of the body as well as the breath during more strenuous standing sequences, participants felt able to focus and quiet their mind because these sequences required concentration and thus helped them ignore other stimuli (73). Participants felt that breathwork, relaxation, and working through various postures contributed to feeling mentally balanced/charged (33), increased their coping skills (33), and provided them with stress-management skills (33, 34, 74). In addition, participants felt that centering the self during yoga led to feelings of optimism, pleasure, and tranquility (66).

Category 4: Breathwork and meditation are integral elements of yoga

Main theme 1: Separate strategies that can be used in daily life

Although breathwork and meditation can be delivered as standalone interventions, according to yogic philosophy they are integral components of yoga (27). Of the 24 articles, 15 (62.5%) explicitly mentioned the impact of breathwork and/or meditation on participants' experiences. Participants felt breathwork required focus, mental effort, and attention (63, 64). Participants thought of breathwork and meditation as tools or strategies to use beyond yoga sessions because they are easy (63, 64), unobtrusive (63, 64), require little preparation (63, 64), and can be practiced daily (33, 60). Participants also linked breathwork and meditation to improvements in emotional, psychological, physical, and cognitive wellbeing.

Main theme 2: Facilitation of inner tranquility, connection to internal states, awareness of body, and decreased rumination on the external

Breathwork and meditation supported emotional wellbeing by increasing positive affect (73), by facilitating a sense of calm (62, 74), relaxation (76), and peacefulness (62), and by encouraging a 'letting go' stance (34). In addition, participants felt breathwork and meditation

helped them feel more relaxed (64, 67), less stressed (59, 63, 64), and more in control of their reactions in negative situations (e.g., chemotherapy treatment (60)). For psychological wellbeing, participants felt that breathwork and meditation increased their bodily awareness (63, 64) and helped them manage their anxiety symptoms (59). For physical wellbeing, participants reported that breathwork and meditation contributed to pain relief (37), reduced tension (34), increased energy (34), improved sleep (63, 64, 66), reduced coughing (61), and improved lung capacity (61). Finally, for cognitive wellbeing, breathwork and meditation helped participants calm their thoughts (59), provided a distraction for maladaptive thoughts (62, 64), and increased focus (67, 73), concentration (73), and awareness of moment-to-moment experiences (66, 73, 74).

Category 5: Yoga practice may support lifestyle behavior change

Of the 24 articles, five (20.8%) reported participants' perspectives around lifestyle behaviors, including yoga. Participants reported intentions and motivation to continue with yoga post-intervention to sustain benefits (61, 63, 75). In one article (4.2%), participants expressed understanding the need for consistent practice to improve/sustain physical improvements and that they felt hopeful but unsure about their abilities to do so (61). In addition, participants reported becoming more mindful of their eating behaviors and greater engagement in other physical activities because of yoga. In one article (4.2%), participants attributed behavioral changes pertaining to diet and physical activity to a change in mindset or appreciation for the health benefits of these behaviors; however, not all participants in this article reported these changes (59). In another article (4.2%), participants described increased physical activity and mindful eating practices stemming from their participation in yoga, which they believed were responsible for their weight loss (35).

Table 3-3. Supporting quotations identified in the articles included in the meta-synthesis (n=24) related to changes in dimensions of quality of life.

Theme	Sub-theme	Reference	Sample quotations
<i>Category 1: Yoga can support improvements in multiple dimensions of QoL in women diagnosed with cancer</i>			
Regain the ability to perform basic and instrumental activities of daily living	Improved physiological functions of body systems	(33, 34, 37, 59-62)	"I find that it's helpful with my breathing because I think part of being anxious about being sick is it messes up your breathing and you catch yourself not breathing fully and properly." ⁽⁶²⁾
	Improved physical fitness and body alignment	(33-35, 37, 59, 61, 63-71)	"I am trying more things now. Like, I picked up a box of books and carried them." ⁽³⁷⁾
	Improved execution of task or activity	(35, 60, 61, 65, 67, 68, 72)	"I think my balance is a little better. I'm not so afraid to walk fast as I was for a while." ⁽⁶⁷⁾
	Improvements in fatigue and energy levels	(33-35, 59-62, 64, 65, 68-70, 72-74)	"My muscles are sore, but I feel more energized." ⁽⁶⁴⁾
Let go of negative emotions and thoughts while embracing inner tranquility	Decreased pain, numbness, and cancer-related symptoms	(33-37, 59, 60, 62-70, 74, 75)	"Less numbness and a general feeling of being closer to 'normal'. " ⁽³⁷⁾
	Increased emotional regulation	(33-35, 59, 64-69, 74)	"I think that it (yoga) helps also in managing work stress too because I'm able to kind of better handle it. " ⁽³⁵⁾
	Increased experiences of positive feelings, emotions, and mood	(33-35, 59, 60, 64, 65, 67-69, 72-74, 76)	"... it calms my mind and gives me positive energy, especially on a day like today which could turn bad at any moment." ⁽⁶⁴⁾

Connect the mind and body to gain a deeper self-appreciation and understanding of oneself	Increased mental strength and resilience	(33, 67)	“...we stretched [our arms] out and thought about extending our energy [through our fingertips] and it was a lot harder to push our arms down. So I think mentally it showed us that we had strength inside. And that helped me a lot.” ⁽⁶⁷⁾
	Increased connection to and awareness of the body, behaviours, and capabilities	(33, 34, 37, 65, 69, 70, 76)	“I’m now more conscious of keeping my body more upright and learning to move in a relaxed manner and by having an awareness of what’s happening with my body trying to maintain a healthy way of being.” ⁽⁶⁵⁾
	Improved coping	(33-35, 64, 70)	“I did some breathing and wrist stretches at the eye doctor. It took the stress out of the possibility of surgery.” ⁽⁶⁴⁾
	Increase in positive beliefs about self	(33-35, 59, 61, 65, 68, 70, 76)	“And we also did a lot of things with our bodies that I didn’t think possible—like hanging upside down and the different ways we stretched. And for confidence, it was great to see.” ⁽³⁵⁾
	Increased feelings of self-acceptance, reduced inner critiques, and freeing oneself from negative thoughts, feelings, and beliefs	(33-35, 37, 59, 61, 62, 65, 68, 69, 74)	“I experience myself being more in my body. And I can connect it to the sense of wellbeing, I feel more empowered due to I can help myself, and [be] more self-accepting.” ⁽³⁴⁾
	Increased understanding of self, feelings of empowerment, and self-advocation of needs	(33, 34, 37, 59, 64, 65, 70, 76)	“How important it is to take time out of my busy life to check in with my body and emotions on a regular basis.” ⁽⁷⁶⁾

	Improved outlook and mindset	(33, 34, 59-62, 65, 68)	“It’s been very positive. Every time I did it, I would feel really good about myself and about doing it. When you have a chronic illness . . . it’s really easy to fall into the trap of thinking that’s me. And you lose sight of the fact that there’s a whole lot of you, and I can find a way to tap into that and realize that you’re still strong in ways, it’s really good.” ⁽⁵⁹⁾
Quiet the mental chatter to focus on the present	Increased focus	(33, 36, 61, 65, 70, 73)	“I was feeling more focused because my body was doing something, so the mind was not able to go grocery shopping.” ⁽⁷³⁾
	Increased attention	(65, 73)	“Instead of just doing something, the exercises that we’ve been given, I actually have put some thought into what I’m doing and how I’m doing it, rather than just barging in with no thought at all.” ⁽⁶⁵⁾
	Increased feelings of mindfulness	(33, 70, 73)	“Iyengar yoga focuses a lot on the details of the poses and it takes you away from your thoughts; it quiets that chatterbox that’s always going inside your head. It helps you live more in the present and not sweat the small stuff.” ⁽⁷⁰⁾
Find contact and connection for emotional support and companionship	Increased sociability	(35, 65, 69)	"The community aspect, we socialize and hike and it's nice to hear what the other people are doing, I think that's big factor.” ⁽⁶⁹⁾
	Feeling connected to others	(33, 60, 61, 63-65, 67, 68, 74, 76)	“It just was nice hearing [others’] stories and seeing how they were progressing. It felt like I wasn’t alone.” ⁽⁶¹⁾

Category 2: Women diagnosed with cancer experience an interaction between QoL dimensions

<i>Improved fitness supports positive self-beliefs, sociability, and emotional regulation</i>	(34, 35, 59, 64, 65, 74)	“I’m not reluctant to go out any more because I was reluctant in the past to just be active because I didn’t want to be tired all the time afterward. And I’m not so reluctant about that anymore.” ⁽³⁵⁾
<i>Greater control over emotions coupled with more positive emotions supports functioning of body systems, positive self-evaluations and coping methods, and connection with others</i>	(34, 35, 59, 65, 74) (35, 64, 65)	“I did feel that every time I did finish one of the sessions like I did really accomplish something and it put me in a better mood and I’m sure that showed when I spoke to people.” ⁽⁵⁹⁾
<i>Category 3: Elements of yoga that support improvements in QoL dimensions</i>		
Being in a group of others who share common experiences	(33, 61, 63-66, 74)	“The gathering of the same people with the same condition, that’s really good because everybody understands why each other are here, and so you haven’t got to say or do anything.” ⁽⁶³⁾
Detailed and tailored instruction	(64, 70)	“I am glad we are practicing balancing, I am awful at it and have found that [Andee’s] instructions really help.” ⁽⁶⁴⁾
Physical postures, turning inward, and breathwork	(33, 34, 66, 73, 74)	“When I came in I was drowsy and sleepy. Savasana (supine meditation) is just like having a power nap... at the end of it I was feeling much more energized.” ⁽⁷³⁾
<i>Category 4: Breathwork and meditation are integral elements of yoga</i>		
Separate strategies that can be used in daily life	(33, 60, 63, 64)	“I think I really ought to put half an hour aside and do some real stretching and then I’m busy doing something, but your breathing you can do it anytime, you know, just for the odd 5 minutes and it just sort of just brings you down.” ⁽⁶³⁾

Facilitation of inner tranquility, connection to internal states, awareness of body, and decreased rumination on the external

(34, 37, 59-64, 66, 67, 73, 74, 76)

“My greatest joy was in fact working on some of the deep breathing, the meditation breathing, the sort of release to let go, and actually it’s so much more helpful because it keeps you from ending up with that tension headache and the constant knot in the stomach.”⁽³⁴⁾

Category 5: Yoga practice may support lifestyle behaviour change

(35, 59, 61, 63, 75)

“It has just encouraged me to be more active in general...really take stock on a weekly basis of what kind of things have I done and have I been active and often?”⁽⁵⁹⁾

4. Discussion

Findings from multiple articles presenting qualitative findings can be synthesized to provide an in-depth understanding of the experiences of diverse participants across settings. A systematic overview of all relevant qualitative articles focused on women's experiences participating in yoga after a cancer diagnosis is lacking as previous reviews have not focused on qualitative research (e.g., 22, 23-25). Therefore, the aim of this qualitative meta-synthesis was to examine women's perspectives on the impact of yoga on their QoL and wellbeing following a cancer diagnosis. Thematic synthesis was used to identify the main, recurrent themes of multiple qualitative articles across settings and subgroups of women with different cancer diagnoses, prognoses, and challenges. The synthesis of 24 articles provided convincing evidence that yoga yields a range of perceived benefits categorized into five broad QoL dimensions that interact: *physical, psychological, emotional, cognitive, and social*. The themes and associated quotes across articles showed common experiences and confirm that yoga helps women manage the adverse side effects of cancer and its treatments, rediscover strength and physical abilities, embrace a positive outlook and relationship with themselves, develop strategies for coping with stressors, foster social connections and support, and become more attentive and mindful. The resulting classification of themes in the current meta-study meta-synthesis corroborates current conceptualizations of QoL as a dynamic, multilevel, and complex concept reflecting subjective experience, wherein the multiple dimensions interact (77, 78). As explored in Category 2 of the results, knowing that experiences in one domain (e.g., physical wellbeing) can influence another (e.g., psychological and emotional wellbeing) based on women's accounts is important to ensure QoL measures assess multiple dimensions and that analytical approaches used in future studies capture possible interactions.

Yoga is a mind-body practice that can include meditation and breath practices in addition to guidance on leading an ethical lifestyle (27). Yet, many of the yoga interventions and programs reviewed in the 24 articles focused primarily on strengthening and stretching the body as well as improving fitness through physical postures (i.e., asanas). Findings suggest that interventions and programs promoting turning inwards for self-reflection, meditation, and breathwork can support participants' physical, psychological, emotional, and cognitive wellbeing, and should therefore be considered when designing future interventions and programs. Based on findings, another consideration is to offer women opportunities to connect with others who share common experiences and to engage with an instructor capable of offering detailed and tailored instruction, perhaps through in-person, group-based interventions and programs. A meta-study on the topic of social support and physical activity for cancer survivors asserts this conclusion (79), suggesting group-based yoga may enhance women's yoga experiences and keep them engaged after being diagnosed with cancer.

This review demonstrates a possible connection between practicing yoga and engaging in other health-promoting lifestyle behaviors such as healthy eating and other physical activities. However, only five (20.8%) articles probed this topic and even then, they did not provide insight into *why* or *how* such behaviors may be connected to practicing yoga. Perhaps experiencing improved QoL and wellbeing may have motivated participants to prioritize health-promoting, self-care behaviors/practices to further support their QoL and wellbeing. Thus, if yoga can support positive behavior change, it may make it even more meaningful for women, especially for those who would like to improve their health and wellbeing through multiple or holistic means. Future research should seek to understand the underlying mechanisms that foster QoL

and wellbeing in yoga interventions, as well as the association between yoga and behavior change.

4.1 Strengths and Limitations of Reviewed Articles

This review contributes to our understanding of QoL and wellbeing from the perspective of women practicing yoga after being diagnosed with cancer. Strengths of the included articles were that they: (1) examined experiences of women with different cancer diagnoses, prognoses, and challenges (although those diagnosed with breast cancer do represent the majority of published work), (2) investigated different types of yoga, and (3) varied in terms of the social setting, length, dosage, and delivery method of the interventions and programs, as well as presence and delivery of at-home components of the interventions. Although summarizing and analyzing data from multiple, heterogenous single articles presents challenges, it does align more closely with the ‘real’ world and the plethora of yoga classes and programs offered in various communities. It is unlikely that a single yoga intervention or program will be appropriate for all women diagnosed with cancer; therefore, it is necessary to explore women’s opinions on the ideal yoga intervention or program for promoting QoL and wellbeing to elucidate the most beneficial components. In addition, there was some variation in the qualitative methods used (e.g., semi-structured interviews, focus groups, open-ended surveys); variation in researchers’ lenses helps to provide a more nuanced interpretation of the results. Despite the strengths, there were notable limitations of the primary articles reviewed in this meta-synthesis related to reporting, intervention and program design, study procedures, and conceptualization of QoL.

4.1.1 Limitations of reporting

The majority of the reviewed articles did not reference the use of reporting guidelines (e.g., Consolidated Standards of Reporting Trials, (80); Standards for Reporting Qualitative

Research, (81)), resulting in inconsistent reporting in the primary articles. Relatedly, authors varied in their description of yoga and research procedures, with some providing very short descriptions. The Checklist Standardising the Reporting of Interventions For Yoga (CLARIFY) guidelines for yoga interventions (i.e., a reporting guideline extension to complement standard reporting guidelines), comprise 21 items across 10 reporting categories (82) and builds on previous recommendations (83); this can help improve transparency and consistency when reporting yoga interventions or programs. The following section uses the CLARIFY guidelines as a framework for discussing reporting limitations of the primary articles reviewed and can provide direction to researchers and persons seeking to develop yoga interventions and programs.

The instructor

The CLARIFY guidelines call for detailed description of the person delivering the intervention. The results of this review indicate that women find an instructors' interacting style (i.e., the manner in which an instructor/facilitator interacts with clients or participants; (84)) to be a valuable and integral component of how yoga can facilitate QoL and wellbeing. Fitness and yoga instructors' interacting styles can significantly affect participants' enjoyment and affect during/after sessions (84, 85). Therefore, authors would benefit from providing as much detail as possible on the interacting style of the person(s) delivering the yoga sessions, including whether they use visual demonstration, verbal guidance, and/or hands-on assistance. Similarly, as yoga instructors have a responsibility to maintain a safe, inclusive, and welcoming environment for participants, authors should describe how they ensured their yoga instructors were prepared to offer the intervention by detailing their expertise, experience, personal background, and education/training.

Content

The CLARIFY guidelines call for detailed reporting of the content of the intervention, including what postures, meditation, and breathwork were delivered. Although findings from this review assert the importance of particular postures, breathwork, and meditation, only three (12.5%) articles provided clear descriptions of the physical postures and only two (8.3%) included details about the breathwork and meditation used. There are nearly 100 ‘common’ physical postures that could be incorporated into a yoga class, each with their own purposes; thus, without a description or breakdown of the intervention, it makes it difficult to replicate the intervention and subsequent findings. Therefore, it is necessary for authors to describe in detail the activities/content of the yoga intervention or program, including the type of yoga and the specific elements practiced (e.g., postures/asanas, breathwork/pranayama, meditation, relaxation), with offered alternatives (if any). Similarly, when and how formal independent practice (e.g., at-home) is recommended as part of the intervention or program should be reported, and copies of materials to support such practice should be made available.

Environmental characteristics

Although not a category in the CLARIFY guidelines, authors describing future yoga interventions or programs should detail the location and layout of the space where the intervention is delivered because environments that have been carefully and effectively arranged may help promote positive experiences. For example, setting a peaceful mood by including elements such as dim lighting, views of nature (e.g., windows in the practice space), high ceilings, and ample practice space can encourage continued practice (85). In contrast, mirrors in yoga studios have been identified as a source of negative self-perceptions related to one’s physical appearance and capabilities (86, 87). Having details on the features of the space (e.g.,

windows, lighting, sound), provision of props (e.g., mats, blocks, straps, bolsters), and arrangement of participants (e.g., circular, side-by-side) would aid those setting out to create an optimal physical environment that supports women's yoga practice after cancer.

4.1.2 Limitations in Intervention and Program Design

Beyond illustrating the need for accurate and comprehensive reporting of yoga interventions and programs to allow readers to understand exactly what has been developed and evaluated, the reviewed articles raise some important questions on the type and dosage (i.e., intensity, frequency, duration) of yoga and combination of content most effective for women after a cancer diagnosis. While yoga interventions and programs prioritized primarily physical postures, limited reporting and heterogeneity across articles make robust conclusions difficult. Nevertheless, findings from this review, coupled with findings from a recent systematic review of meta-analyses of yoga interventions (88), suggest the need to include more components of traditional yoga (e.g., ethical education, postures, breathing, meditation). Future studies should shift away from the tendency to prioritize the physical element of yoga and include more breathwork and meditation, while also seeking to identify the optimal features of yoga interventions and considering the unique needs and preferences of different groups of people who may participate. Explicit comparison of two or more yoga interventions or programs varying in intensities, frequencies, and durations of postures, breath practices, and meditations should be conducted. It may also be prudent to investigate the potential for self-selecting the intensity, frequency, and duration of yoga practices because research in the domain of physical activity suggests that allowing participants in the general population to self-select physical activity can lead to better psychological/emotional functioning (89). Finally, including the Essential Properties of Yoga Questionnaire (90) would be a valuable addition to study design and

reporting to allow researchers to objectively characterize the 14 key dimensions of yoga interventions and programs (i.e., acceptance/compassion, bandhas, body awareness, breathwork, instructor mention of health benefits, individual attention, meditation and mindfulness, mental and emotional awareness, physicality, active postures, restorative postures, social aspects, spirituality, and yoga philosophy), and thus serve to enhance reliability, transparency, validity, and comparison across studies.

4.1.3 Limitations of Study Procedures

While 15 main themes were identified from 24 articles reporting qualitative results from different subgroups of women, those who were middle-aged and diagnosed with breast cancer were overrepresented, indicating a need to closely examine other groups (e.g., young adults, elderly, lung cancer) as this may reveal different QoL and wellbeing experiences related to yoga as well as different contextual considerations. Second, 19 (79.2%) articles did not report making use of any theory or models. It is unclear why more authors have not anchored their studies in theory or models, but one hypothesis is that the complex nature of yoga (wherein multiple moving parts of interventions including physical postures, instructors, and peers may influence participants' experiences) is not well-captured in current theories or models. As such, researchers may need to draw on multiple theories and models that align with the goals of their research or develop frameworks or theories that support the development of yoga interventions and programs. Last, 21 (87.5%) articles reported on participants' experiences after completing an intervention; consequently, the conceptualization of yoga and QoL are limited to controlled conditions created by researchers. Studies are needed to confirm if this would also be the case amongst women diagnosed with cancer who practice yoga independent of an intervention. Finally, studies with longer follow-up qualitative assessments are warranted to investigate the

long-term effects of yoga and hence determine if short-term improvements in QoL and wellbeing are sustained over time.

4.1.4 Limitations in Conceptualization of QoL

Only three (12.5%) articles reported negative outcomes pertaining to QoL dimensions. While this may occur because of publication bias, this could also be due to bias or oversight in the development of qualitative data collection methods (or true findings); for example, interview questions have a tendency toward eliciting positive feedback. It is important that both positive *and* negative experiences be assessed and interpreted appropriately in future research. Relatedly, as this synthesis affirms that QoL is multidimensional and dynamic, using flexible data collection methods that allow for exploring change within QoL dimensions and associations between dimensions at various time points (e.g., before, during, and after interventions) would be more in line with the characterization of QoL found in this review. More attention needs to be focused on using diverse qualitative methodologies (e.g., ethnography, narrative discourse, grounded theory) to explore the interconnectedness and multidimensional nature of QoL and wellbeing after yoga participation. Doing so may help to better understand the processes underlying women's experiences of their QoL and wellbeing and thus inform the development of optimal yoga interventions.

4.2 Strengths and Limitations of Meta-Synthesis

A main strength of this meta-synthesis is that a comprehensive and systematic approach following recommendations for a meta-study meta-synthesis was used (43). Developing the search strategy in consultation with an experienced librarian and having multiple authors independently screen, extract, analyze, and interpret findings from retrieved articles are also strengths. Also, this review adopted a broad approach (i.e., cancer and yoga characteristics were

not exclusion criteria) so that data from different subgroups of diverse women (e.g., younger and older age groups) taking part in different types of yoga across different settings (e.g., in-person or online, at a community center, yoga studio, or hospital) could be synthesized to capture all available qualitative data on how yoga impacts QoL and wellbeing. Similarly, an advantage of including all qualitative articles, regardless of qualitative methods used (e.g., semi-structured interviews, focus groups, open-ended surveys), is that it ensures that conclusions are not influenced by one specific methodological orientation, allowing for more robust conclusions.

Nevertheless, there are notable limitations that should be considered. First, only peer-reviewed published articles were reviewed, presenting the risk of publication bias (whereby articles showing a beneficial impact of yoga may have been more likely to be published). Second, only articles published in English language were reviewed. Third, although data analysis was conducted by multiple authors, the themes and subthemes developed herein may differ from those developed by other authors. The authors' professional and personal backgrounds have influenced the results and interpretation of women's experiences of QoL and wellbeing in relation to yoga (much like the values, backgrounds, and experiences of the primary authors of the included articles could have influenced their results). Fourth, studies with <50% men were included in this meta-synthesis. However, all articles did not report whether quotations or interpretations were based on men's experiences, therefore, it is possible that some codes may have been derived from men's experiences. Fifth, most articles in the review focused on asana-based yoga with only one focusing on non-asana-based yoga; the presence of physical movement in the asana-based yoga may have an impact on participants' experiences. Last, some authors provided very short descriptions/explanations of their data (perhaps due to journal word count limits) in the primary articles, offering limited insights and potentially contributing less to this

synthesis than articles with rich descriptions and comprehensive quotations. Accordingly, the quality of this meta-study meta-synthesis cannot be any better than the quality of the individual articles it is summarizing.

Conclusions

This review used rigorous methods (i.e., meta-study meta-synthesis) to synthesize qualitative research and highlights that yoga can have a positive influence on various dimensions of QoL among women diagnosed with cancer. It represents a much-needed synthesis of this research as prior reviews have focused on quantitative evidence (e.g., 22, 23-25). From the 24 articles reviewed, five overarching categories were identified: (1) women's experiences of changes in dimensions of QoL (physical, psychological, emotional, social, cognitive), (2) processes related to changes in QoL, (3) contextual considerations for these changes, (4) the importance of breathwork and meditation for improving QoL, and (5) the potential influence of yoga on lifestyle behavior change. Ultimately, findings help extend our understanding of how yoga impacts the lives of women diagnosed with cancer. Based on this review, yoga may promote QoL by helping women experience positive physical and mental changes, become more socially connected and supported, and live meaningfully and mindfully. From a research perspective, this review has the specific advantage of synthesizing heterogeneous qualitative findings, making it easier to understand *how* and *why* yoga may support improvements in QoL among women diagnosed with cancer. It also helps generate new hypotheses about intervention/program setting and content, theory, and conceptualizations of QoL; thus, this review allows people to make informed decisions based on all available evidence. In turn, through the process of synthesizing multiple articles, it provides increased confidence that yoga interventions or programs are likely to have significant implications for promoting positive

changes in women's QoL and should therefore feature in future studies and practices seeking to find alternative therapies to promote QoL in this population.

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Chapter 4: Study 2 (article 3), Meta-Synthesis Part 2

Women's experiences with yoga after a cancer diagnosis: A qualitative meta-synthesis – Part 2

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Published in *Complementary Therapies in Clinical Practice*

Final publication is available from Elsevier:

<https://doi.org/10.1016/j.ctcp.2023.101752>

Abstract

A review of qualitative research exploring women's experiences with yoga after a cancer diagnosis can provide important insights into their motives, barriers, and preferences for yoga participation, which can be used to enhance engagement. In this meta-study meta-synthesis, 6 electronic databases were systematically searched to identify qualitative studies focused on women diagnosed with cancer who engage in yoga. The search yielded 6,804 results after de-duplication; of these, 24 articles were eligible and included. Extracted data pertaining to the results, methods, and theoretical approach(es) were analyzed. This paper synthesizes and integrates results from 16 of the 24 articles focused on women's motives, barriers, and preferences for participating in yoga programs and interventions; it is Part II of a 2-part meta-study meta-synthesis. Motives to participate in yoga included: rehabilitation, physical activity, social support, and novel experience. Barriers centred around time constraints, lack of intentionality, online adaption difficulties, health condition, and cost. Main approaches to delivering yoga comprised: in-person, in-person with an at-home component, asynchronous online, and synchronous online. Each mode of delivery presented its own benefits and challenges, with suggestions for improvement; participants highlighted the value of supportive and knowledgeable instructors, the ability to connect with others, and the importance of well-rounded classes focused on more than just movement. Participants' challenges also highlighted a need to actively seek solutions to anticipated challenges prior to delivering interventions and programs. Findings provide information that can be used to develop and deliver yoga interventions to women diagnosed with cancer that prioritize their needs and preferences.

Registration: PROSPERO; registration number: CRD42021229253; February 17, 2021.

Keywords: Mind-body; Oncology; Physical Activity; Exercise; Female; Review

1. Introduction

While conventional treatments for cancer (e.g., surgery, chemotherapy, radiotherapy) have increased survival rates for women, they often cause persistent and distressing side effects that diminish quality of life. Commonly reported side effects include physical consequences (e.g., scarring, hot flashes, vaginal dryness, weight gain/fluctuations [1-4]) and psychosocial challenges (e.g., anxiety, depression, cognitive deficits, negative body image [5-8]). The enduring and adverse impact of side effects has spurred research into approaches that can help women thrive during and following treatment. Physical activity has emerged as a key strategy to help mitigate the negative physical and psychosocial side effects of cancer and its treatments, reduce the risk of comorbidities and secondary malignancies, and improve quality of life [9, 10]; however, many women do not regain pre-cancer physical activity levels [11, 12].

Providing women opportunities to engage in physical activity within the context of an intervention or program can help them increase their physical activity levels after treatment [13, 14]. Researchers have evaluated a wide range of physical activity programs (e.g., dragon boating [21], aerobic exercise classes [16], mountain climbing [23]); although promising to increase physical activity, women have identified a need for mind-body physical activity programs that can potentially address physical and psychosocial side-effects [15]. Yoga may fill this need. Notably, several systematic reviews and meta-analyses suggest that yoga, a mind-body physical activity, yields positive effects on health-related quality of life, depression, anxiety, fatigue, and sleep disturbances as compared to no intervention or other active interventions in women diagnosed with cancer [e.g., 16, 17]. The promising results support its promotion; yet, questions remain as to how to optimize engagement and in turn outcomes. By better understanding

women's motives, barriers, and preferences for engaging in yoga after a cancer diagnosis, more acceptable and beneficial yoga interventions/programs in this population can be developed.

Current research in the field of physical activity helps elucidate possible motives (i.e., factors that facilitate physical activity initiation and maintenance and refer to the outcomes or states that an individual aims to attain or avoid [18]) and barriers (i.e., obstacles that can interfere with behaviour initiation and maintenance [19]) women may experience when participating in yoga after a cancer diagnosis [20-22]. Motives and barriers can be grouped based on whether they relate to the situation (i.e., situational motives/barriers) or the individual (i.e., internal motives/barriers) [19]. Situational motives and barriers are factors outside of an individual's control that may promote or prevent/limit participation in an activity; these can be interpersonal (e.g., social support), institutional (e.g., responsibilities and roles), community (e.g., access to facilities, distance to the place of practice), public policy (e.g., rules and practices around safety), or physical environment characteristics (e.g., weather). Internal motives and barriers reflect the biological events and internal thoughts, cognitions, and emotions people identify as reasons to (or not) to participate in an activity. Examples of motives women have identified for engaging in physical activity after being diagnosed with cancer include disease management, improving physical fitness, promoting psychological wellbeing, ease and opportunity for physical activity, support from family and friends, and acquiring social support [13, 20]. Conversely, examples of barriers include lack of time, bad weather, limited access to facilities, fatigue, fear of injury, poor physical condition, lack of motivation, insufficient knowledge, and/or no enjoyment [20, 23].

In addition to women's motives and barriers to engaging in physical activity programs like yoga, program characteristics may have a direct impact on whether they maintain their engagement in yoga interventions or program [24, 25]. For instance, women diagnosed with

cancer have reported practical considerations (e.g., dose, scheduling, setting), yoga-related elements (e.g., instruction style, yoga type), and member characteristics and interactions (e.g., diagnosis type, support offered) as impacting their participation during yoga interventions and programs [25-27]. Qualitative research has been used to gather in-depth insights into participants' experiences in real-world contexts in which yoga occurs and the meaning they make of it to understand aspects not easily captured by quantitative means. For example, qualitative research has involved asking women who have participated in a yoga intervention or program after a cancer diagnosis about their thoughts pertaining to the different modes, formats, and content of programs to ensure they match women's needs and/or preferences [e.g., 24, 26]. It is important to synthesize the data generated in such studies to make recommendations for the development and implementation of future yoga interventions/programs and ultimately enhance the relevance, accessibility, and quality of their implementation. Therefore, the aim of this 2-part meta-study meta-synthesis was to use a standardized, rigorous method to synthesize the qualitative literature and address the following 3 research questions: (1) what are the experiences of women who have participated in yoga after a cancer diagnosis? (2) what elements of yoga contribute to participants' positive or negative experiences? and (3) what are participants' motives, barriers, and preferences for their participation in yoga interventions and programs? The current paper comprises Part II of the 2-part meta-study meta-synthesis and reports on findings focused on addressing the third question; Part I reported on women's wellbeing and quality of life [28].

2. Methods

The protocol for this review was registered in PROSPERO on February 17, 2021 (registration number: CRD42021229253) and has been published [29]. The Preferred Reporting

Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist was adhered to during the preparation of this manuscript (see [Appendix E](#) Figure 1 for the PRISMA flow diagram).

2.1 Eligibility Criteria

The inclusion criteria emerged directly from the research questions and were set a priori. To be included, articles must have: (1) been primary studies conducted with women ≥ 18 years diagnosed with cancer, regardless of type of cancer, disease stage, and timing (e.g., at diagnosis, on treatment, post-treatment, or palliative care), (2) used qualitative methods to collect data (e.g., interviews, focus groups, observations, journaling, open-ended survey questions), (3) reported on participants' experiences engaging in yoga of any type and dose, and (4) comprised original research published in the English language in a peer-reviewed journal. Mixed-methods studies that presented qualitative findings were included; those that did not were excluded, as were grey literature, books, opinion pieces, and reviews. Moreover, studies with a sample consisting of $>50\%$ men were excluded.

2.2 Information Sources and Search Strategy

Articles were retrieved by searching 6 electronic databases: Medical Literature Analysis and Retrieval System Online (MEDLINE), Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsycINFO, Scopus, SPORTDiscus, and Web of Science. The search strategy was pilot-tested and finalized in MEDLINE (see [Appendix D](#)) before being translated for use in the other 5 databases. An initial database search was completed on November 14, 2020. Results were exported into Covidence [30], a systematic review online platform, and duplicates were automatically deleted. To ensure all pertinent studies were identified, the reference lists of relevant reviews retrieved during the electronic database search and of eligible

studies were scanned on August 15, 2021. A second database search was performed on October 16, 2021 to retrieve articles published during or after November 2020.

2.3 Selection and Data Collection Process

Covidence was used to store, organize, and manage citations. After the removal of duplicate records, the titles and abstracts of remaining citations were independently reviewed by 2 reviewers, followed by full-text review of retained citations. During both steps, a 3rd reviewer made the final decision when disagreements occurred. Cohen's kappa was calculated to measure inter-coder agreement at both screening steps, and can be interpreted as follows: 0-0.20 = none, 0.21-0.39 = minimal, 0.40-0.59 = weak, 0.60-0.79 = moderate, 0.80-0.90 = strong, >0.90 = excellent agreement [31].

2.3.1 Data Extraction

Data extraction was conducted independently by 2 reviewers using a template for collecting data housed on Covidence. The following data were extracted: (1) study information (i.e., authors, country of data collection, year of publication), (2) study characteristics (i.e., study design, sampling methods, methodology, data collection methods, analysis methods), (3) sample characteristics (i.e., sample size, age, percent female, type of cancer(s), disease stage(s), treatment status(es)), (4) reported yoga background and practice characteristics (i.e., dose(s) [frequency of practice, length of intervention, session duration], location(s), style(s) of yoga, social setting(s), mode(s) of delivery); (5) declared conceptual/theoretical frameworks, and (6) qualitative findings. If the information presented in the primary article was unclear or missing, the corresponding author was emailed for clarification (a maximum of 3 attempts were made). To ensure completeness and accuracy, 2 reviewers independently extracted data from each

article, validation checks were conducted after extraction was complete, and 2 reviewers met to discuss any differences before proceeding to analysis.

2.4 Quality Assessment

The Consolidated Criteria for Reporting Qualitative Research (COREQ) 32-item checklist [32] was used to assess the quality of included studies; related results are presented narratively in Part I [28].

2.5 Synthesis Methods

2.5.1 Meta-Data Analysis

For the meta-data analysis, a thematic synthesis approach was used [33] and carried out by 2 reviewers. First, the extracted data (i.e., a combination of illustrative quotes and the interpretations from the primary studies' authors) were coded line-by-line to search for patterns and sub-themes within and across articles. Second, similarities were grouped together into main themes. Third, main themes pertaining to *Research Question 3* were compiled and a narrative summary was prepared. Finally, initial codes and themes were discussed with a 3rd reviewer and revisited or refined accordingly. During the analysis, any disagreements were resolved through discussion.

2.5.2 Meta-Method Analysis

For the meta-method analysis [34], data pertaining to the yoga intervention or program characteristics were compared within and across studies. The goal was to look for links and patterns across studies that would provide an understanding of the key features relating to participants' motives, barriers, and preferences for their participation in yoga interventions or programs.

2.5.3 Meta-Theory Analysis

For the meta-theory analysis [34], data pertaining to conceptual/theoretical frameworks informing the intervention or program or the analysis of participants' motives, barriers, and preferences for participating in yoga were examined. This involved: identifying declared conceptual/theoretical frameworks, examining the assumptions/propositions that underlie the frameworks, and assessing consistency between the underpinning assumptions/propositions and the study characteristics (i.e., study design, sampling methods, methodology, data collection methods, analysis methods), as well as the results and the ways in which the authors interpreted them.

2.5.4 Meta-Synthesis

Through selecting, appraising, summarizing, and combining qualitative findings, new interpretations were formed to create an overarching narrative of women's motives, barriers, and preferences for participating in yoga. The goal was to generate new or alternative approaches that may allow for yoga interventions and programs to be delivered to women in a manner that meets their needs, wants, and preferences.

3. Results

Of the 12041 references retrieved during the electronic database searches, 5237 were removed as duplicates. Titles and abstracts were screened for the remaining 6804 citations, and 6730 citations were deemed irrelevant (Cohen's kappa=0.83). This left 74 full-texts to be screened; 22 were eligible (Cohen's kappa=0.90). Hand-searching relevant reviews and the eligible full-texts yielded 2 potentially relevant full-texts; both were eligible. A total of 24 articles were included in the final meta-synthesis, with 16 addressing *Research Question 3*; the

following sections present results pertaining to these 16 articles and the corresponding 18 interventions or programs.

3.1 Meta-Method Results

Table 4-1 presents a summary of the 16 articles included in Part II, including country of data collection, study design, sample characteristics (i.e., sample size, age, percent female, type of cancer(s), disease stage(s), treatment status(es)), intervention characteristics (i.e., dose(s) [frequency of practice, length of intervention, session duration], location(s), style(s) of yoga, social setting(s), mode(s) of delivery), qualitative methodology, data collection methods, data analysis methods, and conceptual/theoretical frameworks. An overview of the 24 eligible articles is presented elsewhere [28]. The earliest article that was reviewed was published in 2008. The 16 articles involved 386 participants (320 women; 82.9%) from 5 countries, with sample sizes ranging from 3 to 74 ($M=24.13$, $SD=18.9$). The average age of participants across studies ranged from 35.7 ($SD=7.02$) to 73.09 ($SD=6.8$) years.

Table 4-1. Summary of article characteristics included in the meta-synthesis of women's experiences participating in yoga after a cancer diagnosis ($n=16$).

	N (%)
Study Information and Characteristics	
Country of Data collection	
Canada	5 (31.3%)
Netherlands	1 (6.3%)
Sweden	1 (6.3%)
United Kingdom	1 (6.3%)
United States of America	8 (50.0%)
Study Designs	
Quasi-experimental	9 (56.3%)
Experimental	6 (37.5%)
Observational	1 (6.3%)
Sample Characteristics (N=386)	
Sample size (M number $\pm$ SD ; range)	24.13 ± 18.9 ; 3-74
Age of participants (M years; range) *	56.3; 35.7-73.09
Sex (n , % female)	320 (82.9%)
Treatment Status at Recruitment	
On-treatment	7 (43.8%)

Post-treatment	4 (25.0%)
On- and post-treatment	3 (18.8%)
Not reported	2 (12.5%)
Cancer Type	
Blood	1 (6.3%)
Breast	5 (31.3%)
Lung	1 (6.3%)
Mixed diagnosis	8 (50.0%)
Not reported	1 (6.3%)
Disease Stage	
0-3	5 (31.3%)
0-4	3 (18.8%)
4	1 (6.3%)
Not applicable	1 (6.3%)
Not reported	6 (37.5%)
Epistemology, methodology, and methods	
Qualitative Methodology	
Interpretative phenomenological analysis	1 (6.3%)
Descriptive	1 (6.3%)
Instrumental case study	1 (6.3%)
Interpretive description methodology	1 (6.3%)
A combination of symbolic interactionism, ethnography, mindful inquiry, and phenomenology	1 (6.3%)
Not reported	11 (68.8%)
Data Collection Method	
Interviews	7 (43.8%)
Focus groups	4 (25.0%)
Open-ended survey questions	3 (18.8%)
Interviews and evaluation forms	1 (6.3%)
Interviews and journals	1 (6.3%)
Data Analysis Technique	
Thematic	4 (25.0%)
Grounded theory	1 (6.3%)
Interpretative phenomenological	2 (12.5%)
Constant comparison	1 (6.3%)
Ethnographic content	1 (6.3%)
Categorical aggregation/iterative	1 (6.3%)
Iterative-thematic	1 (6.3%)
Inductive reasoning	1 (6.3%)
Reflective thematic	1 (6.3%)
Not reported	3 (18.8%)
Conceptual/Theoretical Frameworks	
Power as Knowing Participation in Change	1 (6.3%)
Not reported	15 (93.7%)
<i>Note:</i> *= mean of all the mean ages	

Table 4-2 presents individual intervention characteristics (i.e., dose(s) [frequency of practice, length of intervention, session duration], location(s), style(s) of yoga, social setting(s), mode(s) of delivery). Thirteen (81.3%) articles presented data from participants who participated in 1 intervention, 1 (6.3%) article presented data from participants who participated in 3 interventions (or “in 1 of 3 interventions), and 2 (12.5%) articles presented data from participants who engaged in a community program. The yoga interventions and programs were offered for 1 to 12 weeks ($M=7.3$), consisted of 1 to 36 sessions ($M=12.5$), lasted 20 to 120 minutes ($M=65.9$), and ranged from 1 to 7 times per week ($M=1.7$). Across the articles, several strategies were identified for how investigators designed or developed the interventions/programs. Specifically, investigators developed a prescription from a video library of yoga classes ($n=1$; 6.2%), delivered a modified version of an established program (i.e., the Mindfulness-Based Stress Reduction program ($n=1$; 6.2%)), identified intervention components based on previous literature and had them reviewed by certified yoga instructors ($n=1$; 6.2%), delivered a program developed based on previous pilot research ($n=2$, 12.5%), and invited cancer survivors and family members to participate and guide development of the intervention ($n=1$; 6.2%). In 7 (58.3%) articles, the authors did not provide information pertaining to how the intervention was designed or developed. Finally, 3 (18.7%) articles reported on observational findings from community-based programs.

Table 4-2. Overview of individual intervention characteristics included in the meta-synthesis of women's experiences participating in yoga after a cancer diagnosis (n=16).

First author	Intervention or program	Mode of delivery	Social setting	Length of intervention (weeks)	Frequency of practice (sessions/week)	Number of sessions (total)	Session duration	Location	Style
Addington 2018	Intervention	Synchronous videoconferencing	Group	6	2	12	75mins	Online	Integral
Archer 2015	Intervention	In-person	NR	10	1	10	60mins	Multi-faith centre	Hatha
Carr 2016	Intervention	In-person + CD (no prescription)	1-on-1 + Self-guided	3	1	3	45mins	Home	Kripaula
Danhauer 2008	Intervention	In-person	Group	10	1	10	75mins	Studio	Restorative
Duncan 2008	Community program	In-person	Group	10	1	10	90mins	Studio	Iyengar
Flanagan 2021	Intervention	Pre-recorded video	Self-guided	4	7 (daily)	28	20mins	Online	Mindfulness-based
Galantino 2012b	Intervention	In-person + Handouts	Group + Self-guided	12	1-2 + 3 (after week 6) <i>at home</i>	18 + 18 <i>at home</i>	70mins + 15mins	Unclear + Home	Iyengar-inspired
Huberty 2018	Intervention	Asynchronous videos on website	Self-guided	12	2-3	24-36	20mins	Online	Hatha and vinyasa
Kligler 2011	Intervention	In-person	1-on-1	NR	NR	NR	NR	Hospital	NR

Kvillemo 2011	Intervention	In-person + Instruction tape (no prescription)	Group + Self- guided	8	1	8	120mins	Studio + Home	Hatha
McCall 2015a <i>Group A – Low dose</i>	Intervention	In-person	Group	1	1	1	30mins	Studio	Pranayama
McCall 2015a <i>Group B – Medium dose</i>	Intervention	In-person + Asynchronous videos on website (no prescription)	Group + Self- guided	NR	NR	2	75- 120mins	Studio + Online	Restorative
McCall 2015a <i>Group C – High dose</i>	Intervention	In-person + Asynchronous videos on website (no prescription)	Group + Self- guided	4	3	12	60mins	Studio + Online	Restorative
McCall 2015b	Community program	In-person	Group	N/A	N/A	N/A	60mins	Private cancer care facility	Restorative
McDonnel l 2020	Intervention	In-person	Group	8	1	8 + 1 4hr retreat	120mins	Studio	Hatha
Taylor 2018	Intervention	In-person	Group	8	1	8	75mins	Howard University Communit y centre/ church	Restorative
Thomas 2011	Intervention	In-person	Group	6	1	6	NR		Iyengar
vanUden- Kraan 2013	Community program	In-person	Group	N/A	1	NR	60mins	Studio	Hatha and Healing

Notes: NR=Not reported.

3.2 Meta-Theory Results

Only 1 (6.2%) article cited theory when describing the development of their yoga intervention. In this study, Flanagan and colleagues [35] stated using the *Power as Knowing Participation in Change* theory to frame their approach to the intervention, inform data collection measures (qualitative and quantitative), and inform deductive data analysis. Power as Knowing Participation in Change framework suggests when people are aware, understand their choices, are free to act intentionally, and are involved in creating change they will positively experience power. While it is unclear if and how the framework influenced some methodological decisions (i.e., study design, sampling), it did influence the data collected as the authors collected qualitative data pertaining to theoretical outcomes. Additionally, as the authors deductively-inductively analysed the findings in line with the framework, it also influenced the data analysis process. Last, the authors aligned the design of their intervention with tenets of the framework, in that they offered flexibility in their at-home video intervention to promote freedom and choice, and in turn they concluded that participants' sense of power during the intervention prevented loss to follow up during the study – a conclusion that is not directly in line with the theory.

3.3 Meta-Data Results

Participants' insights into their experiences participating in a yoga intervention or program after a cancer diagnosis were collected mostly via interviews (n=9, 56.2%), with fewer studies using open-ended survey questions (n=5, 31.2%) and focus groups (n=2, 12.5%). Synthesis of the results from the 16 studies yielded 6 main themes (see Table 4-3 for an overview, Table 4-4 for supporting data). The first 2 themes present women's motives for (i.e., underlying reasons that inspired a participant to enrol in yoga) and barriers to (i.e., obstacles that prevented or restricted participants from engaging in yoga) participating in yoga interventions

and programs. The next 4 themes centre around the delivery mode: (1) in-person, (2) in-person with an at-home component, (3) online asynchronous, and (4) online synchronous. The latter 4 themes encompass a description of the elements participants considered beneficial or that they appreciated (i.e., advantages or positive outcomes that resulted from the delivery mode), alongside the challenges they experienced (i.e., difficulties faced in participating in yoga that resulted from the delivery mode), as well as suggestions for changes and important considerations pertaining to improving the intervention based on the delivery mode.

Table 4-3. Overview of categories, themes, and subthemes included in the meta-synthesis of women's experiences participating in yoga after a cancer diagnosis (n=16).

Themes	Subthemes
<i>Category 1: Influences for engaging in yoga</i>	
Motives for Participation:	For rehabilitation
Yoga as a means to support wellbeing	Physical activity
	Social support
	Novel experience
Barriers to Participation:	Time constraints
Internal and external obstacles	Lack of intentionality
	Online adaptation difficulties
	Health condition
	Costs
<i>Category 2: In-person Interventions and programs</i>	
Benefits: A space for guided self-care	The opportunity to prioritize oneself
	Access to supportive and knowledgeable instructors
	More than just physical movement
Challenges: Falling short of expectations	Difficulties connecting with others
	Mismatch between program characteristics and participants' preferences
Suggestions	More yoga
	Higher intensity
	Broader objectives
	Calmer location
	Earlier on the continuum
	More convenient options
	More social support
<i>Category 3: In-Person Interventions with Self-Guided at Home Practice</i>	
Benefits: A space for care, connection, and comfort	Access to supportive and knowledgeable instructors
	More than just physical movement
	Connecting with others

Challenges: Not the right space or guidance	In-home delivery increased access Not appropriately adapted for their needs
Suggestions	More social support Earlier on the continuum
<i>Category 4: Online Asynchronous Interventions</i>	
Benefits: Supporting usability	Increased accessibility Tailor the practice
Challenges: Not being able to connect	Lack of access to a supportive and knowledgeable instructor Online adaptation difficulties Not being able to connect with others
Suggestions	More yoga Flexibility of how to attend
<i>Category 5: Online Synchronous Intervention</i>	
Benefits: Convenient connection	Access to supportive and knowledgeable instructors Connect with others
Challenges: Limited accessibility	Online adaptation difficulties Mismatch between program characteristics and participants preferences
Suggestions	More options Later on the continuum

3.3.1 Category 1: Influences for engaging in yoga

Motives for Participation: Yoga as a means to support wellbeing

Five articles reported the reasons women participated in yoga or a study featuring yoga providing insight into what motivates women to enrol in studies offering yoga. Participants indicated that they participated in yoga *for rehabilitation*, explaining that they felt yoga was a non-medical approach to support their health [15, 36] and could help them develop a “mind-body connection” [37]; it was also seen as a potential approach to improve their physical functioning (e.g., flexibility) [26, 36], psychological health (e.g., relaxation, stress relief, improve breathing) [26, 36-38], as well as overall health [15, 26, 36, 37]. In terms of *physical activity*, participants shared that they wanted to participate in the yoga studies because it offered them an opportunity to increase their physical activity levels [36, 37], it was considered an adaptive form of physical activity [15, 36, 37] while others saw it as an opportune activity because the sessions were

located in close proximity to their homes [36]. Yoga as a means of *social support* was also reported as a motive because participants considered it a social activity that they could engage in with other cancer survivors [26, 36, 38]. Finally, participants shared that they had wanted to participate in yoga for a *novel experience* because they wanted to learn about yoga [26] or because they had received recommendations from others to engage in yoga [26].

Barriers to Participation: Internal and external obstacles

Seven articles provide context for the barriers or obstacles that women experience that prevent or restrict their access or progress within a study on yoga or continuing yoga afterwards. During interventions, participants in all 7 articles expressed barriers related to *time constraints* due to competing priorities [15, 26, 39], scheduling conflicts [26], finding yoga time-consuming [40], and feeling like they had a lack of time to participate [15, 25, 41]. Participants discussed *lack of intentionality* to participate; participants expressed concerns around having a lack of discipline [15] and motivation [25] to engage in yoga. For those practicing yoga at home whilst doing an intervention with an online component they experienced *online adaptation difficulties*, voicing that technological difficulties [24], a lack of space [25], and unclear instructions [25] were barriers to their engagement. Further, participants were hindered by their *health condition*, reporting side-effects related to treatment [25, 26, 39] (e.g., fatigue, stiffness, reduced strength), ill health [41], and physical limitations [39, 41] as obstacles to participating in yoga. Finally, post-intervention, participants reported *costs* related to enrolling in programs [15, 25] and transportation costs [25] as barriers to continued participation in yoga.

3.3. 2 Category 2: In-Person Interventions and Programs

In 8 articles, women provided insight into the elements of in-person yoga interventions/programs they appreciated, found challenging, and felt could be altered to improve future participants' experiences.

Benefits: A space for guided self-care

Participants expressed that in-person interventions or programs offered *the opportunity to prioritize oneself* by providing space for relaxation and 'me time' [26], as well as opportunities for social support from others with similar experiences [15, 25, 26, 38, 42]. In addition, attending in-person gave participants *access to supportive and knowledgeable instructors*, thus participants appreciated receiving expert [15] and individual [42] instruction from instructors who had created inclusive and relaxing environments [25, 26], helped participants manage their expectations [27], and tailored classes to their intensity requirements [15]. Participants also enjoyed having built-in education about yoga (e.g., poses and counter poses, benefits; [26]) and being offered brief training or instruction for self-guided at-home practice [15] within classes. Participants also felt they benefited from classes that were *more than just physical movement* and appreciated when classes incorporated breathing techniques [25, 26], meditation [25, 26], and physical postures for strength and conditioning [25-27], as well as poses that were low-intensity/gentle [38], restorative [25], and involved props to assist with alignment in poses [42].

Challenges: Falling short of expectations

Although cancer-specific groups were appreciated [15, 25], *difficulties connecting with others* who had different diagnoses or who were at different stages on the cancer continuum occurred [26]. *Mismatch between program characteristics and participants' preferences* were also noted. Specifically, smaller classes deterred some who preferred larger classes [26] or vice

versa [25]. In addition, participants reported that classes were too short (i.e., 75 minutes), the day/time of the classes was inconvenient, the location was undesirable (i.e., too far from home), and the content was repetitive [26]. Finally, concerns were raised about difficulties maintaining at-home practice without proper guidance [27].

Suggestions

Women suggested in-person yoga interventions and programs could be improved by modifying the structure, intensity, objectives, location, timing, mode of delivery, and social setting. Specifically, for the structure, participants suggested *more yoga* with longer interventions (i.e., > 8 weeks; [38, 43]), longer classes (i.e., > 75 minutes), more frequent classes (i.e., >1/week) [26], and greater guidance for at-home practice in the form of handouts [26]. In terms of *higher intensity*, participants suggested a more vigorous/strenuous style of yoga [26, 27] or offering different intensity options [38]. Participants also suggested *broader objectives* for the yoga interventions, as they thought adding lifestyle counselling [43] and information on the benefits of yoga [26] into the interventions and programs could be useful. In terms of *calmer location*, participants felt yoga should be delivered in a more restful space that does not feel clinical (versus at a hospital) [44]. Offered *earlier on the continuum* was suggested because participants were of the perspective that in-person yoga interventions or programs prior to conventional treatment or surgical operations would be beneficial [25]. Regarding *more convenient options*, although in-person yoga interventions and programs seemed generally acceptable and even preferred to other methods (e.g., online) [15], online delivery was noted as a advantageous to help reduce fear of contracting infections and to increase convenience [25]. Finally, with respect to *more social support*, participants suggested it may be appropriate to

facilitate regular group meetings amongst participants to encourage participation [25] and/or incorporate the classes into a support group [43].

3.3.3 Category 3: In-Person Interventions with Self-Guided at Home Practice

In 4 articles, those who participated in an in-person intervention that included a self-guided at-home component provided similar evaluations for the in-person component of the interventions while also providing insight into the at-home component of the intervention.

Benefits: A space for care, connection, and comfort

Participants appreciated having *access to supportive and knowledgeable instructors* who were inclusive [25], facilitated relaxation [25], had a gentle, encouraging, and supportive demeanor [45], were kind [39], accepting [39, 40], and non-judgmental [40], and was capable of tailoring the classes to participants' abilities [45]. Participants also appreciated when the content of the yoga classes were *more than just physical movement* and included breathing techniques [25, 39], meditation [25, 39, 40], and physical postures for strength and conditioning [25], as well as poses that were comfortable [40], relaxing [40], restorative [25], and allowed for gentle stretching [25, 39]. In addition, participants echoed the importance of *connecting with others* by being able to receive social support from similar others [25, 39, 45] in a small class size setting [25]. For one intervention, *in-home delivery increased access*, because participants appreciated the ease, convenience, and comfort of having an instructor coming to their home [45].

Challenges: Not the right space or guidance for yoga.

Participants found the self-guided at-home component of the interventions and programs was *not appropriately adapted for their needs*. Specifically, they shared that the prescribed yoga frequency for at-home practices (i.e., 6 times/week) was too much or overwhelming [40]. Also, participants expressed struggling to engage in their at-home practice when they did not have the

appropriate space to accommodate their practice [25]. Participants also relayed challenges with initiating their at-home practice due to confusing instructions [25]. In addition, powerful and strong emotions were experienced during at-home practices and participants felt like they did not have the necessary supports available to handle or cope in these moments [40].

Suggestions

Participants receiving an individual intervention at-home wanted *more social support* and felt the social setting of the intervention could be improved with the incorporation of some type of group-based element into the intervention/program to facilitate social support [45]. For *earlier on the continuum*, participants were of the perspective that in-person yoga interventions or programs prior to conventional treatment or surgical operations would be beneficial [25].

3.3.4 Category 4: Online Asynchronous Interventions

In 2 articles, participants provided insight into the elements of online asynchronous yoga interventions they appreciated and which should be altered to improve participants' experiences.

Benefits: Supporting usability

Participants felt online, asynchronous interventions or programs were beneficial because they *increased accessibility*; they were considered convenient [41], allowed for flexibility in scheduling [41], and were appropriate for those unable to attend in-person classes for various reasons (e.g., rural living, older adults with limited mobility, cancer-related restrictions, preference to practice in the privacy of one's own home [41]). Also, participants appreciated that the videos were available from an easily accessible website [35] and that providers/physicians were involved in the creation of the videos [35]. Participants benefited from being able to *tailor the practice* by having access to a database of videos with different intensities that could be rewatched at their convenience because it allowed them to tailor their practice based on their

current energy levels and abilities [41]. Further, participants appreciated that videos offered opportunities for meditation or relaxation, either as part of the practice or via separate videos [41].

Challenges: Not being able to connect

However, online, asynchronous interventions or programs presented challenges due to the *lack of access to a supportive and knowledgeable instructor* to offer feedback, especially when yoga routines were too difficult or causing pain [41]. Also, participants found that the pre-recorded practices could become repetitive [35]. Participants reported that the intervention or program had *online adaptation difficulties*; specifically, participants experienced technological difficulties and disliked only having access to videos on their laptop/computer. As well, participants reported that practicing at-home was challenging due to space restrictions [41]. Finally, in terms of *not being able to connect with others*, participants disliked the lack of social interaction and the lack of a sense of community [41].

Suggestions

Participants felt that the structure of the intervention and programs could be improved with *more yoga*. Although participants appreciated having a target for self-guided practice (i.e., 60 minutes/week), some would have preferred a larger target of more minutes/week [41]. As well, participants who only had access to 1 pre-recorded video suggested offering more [35]. Finally, in terms of *flexibility of how to attend*, participants acknowledged that it would be appreciated to have the option to attend sessions in-person [41].

3.3.5 Category 5: Online Synchronous Intervention

Although there is considerably less data pertaining to online, synchronous interventions, Addington and colleagues' [24] study delivering a group-based, integral yoga intervention over

12 weeks provides important considerations for researchers interested in delivering this style of intervention.

Benefits: Convenient connection

Participants considered the online synchronous intervention to be convenient and they appreciated having *access to supportive and knowledgeable instructors* so that they could learn about yoga and engaging in relaxing postures and poses, while also being able to *connect with others* to receive group social support.

Challenges: Limited accessibility

However, there were *online adaptation difficulties* because the teleconferencing technology was confusing and complicated for some. As well, the lack space and lighting at home retracted from the calm and relaxing intention of yoga. Finally, participants felt there was a *mismatch between program characteristics and participant preferences*; the 75-minute classes were too long and the integral yoga was not strenuous/intense enough for their liking.

Suggestions

To improve *convenience*, participants suggested *more options* as changes to the *structure* of the intervention in that classes could be offered on different days and at different times. For timing, *later on the continuum*, would have appreciated participating in an online synchronous intervention or program post-treatment (rather than on-treatment).

Table 4-4. Categories and themes with sample quotations identified in articles included in the meta-synthesis of women's experiences participating in yoga after a cancer diagnosis (n=16).

Categories	Themes	References	Sample Quotations
Influences for engaging in yoga	Motives for participation: Yoga as a means to support wellbeing	[15, 26, 36-38]	"My body needed attention. During treatment you become common property, something that everyone meddles with. I needed something for my body, a present for myself." [37]
	Barriers to participation: Internal and external obstacles	[15, 24-26, 39-41]	"You have to pick Suzie up at day care and Johnny needs to go skating and somebody's got to make dinner, where do you find time?" [15]
In-Person Interventions and Programs	Benefits: A space for guided self-care	[15, 25-27, 38, 42]	"Being in a group of like-situated people created some comfort with the reality of things like scars and changes in my body and the reality of cancer as an everyday part of life." [42]
	Challenges: Falling short of expectations	[15, 25-27]	"It got a little boring doing the same things each week." [26]
	Suggestions	[15, 25-27, 38, 43, 44]	"Participants verbalized a desire for a program extension (beyond 8 weeks) and for a level 3 (anticipating responsibility for their own continued efforts)." [38]
In-Person Interventions with Self-Guided at Home Practices	Benefits: A space for care, connection, and comfort	[25, 39, 40, 45]	"That feeling of having [yoga] at home makes such a difference to the experience." [45]
	Challenges: Not the right space or guidance	[25, 40]	"Of course it is time consuming, especially during the weekends. I want to find time for it, but it is a more difficult thing when you have 3 children." [40]
	Suggestions	[25, 45]	"In terms of yoga delivery, some patients (n=3) felt that yoga intervention should be offered before conventional treatment or surgical operations." [25]
Online Asynchronous Interventions	Benefits: Supporting usability	[35, 41]	"I like the flexibility of doing it when I had time. When it was convenient for me was probably the best thing about doing it online." [41]
	Challenges: Not being able to connect	[35, 41]	"I don't know if it was my wifi or what but there were a lot of videos that would like just freeze up, umm, so sometimes that was a little frustrating." [41]

	Suggestions	[35, 41]	“60 minutes got too little at the end ... They should’ve had to do 90 minutes . . . I wound up doing more because it felt like you needed to do more. Or you wanted to do more. Same with exercise, once you start walking, your body tends to want to do it.” ^[35]
Online Synchronous Intervention	Benefits: Convenient connection	[24]	“The three women who attended > 1 class enjoyed learning about yoga, relaxing, and meeting each other.” ^[24]
	Challenges: Limited accessibility	[24]	“All four women described negative experiences with the videoconferencing technology (e.g., “complicated,” “confusing”).” ^[24]
	Suggestions	[24]	“All four women indicated that offering classes at varied times of day could facilitate increased attendance, and two recommended beginning yoga post-treatment.” ^[24]

4. Discussion

The overall aim of this 2-part meta-synthesis was to systematically search, analyze, critically appraise, synthesize, and interpret the collective results from qualitative research on women's perspectives, thoughts, and beliefs regarding their participation in yoga following a cancer diagnosis. The present paper is Part II of the meta-synthesis and is focused on women's motives, barriers, and preferences for the yoga interventions/programs in which they participated; to our knowledge, this meta-synthesis represents the first attempt to systematically address this research question. From the 16 articles included in this review, 50% (n=8) were performed in-person, with a clear predominance of middle-aged women diagnosed with breast cancer. Preferences for intervention delivery were most frequently investigated (n=14), followed by barriers (n=7), and then motives (n=5). Broadly speaking, this meta-synthesis illustrates that women are motivated by fulfilling rehabilitative needs, increasing physical activity, gaining social support, and novel experience to engage in yoga; however, they also experience several situational and personal barriers to doing so. Findings also highlight that the characteristics of the yoga intervention or program are important; across the different modes of delivery, it was evident that providing participants with access to supportive and knowledgeable instructors, opportunities to connect with others, and well-rounded yoga classes that focus on more than just movement are all appreciated qualities of yoga interventions and programs. However, there remains a mismatch between program characteristics and participants' preferences, and a specific need to ensure that programs and interventions with an online component are appropriately adapted. Collectively, these results give evidence of what elements of yoga programs and interventions end users themselves—women diagnosed with cancer—interpret as meaningful in real-world contexts in which yoga occurs. Further, findings generate rich, detailed data that adds

to women's meaning making experiences pertaining to why they choose to participate in yoga and the elements that may deter their practice, which could not be easily captured by means of standardized methods or reduced to numbers.

On the basis of the 16 articles synthesized herein, results suggest that women are willing and want to engage in yoga interventions and programs after a cancer diagnosis, with participants identifying several situational (e.g., being around similar others) and internal (e.g., rehabilitation, physical and psychological benefits) motives that have been reported in previous physical activity oncology literature [46]. Several other motives have been identified for participating in yoga across non-clinical populations, including positive affect, health/fitness, nimbleness, mind-body integration, coping/stress management, supplementary activity, competition/social recognition, and spirituality [47-49]; however, these reasons do not appear to be universally-motivating. Indeed, differing motives have been identified amongst women and men [48] and those who perceive yoga as a physical practice versus a psycho-spiritual practice [49]. As well, length of time practicing (i.e., years of experience) has been reported to influence motives for yoga participation [47]. Within this meta-synthesis, participants reported the following 4 motives that could be interpreted as being directly related to yoga: (1) they considered it an adaptive form of physical activity, (2) they wanted to learn about yoga, (3) they were interested in cultivating a mind-body connection, and (4) yoga was recommended to them by others within their personal or healthcare circle. While the mind-body connection mirrors motives reported by non-clinical samples [47, 49], the other yoga-related motives suggest that women diagnosed with cancer may be motivated to practice yoga because it offers a novel experience that helps address both physical and psychosocial sequelae. That being said, most articles explored the experiences of participants who had not previously participated in yoga;

therefore, their motives may change as (or if) they seek to maintain their yoga practice post-intervention/program. As such, it would be beneficial to use longitudinal study designs to capture if and how motives change during and after a structured intervention or program. Relatedly, if future yoga interventions and programs are to cater to both novice and experienced practitioners, then individuals seeking to create and deliver programs should consider how yoga is understood by the intended participants. Additionally, it may be beneficial to recognize what motives encourage people enrol in yoga interventions and programs, but seek to promote motives generally aligned with maintenance as the intervention or program progresses. Incorporating women diagnosed with cancer in the development of promotional and maintenance messaging may also help to ensure that the messages are aligned with the target sample.

Moreover, while women may be willing and want to engage in yoga after a cancer diagnosis, they also experience several situational (e.g., technological difficulties, unclear instructions) and internal (e.g., lack of time, lack of discipline) barriers to their participation in yoga during the interventions and programs. Some of the health-related barriers reported in this meta-synthesis (e.g., side-effects related to treatment) are indeed unique to adults diagnosed with cancer, but most of the barriers have been reported previously in the non-clinical physical activity literature. For example, in a scoping review of 88 articles exploring the facilitators and barriers to yoga in the general population [50], 38 articles mentioned barriers which were organized into 6 categories: (1) psychological barriers, (2) negative impressions of yoga, (3) lack of resources, (4) social barriers, (5) characteristics of the yoga program or intervention, and (6) health issues. Although participants in this meta-synthesis did not report negative impressions of yoga (e.g., requires flexibility/athleticism, racialized and only for white people, in conflict with personal beliefs, inaccessible or exclusive), this may be because participants actively sought to

participate in yoga intervention or program studies and thus potentially had a biased view. Therefore, it is necessary to specifically seek out the thoughts, beliefs, and opinions of women diagnosed with cancer who do *not* typically participate or wish to participate in yoga to gain a more in-depth understanding of their barriers to participation. Similarly, collecting data on participants' reasons for dropout may provide insight into what elements of an intervention or program may need refinement. For instance, within the reviewed articles, Danhauer, Tooze [26] reported that women who did not complete the program cited schedule conflicts, competing responsibilities, and effects of cancer treatment as reasons for dropout. In addition, most barriers identified in this meta-synthesis were internal (e.g., time constraints, lack of motivation, physical limitations). To facilitate continued participation post-intervention, it is necessary to help participants identify their barriers, offer suggestions and strategies for overcoming their barriers, and foster barrier self-efficacy beliefs (i.e., their perceived ability to overcome their barriers to yoga).

Within the context of health and wellbeing promotion, the purpose of evaluating an intervention or program is to determine whether the program has *merit* (i.e., intrinsic value of the program), *worth* (i.e., extrinsic value of the program to those in the larger community), *value* (i.e., political and social contextual criteria influencing merit and worth), and *impact* (i.e., the effect of the intervention/program on the participants) [51]; this information can be used to improve, expand, adjust, or eliminate the intervention or program moving forward [52, 53]. The present meta-synthesis highlights the *merit* of existing yoga interventions and programs for women diagnosed with cancer by discussing the several facilitating factors they identified for participating in different types of interventions. In particular, online and self-guided interventions (whether synchronous or asynchronous) offered participants convenience and

flexibility, whereas in-person interventions offered women the opportunity for support, guidance and tailoring, and a relaxing environment that was free of distraction (if offered at a location outside of the home). However, there was no one type of intervention/program that was unanimously favoured, nor one that did not have its challenges in this review, which could (directly or indirectly) influence the value of existing yoga interventions and programs. These challenges can be categorized as issues pertaining to: (1) structure (e.g., class size, class length, location), (2) performance (e.g., maintaining an at-home practice without guidance), (3) compatibility (e.g., day/time of class, location of class), (4) sensory environment (e.g., too small of space, distractions in space), (5) accessibility (e.g., confusing instructions for at-home practice, only able to access classes on laptop/computer), (6) risk (e.g., no instructor to tailor difficult or painful poses), and (7) participant experience (e.g., poor or no social interaction, repetitive content). Since only 1 article [38] stated involving end-users in the development of the intervention, a method to improve the merit of yoga interventions and programs is to involve end-users during the development phase to ensure yoga interventions and programs consider factors that contribute to yoga being intrinsically valuable. Additionally, it would be beneficial to assess the acceptability of planned interventions and programs prospectively, concurrently, and retrospectively to ensure continued refinement and improvement of interventions and programs.

4.1 Methodological Considerations

While the results of this meta-synthesis provide valuable information on the motives, barriers, and preferences of women diagnosed with cancer who participate in yoga, there are several study design and methods considerations. First, while 82.9% of the sample was female (320/386), with 56.25% (n=9) of articles reporting on samples that were exclusively women, there was no indication that findings varied according to sex nor gender. Moreover, apart from

37.50% (n=6) of articles, the samples in all other studies were heterogenous in terms of cancer types, which can have a bearing on women's experiences during group-based yoga and/or the amalgamation of data. In addition, 56.25% (n=9) of articles reported on data collected using interviews and only 37.5% (n=6) explicitly aimed to explore and analyze participants' motives, barriers and/or preferences. Moving forward, women (i.e., end-users) should be included when both designing and conducting research. Also, ensuring research questions explicitly seek to understand motives, barriers, and preferences will offer even more insight into how to optimize yoga interventions and programs. As well, using longitudinal study design is key to exploring changes and transitional experiences of women participating in yoga after a cancer diagnosis.

4.2 Theoretical Considerations

The use of theory in quantitative research has been touted as necessary to form a basis for understanding and incorporating the accumulated knowledge of the mechanisms of action (mediators) and moderators of change on behaviours (e.g., yoga participation) and outcomes (e.g., quality of life) [54]. However, theory is inconsistently used to inform study design and/or data analysis in qualitative research in psychosocial exercise oncology, despite calls for its inclusion [55]. Similar to other meta-syntheses [56], there was poor integration of theory in the primary studies reviewed herein; only 1 (6.25%) article in this review declared using theory [35]. Despite its current underutilization in the field, several theories may provide rich insight into factors that should be considered when developing yoga interventions and programs to better identify and target the antecedents of behaviours and the causal determinants of change. Based on previous research on yoga [57-61], the developmental theory of embodiment [62], embodiment model of positive body image [63], objectification theory [64], and self-discrepancy theory [65] are possibly relevant theoretical frameworks. For instance, objectification theory [64]

and self-discrepancy theory [65] provide insight into how and why certain psychosocial outcomes (e.g., body image) may influence subjective experiences of self and relationships with others. Whereas, the developmental theory of embodiment [62] and the embodiment model of positive body image [63] provide insight into how and why yoga may attenuate certain outcomes. In addition, researchers in the field of yoga scholarship have developed a conceptual model describing how yoga practice may supportive positive embodiment [66]. Beyond what has been used before, since women were motivated by fulfilling rehabilitation needs and increasing physical activity, there are several other theories, models, or frameworks from the health behaviour change literature that may be appropriate for generating new ideas for yoga research in psychosocial oncology, such as the post-traumatic growth model [67], social cognitive theory [68], trans-theoretical model [69], theory of planned behaviour [70], and self-determination theory [71]. Given the value of theory for allowing researchers to determine whether unsuccessful interventions/programs may have failed due to no effect upon the hypothesised mediator or no effect of the mediator on the outcome of interest (e.g., quality of life), future studies should seek to incorporate theory from study conceptualization onwards and ensure appropriate alignment of the investigators philosophical perspectives, theoretical positions, methodology used, and interpretation of findings to advance qualitative research exploring women's experiences with yoga interventions and programs.

4.3 Limitations and Strengths of Meta-Synthesis

It is important to consider findings in light of the following limitations. First, the synthesis of qualitative data is reliant on the researchers' own interpretations and thus, others may have formed different themes and reached different conclusions than those reported herein. Second, this meta-synthesis mainly captures the motives, barriers, and preferences of women in

one cancer cohort (i.e., middle/older-aged women diagnosed with breast cancer). As such, women diagnosed with other forms of cancer (e.g., colorectal) or those at different stages of their life (e.g., young adults) may have similar or divergent experiences. In addition, transferability may also be limited because all included studies were conducted in high-income countries; thus, it is possible that women living with a cancer diagnosis in other geographic locations and global conditions may: (1) experience different motives, barriers, and preferences with respect to yoga participation, and (2) ascribe different meanings to yoga practices. Third, this meta-synthesis is limited by the quality (or lack thereof) of the primary articles. That is, authors in some primary studies provided less descriptive data than others, limiting the ability to draw insights from their work. Fourth, articles reviewed for/included in this meta-synthesis were all peer-reviewed (which presents the risk of publication bias) and written in the English language (which may have hindered a fully comprehensive synthesis of the available data). Finally, approximately 18 months had passed since the second data base search was conducted in October 2021 and publication of this article. Articles presenting findings that deviate or add to the findings presented herein may have been published since.

However, despite the aforementioned limitations, there are several strengths to this meta-synthesis. First and foremost, following recommendations from Paterson and colleagues [34], this meta-study meta-synthesis was carefully executed using a comprehensive and systematic approach. As well, rigor was ensured by developing the search strategy in conjunction with an experienced librarian, using multiple search engines to capture as many relevant articles as possible, and by having multiple authors independently screen, extract, analyze, and interpret findings while also engaging in validation checks and having discussions when disagreements arose. Further, by not limiting the inclusion of studies based on population (i.e., cancer type,

stage, treatment(s) received) nor qualitative methods used, this meta-synthesis provides a broad narrative of women's motives, barriers, and preferences participating in yoga after a cancer diagnosis.

4.4 Conclusions

This 2-part review used rigorous methods (i.e., meta-study meta-synthesis) to synthesize qualitative research and provides valuable context surrounding women's motives, barriers, and preferences for engaging in yoga after a cancer diagnosis. In line with previous research in the physical activity literature, women in the 16 articles synthesized herein expressed several situational and individual motives and barriers for engaging in yoga that can guide implementation efforts in future research. Further, the benefits, challenges, and suggestions identified and summarized herein provide valuable guidance for the development and evaluation of future interventions and programs. These data, couple with results of Part I, show yoga may be an attractive form of physical activity programming that is viewed as supporting physical and psychosocial health. However, time, technology, interest, health, and feasibility may hinder participants during and after interventions and programs, while practical considerations, yoga-related elements, and member characteristics and interactions may influence their experience during yoga interventions and programs. From a research perspective, this review has the specific advantage of synthesizing heterogeneous qualitative findings, making it easier to understand the multitude of interventions and programs that have been offered in this population as well as the shortcomings of current conceptualizations and implementation of yoga interventions and programs; thus, this review allows people to make informed decisions based on all available evidence.

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Bridging Study 2 and 3

The purpose of *study 2* was to use a qualitative meta-study meta-synthesis methodology to: (1) integrate findings from primary qualitative articles exploring the accounts of women who participated in yoga after a cancer diagnosis, (2) compare and contrast the findings to elucidate patterns or contradictions in conclusions, and (3) develop an overarching narrative of women's experiences participating in yoga after a cancer diagnosis. The themes and associated quotes presented in Part 1 highlight the common outcomes women diagnosed with cancer experience, including managing of adverse side effects of cancer and its treatments, rediscovering strength and physical abilities, embracing a positive outlook and relationship with themselves, developing strategies for coping with stressors, fostering social connections and support, and becoming more attentive and mindful. While the themes and associated quotes presented in Part 2 provide context for the factors that influence women's engagement in yoga after a cancer diagnosis, such as fulfilling rehabilitative needs, increasing physical activity, gaining social support, and having a novel experience, while time, intention, online adaptation difficulties, health condition, and cost are prohibitive to engaging in yoga. In addition, it was evident that providing participants with access to supportive and knowledgeable instructors, opportunities to connect with others, and well-rounded yoga classes that focus on more than just movement are all appreciated while not taking into consideration the needs of participants can detract from the positive experience of participating in yoga. This rigorous review of qualitative research on yoga enabled the gathering of comprehensive information on the experiences and perspectives of women diagnosed with cancer, which could be used to inform the development of a tailored and evidence-based yoga program. Building on the findings from *studies 1 and 2*, *study 3* was designed to facilitate the co-creation of a yoga program by end-users (i.e., women diagnosed with gynecologic cancer, yoga

instructors) in partnership with a community-based cancer support organization (i.e., the Ottawa Regional Cancer Foundation) that would ultimately support implementation of the program.

Chapter 5: Study 3 (article 4), Co-Creation of Program

Co-creating a yoga program for adults diagnosed with gynecologic cancer: A Consensus Study

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Submitted to Peer Review Journal

Abstract

Yoga may be uniquely suited to address bio-psycho-social concerns among adults with gynecologic cancer because it can be tailored to individuals' needs and can help shift focus inward towards self-reflection, body appreciation, and gratitude. This study describes the collaborative process guided by the Knowledge-to-Action framework used to develop a yoga program for adults with gynecologic cancer and inform a feasibility trial. In 3 collaborative phases, yoga instructors and adults diagnosed with gynecologic cancer formulated recommendations for a yoga program and evaluated the co-created program. The program proposed is 12 weeks in length and offers 2 60-minute group-based Hatha yoga classes/week to 5 to 7 participants/class, online or in-person, with optional supplemental features. Overall, participants deemed the co-created program and instructor guidebook to be reflective of their needs and preferences, though they provided feedback to refine the compatibility, performability, accessibility, risk precautions, and value of the program as well as the instructor guidebook. The feasibility, acceptability, and benefits of the program are being assessed in an ongoing feasibility trial. If deemed feasible, acceptable, and beneficial, the yoga program may support the quality of life of adults diagnosed with gynecologic cancer, and thus show promise for broad distribution.

Keywords: Co-creation; Oncology; Mind-Body; Quality of Life

1. Introduction

Over 1.5 million Canadians are living with and beyond cancer, most of whom are living long-term (i.e., 5-25 years after their diagnosis; (1)), which has implications for supportive care services. Every year, 12,000 adults will be diagnosed with a gynecologic cancer (i.e., vulvar, vaginal, ovarian, cervical, endometrial/uterine) in Canada, accounting for more than 11% of new cancer diagnoses (2). Adults diagnosed with gynecologic cancer report poorer quality of life (QoL) than published norms from the general population (3-6); yet, little research has explored means of improving their QoL – a key patient-reported outcome encompassing physical, social, emotional, psychological, and cognitive well-being (7, 8). Moreover, adults diagnosed with gynecologic cancer report reduced connection to their body (9), disrupted self-perceptions (10), and concerns about others' responses to their bodies (11), in addition to reduced feelings of femininity and sexual energy/libido (12), all of which can further reduce QoL. Indeed, adults diagnosed with gynecologic cancer report enduring side effects related to sexual health and body image as influential for QoL (13-15). Therefore, supportive care services that support bio-psycho-social processes that contribute to improving adults' relationship with their bodies after a gynecologic cancer diagnosis are necessary to promote QoL into survivorship.

Yoga is a form of leisure activity that may be uniquely suited to promote QoL by supporting positive thoughts, feelings, and behaviours towards one's physical function, appearance, and interactions with others (16). Yoga, in the modern-day Western setting, is often focused on moving, stretching, and balancing through a series of poses (asanas), awareness of breath (breathwork; pranayama), and cultivating the connection between the mind and body (meditation; dhyana and dharana) (17, 18). A recent meta-synthesis of qualitative articles exploring women's experiences participating in yoga after a cancer diagnosis suggest the

physical poses in yoga facilitate the “journey inward” by encouraging a focus on proprioceptive feedback from the body, breathwork can provide a foundation for the calming of the mind (e.g., by observing the breath as it is, changing the breath in tandem with a count, or attaching breath to imagery), and meditation can help meet present-moment experiences with openness, acceptance, and nonjudgment (19). Women without a history of disease report reduced self-objectification and body surveillance, and increased mindfulness, self-compassion, body appreciation, body image flexibility, perceptions of competence, and positive affective states (e.g., joy, desire, pleasure) after practicing yoga (16). Many of these benefits are also reported by women diagnosed with cancer; yoga can help women manage symptoms and side effects, rediscover strength and physical abilities, embrace a positive outlook and relationship with themselves, develop strategies for coping with stressors, foster social connections and support, and become more attentive and mindful (19).

Despite the benefits of yoga, existing programs⁵ have several limitations, especially pertaining to program design and delivery, that diminish their potential. A meta-synthesis of 16 qualitative studies investigating women’s preferences pertaining to yoga programs after a cancer diagnosis reveals participants regularly experience challenges related to the program structure, performance, compatibility, sensory environment, accessibility, risk, and enjoyment (20). Thus, existing programs may not meet the wants and needs of adults diagnosed with gynecologic cancer. In addition, few programs were developed collaboratively with key persons fundamental to program delivery (i.e., yoga instructors), which could promote better instruction practices. Yoga instructors are in a unique position to contribute to participants’ body-related experiences during yoga (21), either positively or negatively via their leadership, verbal commentary about

⁵ For brevity, programs refer to community-based programs, researcher delivered interventions, and services intended to have participants practice yoga.

weight and shape, social support, approach to creating a culture of inclusion, and teasing. One approach to overcome these limitations is to collaborate with yoga instructors and adults diagnosed with gynecologic cancer to co-create a yoga program that takes into consideration the wants, needs, and preferences of knowledge users.

Typically, research co-creation is considered a collaborative process between academic (typically researchers) and non-academic members, wherein the goal is to co-create knowledge rather than only interacting during dissemination of the research results (22, 23). There are several approaches to incorporate knowledge users into the research process. The International Association for Public Participation spectrum of public participation (24) suggests individuals can participate in research at different degrees ranging from: (1) *inform* (i.e., provide the public with balanced and objective information to assist them in understanding), (2) *consult* (i.e., obtain public feedback on analysis, alternatives and/or decisions), (3) *involve* (i.e., work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered), (4) *collaborate* (partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution), to (5) *empower* (i.e., place final decision making in the hands of the public). The relationship between academic and non-academic collaborators in the involve, collaborate, and empower phases of the continuum are sustained for a period of time with roles and responsibilities between members being more fluid. Consequently, the knowledge that is co-created through these collaborative efforts is more likely to be contextually-relevant and suitable for knowledge users (e.g., adults with gynecologic cancer and yoga instructors).

1.1 Project Description

Guided by the Knowledge-to-Action (KTA) framework (25), a yoga program and instructor guidebook were developed using principles of co-creation with knowledge users. The primary purpose of the KTA framework is to bridge the know–do gap (25), ensuring research is utilized by appropriate and/or intended knowledge users to improve health delivery systems and health outcomes (26, 27). The KTA framework comprises two distinct but related components, knowledge creation (i.e., the knowledge funnel) and moving knowledge into action (i.e., the action cycle). Both components involve several overlapping phases that can be iterative. The knowledge funnel represents knowledge creation and as knowledge moves through the funnel it becomes more refined, whereas the action cycle outlines a process representing the activities needed for knowledge to be applied in practice which may be carried out sequentially or simultaneously. The phases of the action cycle are: (1) identify a problem that needs addressing and identify, review, and select the knowledge or research relevant to addressing the problem; (2) adapt the identified knowledge or research to the local context; (3) assess barriers to using the knowledge; (4) select, tailor, and implement interventions to promote the use of knowledge; (5) monitor knowledge use; (6) evaluate the outcomes of using the knowledge; and (7) sustain ongoing knowledge use.

The purpose of this project was to have a research team (JP, JB, CH) partner with non-academics, namely a community organization (the Ottawa Regional Cancer Foundation; ORCF) that offers supportive care services, resources, and programs to cancer patients and survivors to collaborate with (1) adults diagnosed with gynecologic cancer and (2) yoga instructors to (a) facilitate the co-creation of a sustainable yoga program for adults diagnosed with gynecologic cancer with an accompanying instructor guidebook, and (b) inform the development of a feasibility trial to assess the program's feasibility, acceptability, and benefits. An integrative

knowledge translation approach (28) guided by the KTA framework was used to ensure non-academic partners, otherwise known as the community organization (i.e., ORCF) and knowledge users (i.e., yoga instructors, adults diagnosed with gynecologic cancer), were involved throughout the research process to ensure the outputs suit each group, as well as to ensure future uptake and feasibility of the co-created program.

The specific aim of this collaborative project was to provide organizations that offer supportive care to adults diagnosed with gynecologic cancer a yoga program that is both evidence-based and acceptable to knowledge users. By describing the process of developing this complex program in this manuscript, the intention is to assist others interested in co-creating an intervention, program, service, or strategy to address local challenges.

2. Materials and Methods

2.1 Study design

The overall project was divided into 3 distinct phases (see Figure 5-1). Phase 1 focused on collaboration with an advisory board, Phase 2 focused on collaboration with knowledge users during a consensus panel meeting, and Phase 3 focused on evaluating the program proposed through focus groups. Within this approach, Phase 2 and Phase 3 employed a consensus panel meeting methodology (29) and a phenomenology methodology (30), respectively. This approach and methodologies centered on the community organization's and knowledge users' involvement throughout the project. Throughout the process of co-creation, the research team actively collaborated on planning, creation, and assessment decisions with the community organization (i.e., ORCF) and prioritized knowledge user feedback on the design and delivery of the program. The guidance for reporting of patient and public involvement in health and social care research (GRIPP2) checklist was adhered to in the preparation of this manuscript (31).

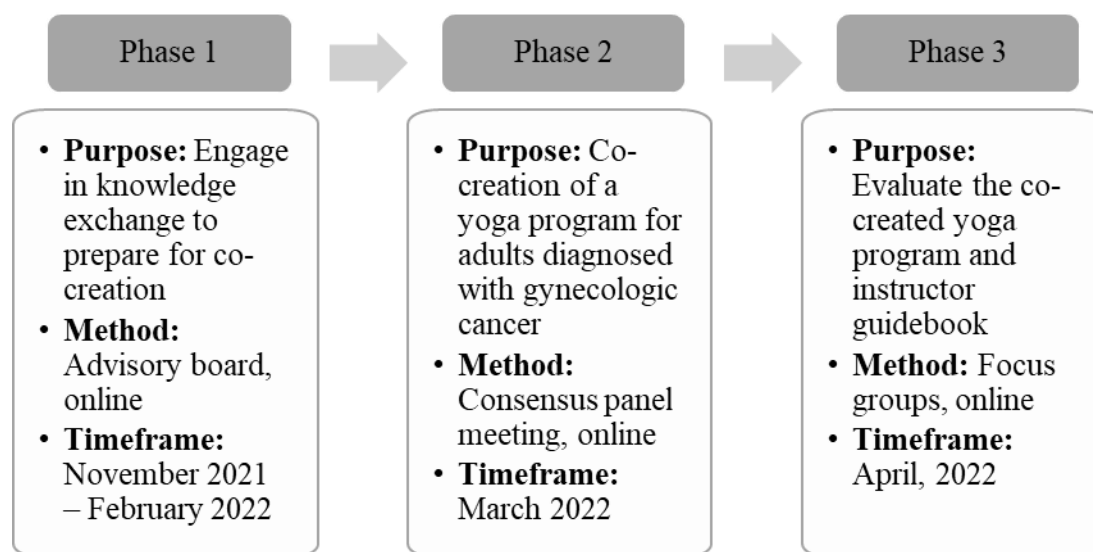


Figure 5-1. Overview of the co-creation process to create a yoga program for adults diagnosed with gynecologic cancer.

2.2 Researcher characteristics and reflexivity

The research team, comprising the 3 authors and one undergraduate student, acknowledged and reflected on their preconceptions, life experiences, and knowledge as they collected and interpreted the data. The first author (JP; principal investigator) is a PhD candidate in the School of Human Kinetics at the University of Ottawa. She is in her mid-20's, a qualitative research trainee in physical activity and health promotion, and a certified vinyasa yoga instructor. The second author (JB, co-investigator) is a Full Professor in the School of Human Kinetics and JP's doctoral supervisor. She is in her late-30's and has experience conducting qualitative research to understand people's suffering and thriving after cancer diagnosis and treatment. The third author (CH, collaborator) is a Clinical Psychologist in her late-40s who has worked closely with individuals diagnosed with cancer in both clinical and research capacities for the past 15 years. AT, in her early-20's, is a third year Bachelor of Science student in the School of Human Kinetics with a minor in Biochemistry who was actively exploring her interest in research at the time this work took place. She was involved in data

collection and was invited to contribute to the manuscript; she ultimately decided it did not align with her professional goals.

2.3 Community organization characteristics

The ORCF describes its organization as the voice for cancer survivorship in Eastern Ontario (Canada). Their mission is to help people living with cancer by providing local residents with increased access to person-centered care through the delivery of patient support, innovative cancer research, and a world-class clinical trials program. The ORCF is classified as a non-for-profit charity; in 2022 they raised \$4.7 million to support their organization's initiatives. The ORCF delivers over 35 programs with over 1,500 visits between June 2022 and April 2023 within the Ottawa (Ontario, Canada) community.

Throughout the project, the research team collaborated with 3 individuals who worked at the ORCF. At the start of the partnership, the research team collaborated with the Manager of the Survivorship Care Program at the ORCF (Collaborator 1); she had worked in the area of health and wellness for over 17 years, spending 13 of those years specifically as an allied healthcare provider supporting cancer survivors through physical activity. She managed the Survivorship Care Program at the ORCF and oversaw the day-to-day operations of the delivery of their health services and programs. However, she left the organization prior to the submission of the grant and another member of the organization took over the position. As such, during Phase 1, the research team collaborated with the new Manager of the Survivorship Care Program (Collaborator 2) who had worked in the area of health and wellness as a Registered Nurse for over 34 years, spending the last 8 of those years as a Cancer Coach at the ORCF to support cancer survivors. During Phase 2, she left the organization; Naomi Praamsma (NP, fourth author, Collaborator 3), Vice President of Programs and Stakeholder Development, took on the role of

primary collaborator for the organization and continued the collaboration process, including contribution to the manuscript. NP is an experienced leader with an MA in Leadership and a demonstrated history of working in the non-profit organisational management field while supporting change in complex systems. She spent 4 years as the Executive Director with the Bethany Hope Centre for young parents, 11 years as their program director, and most recently spent almost 3 years as a Community Development Coordinator with the Ottawa Food Bank. In addition, NP has invested 20 years on the Faculty at Algonquin College supervising students in the Child and Youth work program.

2.4 Phase 1: Engage in knowledge exchange to prepare for co-creation

2.4.1 Description and aims

The ‘identify a problem’ phase of the KTA framework involved a patient and public advisory board. From November 2021 to February 2022, 4 monthly meetings were held online with an advisory board to discuss pertinent literature (19, 20), establish desired outcomes for the co-creation yoga program, review consensus meeting materials, and review data collection approaches. The goal was to ensure the research team understood the experiences and perspectives of the community organization and knowledge users while developing materials used in Phase 2 and Phase 3.

2.4.2 Sampling and participant description for advisory board

The advisory board during Phase 1 consisted of 2 adults diagnosed with gynecologic cancer, 2 yoga instructors, 2 healthcare professionals (CH, Collaborator 2), 2 researchers (JP, JB), and 1 junior trainee (AT). The 2 adults diagnosed with gynecologic cancer were contacted after having been ineligible to participate in a previous study conducted by the authors but had expressed interest in supporting future research on the topic area. The yoga instructors were

contacted after having been identified by participants in a previous study conducted by the authors as individuals who would be interested in sharing their knowledge. JP initiated contact in October 2021 and invited them to join the board. The healthcare professionals, whom JP and JB knew already, were initially approached in March 2021 to collaborate on the grant application to support this project. The junior trainee was invited to work on the project as part of a program at the University of Ottawa to support undergraduate students to gain experience in research.

2.4.3 Procedures

After the members of the advisory board were identified, 4 1-hour meetings were held via Microsoft Teams at a mutually agreed upon time that worked for all members. When members were to provide feedback on documents, these were provided 2 weeks prior to the scheduled meeting to allow enough time to adequately review the wording, topics, and presentation of the documents. Meeting agendas were sent 1 week prior to each meeting and reminder emails (including meeting links) were sent (as per board member request) 10 minutes before the scheduled start of the meeting. The meetings were chaired by JP, and AT took meeting notes. Table 5-1 provides an overview of each meetings' purpose and the knowledge shared during the meeting.

Table 5-1. Advisory board meeting topics and knowledge shared

Meeting Number	Purpose	Knowledge shared
Meeting 1 – November 2021	• Provide an overview of the project • Review roles and responsibilities • Share reasons for participating in the advisory board	Reasons for participating included: • Sharing their cancer experiences • Improving the lives of fellow survivors • Bringing awareness to gynecologic cancers • Helping build a meaningful and universal program for gynecologic cancer survivors

Meeting 2 – December 2021	• Explore desired outcomes of a yoga program • Explore possible ways to facilitate them in a yoga program	Desired outcomes included improving wellbeing: • Physical (e.g., managing symptoms and fatigue, improving physical strength and flexibility, decreasing body aches), • Psychological (e.g., coping with stress and anxiety, emotional stability, confidence, body image, sexuality), and • Social (e.g., increasing sense of community and connection with others)
Meeting 3 – January 2022	• Review the resources, materials, and agenda for Phase 2 (i.e., the consensus panel meeting)	Members highlighted the need to: • Present information in an unbiased manner (i.e., the research team is not directing participants towards a specific outcome) • Condense information into infographics and using concise language that would help keep participants focused on the purpose and objectives of the consensus panel meeting • Provide participants with a video to highlight common symptoms and treatment for gynecologic cancers so that the yoga instructors in attendance would have a stronger understanding of the needs of adults diagnosed with gynecologic cancer
Meeting 4 – February 2022	• Review data collection approaches that would be used in Phase 3 (i.e., the focus groups)	Members provided feedback on: • Wording of questions • Flow of questions • Questions to add

2.5 Phase 2: Co-production of a yoga program for adults diagnosed with gynecologic cancer

2.5.1 Description and aims

In March 2022, a 1-day virtual consensus panel meeting with knowledge users (i.e., adults diagnosed with gynecologic cancer, yoga instructors) and researchers was held to address the second action phase of the KTA framework (adapt knowledge to local context). The outcome of the phase was to ensure knowledge users' voices and experiences guided decisions to ensure a suitable program was created to support their needs and circumstances.

2.5.2 Sampling for virtual consensus panel meeting

Participants were recruited from across Canada during January and February 2022. Adults diagnosed with gynecologic cancer and yoga instructors were recruited through self-referral via recruitment posters distributed around Ottawa, postings on social media and in registries, and word of mouth. Adults diagnosed with gynecologic cancer were eligible if: ≥ 18 years of age, diagnosed with a non-metastatic gynecologic cancer, no prior cancer diagnosis, participate in yoga ≥ 1 /week during a typical month, and able to read/understand English. Yoga instructors were eligible if: ≥ 18 years of age, have ≥ 1 year experience instructing yoga, actively teach yoga ≥ 1 /week in a typical month, and able to read/understand English. Researchers were identified by JP and JB and invited by email to participate. They were eligible if: conducted studies on yoga or related activities (e.g., mindfulness) preferably in cancer populations, published >1 article in a peer reviewed journal on the topic of yoga in the last 10 years, and were able to read/understand English.

2.5.3 Procedures for virtual consensus panel meeting

Adults diagnosed with gynecologic cancer and yoga instructors were screened for eligibility by phone, provided detailed information about the study, and if eligible and interested, provided verbal consent at the end of the screening call. One week prior to the consensus panel meeting, participants were emailed a link to SurveyMonkey and asked to complete a brief survey prior to the consensus panel meeting to collect background information. Adults diagnosed with gynecologic cancer ($n=8$) were asked to self-report sociodemographic (i.e., age, gender, marital status, education, income, employment status, number of children, ethnicity) and medical (i.e., time since diagnosis, cancer type, cancer stage, treatment types, self-report physical and mental wellbeing) information. Yoga instructors ($n=13$) were asked to self-report sociodemographic

information (i.e., age, gender, marital status, education, household income, employment status, ethnicity) and instructional experience (i.e., years instructing, training, average number of classes taught in a typical week, average length of class taught in a typical week). Tables 5-2 and 5-3 present summaries of adults diagnosed with gynecologic cancer and yoga instructors' characteristics, respectively. One week prior to the consensus panel meeting, all participants were granted access to a Microsoft OneDrive folder that contained the consensus panel meeting agenda, information sheets, and recording sheets; whilst encouraged to review beforehand, it was not mandatory and whether participants had done so was not verified.

Table 5-2. Sociodemographic and medical characteristics of adults diagnosed with gynecologic cancer who participated in co-creation of yoga program (n=7)

Variables	Descriptives
Age (years), M $\pm$ SD, range	47.1 $\pm$ 13.4, 32-66
Woman, % (n)	100 (7)
Married or common law, % (n)	71.4 (5)
Completed at least university/college, % (n)	71.4 (5)
Household income >75,000 CAD, % (n)	71.4 (5)
Full-time employment status, % (n)	28.5 (2)
Children ^b	
Have children, % (n)	42.8 (3)
Number of children, M $\pm$ SD, range	2.3 $\pm$ 0.5, 2-3
Age of children, M $\pm$ SD, range	22.8 $\pm$ 7.7, 11-32
Ethnicity	
White	100 (7)
Co-morbid physical conditions, % (n)	71.4 (5)
Co-morbid psychological conditions, % (n)	28.5 (2)
Time since diagnosis, M $\pm$ SD, range	3.3 $\pm$ 3.9, 0.75-12
Cancer type	
Ovarian, % (n)	28.5 (2)
Cervical, % (n)	28.5 (2)
Endometrial/uterine, % (n)	42.8 (3)
Cancer stage	
I, % (n)	57.1 (4)
III, % (n)	42.8 (3)
Treatments	
Surgery, % (n)	100 (7)
Chemotherapy, % (n)	57.1 (4)
Radiation therapy, % (n)	28.5 (2)
Physical wellbeing (1-5), M $\pm$ SD, range	3.4 $\pm$ 0.5, 3-4

Mental wellbeing (1-5), $M \pm SD$, range 3.2 ± 0.7 , 2-4

Notes. 1 participant did not complete the survey; descriptives are calculated using 7 as the denominator. M = mean, SD = standard deviation.

Table 5-3. Sociodemographic and yoga teaching characteristics of yoga instructors who participated in co-creation of yoga program (n=13).

Variables	Descriptives
Age (years), $M \pm SD$, range	50 ± 11.26 ; 28-67
Woman, % (n)	100 (13)
Married or common law, % (n)	76.9 (10)
Completed at least university/college, % (n)	84.6 (11)
Household income >75,000 CAD, % (n)	53.8 (7)
Full-time employment status, % (n)	46.1 (6)
Ethnicity, % (n)	7.6% (1)
White	84.6(11)
Black	7.6 (1)
Prefer not to say	7.6 (1)
Years instructing, $M \pm SD$, range	11 ± 6.9 , 3-24
Styles of yoga trained in	
Hatha, % (n)	84.6 (11)
Iyengar, % (n)	7.6 (1)
Vinyasa, % (n)	61.5 (8)
Yin, % (n)	61.5 (8)
Restorative, % (n)	61.5 (8)
Sivananda, % (n)	7.6 (1)
Adaptive, % (n)	7.6 (1)
YogaFit, % (n)	7.6 (1)
Trauma-sensitive, % (n)	7.6 (1)
Chair, % (n)	7.6 (1)
Mantra, % (n)	7.6 (1)
Kirtan, % (n)	7.6 (1)
Nada Yoga, % (n)	7.6 (1)
Number of classes/week instructed, $M \pm SD$, range	7.2 ± 7.7 , 2-28
Average length of class instructed, $M \pm SD$, range	67.6 ± 15.2 , 40-90

Notes. M = mean, SD = standard deviation.

The consensus panel meeting was scheduled from 9:00am-5:15pm Eastern Standard Time, with scheduled morning, lunch, and afternoon breaks, and 50 minutes at the end of the day to account for extra discussion needed; the meeting concluded at 4:45pm. The meeting was audio- and video-recorded. After welcoming participants at the start of the meeting, JP summarized existing literature (32-35) for attendees to facilitate planned discussions and

activities. Program co-creation was facilitated by activities directed by JP based on recommendations for the conduct of consensus studies (36). Participants took part in group discussions with all participants, as well as smaller (i.e., 6-7 participants) panel discussions to exchange about 5 main topics: (1) program structure, (2) inclusive language, (3) program content, (4) supplemental program features, and (5) outcomes to assess (see Table 5-4 for overview). For each topic, JP briefly presented the topic (e.g., purpose and goal of section, explanation of the topic, previous research on the topic), highlighted questions for participants to discuss, and then moved participants into pre-assigned breakout rooms to discuss with other panel members for 25 minutes. To facilitate smaller panel discussions, 3 breakout rooms were created; each had 2-3 adults diagnosed with gynecologic cancer, 3-4 yoga instructors, and 1 researcher⁶. Each group had an identified member to lead the discussion and a member to record the discussion on the provided recording sheet. Participants were assigned to groups based on age ranges (i.e., 28-40, 47-53, 54-66 years of age) to help participants find common ground. Panel groups stayed the same throughout the day. After each panel discussion, participants were brought back to the main meeting room and a representative from each panel presented their responses to the group at large. Following this, a general discussion took place whereby any participant could comment on the information shared or add to what their representative had shared. When there were contradicting ideas or preferences identified during the discussion, a poll was created to attempt to reach consensus by >80% of participants (36). While JP was facilitating the meeting, JB and AT took notes of discussions, disagreements, and interactions among participants.

⁶ Of note, 1 researcher left the meeting after Section 2 due to a scheduling conflict. Therefore, 1 group did not have a researcher for most of the day.

Table 5-4. Description of topics covered during the consensus panel meeting

Section	Purpose	Example Questions Asked
Program structure	Provide opinions on the ideal structure of the program (i.e., length, duration, dosage, location, style, mode of delivery, yoga type)	• What is the ideal length (i.e., number of weeks) for a yoga program? • What is the ideal way to attend a class (i.e., in-person, virtually, hybrid)? • What is the ideal time to offer a yoga program (e.g., on-treatment, post-treatment, mixed, etc.)?
Inclusive and accessible language	Identify inclusive language and approaches as well as potential prompts	• What are some inclusive and accessible phrases to help transition participants into poses? • What are some inclusive and accessible phrases for offering modifications? • What are some inclusive and accessible methods or phrases for guiding a breath practice?
Program content	Identify physical postures and modifications (Asanas), breathing exercises (Pranayama), and meditations (Dhyana) to include in a base class	• Are there any modifications to certain poses that should be built into the program? • Are there any poses that should be worked up (either over the course of a session or over the course of the program)?
Supplemental program features	Brainstorm additional features that could be incorporated into the program to enhance participant experience	• What is a supplemental program feature that would be helpful to add to this yoga program? • How would this feature work within the program? • Why would this feature be beneficial or worthwhile for participants?
Outcomes to assess	Comment on outcomes for gauging the benefits of the program by ranking the importance of physical, psychological, and social outcomes	• Please identify the top 10 potential outcomes and benefits of the yoga program. • Please rank the potential outcomes and benefits in order of importance, with 1 as the most important.

2.5.4 Synthesis and creation of program and instructor guidebook

The research team's observations and notes, participants' responses to polls, and participants' recorded responses on the recording sheets were synthesized through a dynamic and iterative process. First, JP identified potential features of the program that had substantial agreement among participants (i.e., program length, class length, dose of classes). Second, JP identified potential features that did not have substantial agreement but were similar in nature and could potentially support the overall intention of the program; these elements were woven together (i.e., supplemental program features, inclusive and accessible language to use during classes). Third, JP made note of potential features that were shared during the meeting but that did not have agreement or did not fit the program scope to inquire further about during focus groups. Fourth, JP established the protocol for the program proposed based on the previous steps. Fifth, JP drew on the mission of the ORCF to establish the purpose and scope of the instructor guidebook. Next, she identified the specific topics and procedures that needed to be covered in the guidebook to facilitate delivery of the program and created an outline that served as a framework for the instructor guidebook to organize the content. Then, she wrote the content of the instructor guidebook focusing on clear and concise writing while incorporating visuals and examples to encourage understanding and engagement with the content. Sixth, JP and JB engaged in an iterative process to refine the content of the instructor guidebook to prepare it for review.

2.6 Phase 3: Evaluate the co-created yoga program and instructor guidebook

2.6.1 Description and aims

In April 2022, a qualitative study was undertaken to evaluate the co-created program and accompanying instructor guidebook to address the next phases in the KTA framework (assess

barriers/supports to knowledge use, tailor intervention). The goal was to ensure the co-created program and instructor guidebook reflected the discussions and decisions from the consensus panel meeting and adequately addressed the needs, preferences, and barriers of knowledge users.

2.6.2 Sampling for focus groups

Approximately 4 weeks after the consensus panel meeting, all adults diagnosed with gynecologic cancer and yoga instructors who had participated in the consensus panel meeting were emailed individually to collect their availability to participate in a focus group. Researchers were not invited to participate in this phase as they are not direct knowledge users. Based on guidelines for conducting focus group research (37, 38), multiple focus groups were scheduled so that each focus group would only have 2-4 participants to allow them adequate time to share their perspectives. Focus group composition was adults diagnosed with gynecologic cancer or yoga instructors only to allow for population specific questions and discussions.

2.6.3 Procedures and data collection for focus groups

Participants were emailed a copy of the instructor guidebook 48 hours prior to their focus group to review. Focus groups were conducted via Microsoft Teams to accommodate participants' varying geographical locations and were audio- and video-recorded. For each focus group, JP greeted participants and briefly overviewed the proposed yoga program and instructor guidebook. A semi-structured focus group schedule (see Table 5-5) was used to guide the discussion. Supplemental probes were used as necessary to gather more in-depth information.

Table 5-5. Purpose and questions asked during focus groups

Participants	Purpose	Example Questions
Yoga instructors	Assessment of the (1) structure and features of the program and (2) instructor manual for guiding delivery of the program	What do you think of the length of the program, the duration of the sessions, and number of weekly sessions?

	• Support, training, and resources that would be required to deliver the program	• What are your impressions of the layout of the program, including the hybrid model of delivery? • Do you feel the manual provides enough context and background information for gynecologic cancer? • What kind of support or resources do you think you need to deliver a program like this?
Adults diagnosed with gynecologic cancer	• Assessment of the (1) structure and features of the program and (2) instructor manual for guiding delivery of the program • Impressions of the usefulness and utility of a yoga program to address body image, sexual health perceptions, and their relationships with others	• What do you think of the length of the program, the duration of the sessions, and number of weekly sessions? • What are your impressions of the layout of the program, including the hybrid model of delivery? • Do you feel the manual provides enough context and background information for gynecologic cancer? • Is the program appealing to you and do you think it would be useful to you? • What challenges do you see inhibiting or discouraging you from participating in a program like this?

Notes. Supplemental probes were used as necessary to gather more in-depth information.

2.7 Data Analysis

Quantitative data collected via the SurveyMonkey survey during Phase 2 were analyzed using descriptive statistics in IBM SPSS (Version 26). Audio recordings from the focus groups during Phase 3 were transcribed verbatim, with the video being used to confirm who was speaking, and uploaded into NVivo for deductive content analysis (39). Then, JP (1) read each transcript to acquire an overall understanding of content related to the research aims, (2) read each transcript again while noting repeated viewpoints that could represent meaning units, (3) created a coding scheme to support subsequent coding of meaning units based on existing literature and the research aims, (4) coded each transcript based on these meaning units, and (5)

extracted condensed meaning units from meaning units with regard to the context. Condensed meaning units related by meaning and/or content were merged and abstracted into themes. Then, JP and JB engaged in an iterative process to refine the themes and their presentation.

2.8 Trustworthiness

Several strategies were used to ensure the results were substantiated by the data collected. First, the overall study design of the project ensured the methods were adequate to address the research aims, analyses chosen were in alignment with the research aims and qualitative approaches, and the lived experiences of knowledge users guided the research process and took into consideration the community organization's expectations (e.g., effective integration of the advisory board's feedback). Second, JP engaged in an iterative process with JB acting as a 'critical friend' to refine themes (40). Specifically, JP consulted with JB to discuss, reflect, and refine the themes to ensure they adequately portrayed participants' accounts. In addition, CH and NP critically reviewed the results to provide alternative interpretations of the data to come to a mutual agreement on the interpretation of data that embraces alternative interpretations. Third, the reporting of the results emphasizes transferability (i.e., thick descriptions of participants and results) and confirmability (i.e., direct quotations to justify the themes) (41).

3. Results

3.1 Focus Group Participants

3.1.1 Cancer survivors

Eight cancer survivors provided informed consent to participate in this study and attended the consensus panel meeting; 2 did not participate in the focus groups; [Appendix E](#) displays the individual characteristics of those who participated in the focus groups. All self-identified as a woman and were between the ages of 33 to 67 years ($M_{age}=44.6$; $SD=14.5$). The majority were

in a committed relationship (i.e., married or common law; $n=3$; 60.0%) and had a university/college education ($n=4$; 80.0%). They were diagnosed, on average, 3.7 years prior to their participation in the study (range=10 months-11.5 years). On a scale of 1 to 5, they rated their physical wellbeing as 3.2 ($SD=0.4$) and their mental wellbeing as 3 ($SD=0.7$) on average.

3.1.2 Yoga instructors

Thirteen yoga instructors provided informed consent to participate in this study and attended the consensus panel meeting. Thereafter, 2 withdrew and did not participate in the focus groups; Appendix E displays the individual characteristics of those who participated in the focus groups. All self-identified as a woman and between the ages of 29 to 68 years ($M=50.6$; $SD=10.03$). The majority were in a committed relationship (i.e., married or common law; $n=9$; 81.8%) and had a university/college education ($n=10$; 90.9%). They had been instructing for 3 to 24 years ($M=10.6$; $SD=7.3$), with the majority being trained in Hatha ($n=9$; 81.8%), Vinyasa ($n=7$; 63.6%), and/or Restorative ($n=6$; 54.5%) styles. On average, they taught 6.4 classes/week (range=2-28; $SD=7.6$) for an average of 70.9 minutes/class (range=60-90; $SD=13.5$).

3.2 Program and Instructor Guidebook Description

Based on recommendations from the co-creation process, research indicating yoga can improve quality of life outcomes (19, 34, 35), and tenets of yoga philosophy (42), this program is centered on helping participants ‘thrive’. This is based on theoretical tenets from posttraumatic growth frameworks that suggest that with proper support, individuals can experience positive adaptation or growth as a result of struggling with adversity due to a major threat or trauma like cancer (43, 44). Thriving after a gynecologic cancer diagnosis centers on how a person rewires their brain and body to experience growth around their experiences, emotions, thoughts, and actions. The instructor(s) delivering the program are encouraged to deliver each class in a

manner that can help participants find new meanings, gain new strengths, and develop new perspectives. They can do so by offering choices (e.g., pre-emptively offering different levels of a shape to find what feels comfortable and avoiding glorifying the “full expression” of a shape), avoiding qualifiers (e.g., providing a positive and encouraging suggestion to support participants to practice at their own pace/level and avoiding telling participants what they “should” look like in a shape), and empowering introspection (e.g., asking participants to notice their bodies and sensations and moving in a manner appropriate for them).

The co-creation process resulted in a 12-week program and instructor guidebook to assist with training yoga instructors to deliver the program and facilitate fidelity during the implementation of the program. The program proposed is designed to offer 2 60-minute Hatha yoga classes/week to a group of 5 to 7 participants/class. It would be a flexible bi-modal program that offers online and in-person practice opportunities to support accessibility and meet participants’ needs. However, participants are asked to attend the first 2 weeks of the program in-person to allow the instructor to modify and tailor the classes to each participant to better support safety. The program also includes hybrid supplemental features: group discussions after class, journaling, and an online database of short videos to support at-home practice. In addition, the program includes an intake form and brief 1-on-1 virtual meeting between the instructor and each participant up to 2 weeks before the start of the program to discuss physical capabilities and expectations for the program. See Table 5-6 for an overview of class structure.

Table 5-6. Overview of class structure in the co-created yoga program for adults diagnosed with gynecologic cancer

Activities	Descriptions	Timings
Arrival	Time for instructor to make the class environment welcoming and connect with participants as they transition into the class.	5 mins

Warm-up	A structured sequence of movements intended to help a participant center themselves in the present, get their heart rate elevated, and prepare their mind and body to fully engage in the class by tuning into their body, heart rate, breathing, and energy level; includes a breath practice.	15 mins
Sequence 1	A structured sequence of movements intended to help a participant connect their movement with their breath as they engage in dynamic movement.	10 mins
Sequence 2	A structured sequence of more vigorous movements intended to help a participant connect their movement with their breath and engage multiple muscle groups as they flow through a series of shapes.	15 mins
Restoration	A structured sequence of movements intended to help a participant regulate their breathing and heart rate and begin the calming process to prepare to transition out of the class; includes a meditation practice.	20 mins
Departure	Time for the instructor to help participants transition out of the class safely and successfully, including answering participant questions.	5 mins
Social Time (<i>optional</i>)	A carefully and creatively facilitated conversation with participants intended to promote reflection and connection; the instructor disengages from conversation after initiating the discussion.	5-10 mins

Notes. Mins = Minutes

The instructor guidebook (Version 1) is 36 pages, with 6 main content areas: (1) understanding gynecologic cancer and its impact on QoL, (2) thriving and program delivery, (3) supporting accessibility and inclusivity, (4) program and class description (i.e., program structure, class structure, program features, class breakdown), (5) base session, and (6) appendices (i.e., compendium of yoga shapes, breath practices, and meditation practices, additional resources).

3.3 Program and Instructor Guidebook Assessment

Participants' (i.e., adults diagnosed with gynecologic cancer, yoga instructors) evaluation of the proposed program and instructor guidebook are organized into 6 areas: (1) will the

program meet the needs and wants of the target population, (2) will the target population be able to do what is asked of them in the program, (3) will the target population be able to engage with and use the program as intended, (4) will the target population be at risk for mental or physical adverse events, (5) will the target population value their experiences in the program, and (6) will the instructor guidebook offer adequate guidance for the delivery of the program as intended.

Anonymized quotations are presented in Table 5-7. In addition, the ORCF Vice President of Programs and Stakeholder Development (NP) reviewed the guidebook and provided feedback.

3.3.1 Will the program meet the needs and wants of the target population?

The structure of the program (i.e., program length, class length, and dosage) was deemed reflective of the discussions and appropriate for the intended purpose of the program. Instructors felt comfortable leading 60-minute classes, and adults diagnosed with gynecologic cancer thought it would be “worthwhile” to travel for this amount of time to attend class in-person. Adults diagnosed with gynecologic cancer also believed that 12 weeks would be enough time to build a habit, “ebb and flow with treatment”, and create connections with others. Both groups of participants shared that attending class twice a week was a reasonable time commitment that promoted consistency. With regards to the supplemental program features, adults diagnosed with gynecologic cancer considered 15 minutes a reasonable expectation and “doable” for pre-recorded videos to support an at-home practice. Similarly, capping the group discussions at the end of class at 10 minutes was considered favourable to a longer amount of time as it was a minimal commitment that could lead to more socialization after class, if participants were interested. However, adults diagnosed with gynecologic cancer did underscore that 2 60-minute classes for 12-weeks might be too much for some participants, especially those on-treatment.

3.3.2 Will the target population be able to do what is asked of them in the program?

Both groups of participants were in favour of using a ‘base session’ to structure the class content; they felt that the repetition would allow for bodies to gradually adapt and improve, thus promoting feelings of mastery. However, both groups of participants underscored that some poses in the ‘base session’ may be difficult for certain individuals, including those on-treatment or having recently had surgery. Although some adults diagnosed with gynecologic cancer noted that not all participants would engage with supplemental features (i.e., pre-recorded videos, journal, social time) because of personal interest or desire, both groups of participants felt that the short 15 minutes pre-recorded videos would make it more feasible to fit yoga into a busy day or do when lacking motivation to practice. Adults diagnosed with gynecologic cancer thought the optional journalling as a supplemental feature was doable and would help them work on connecting with themselves and track their progress within the program.

3.3.3 Will the target population be able to engage with and use the program as intended?

To best integrate the target population’s needs and wants, the program proposed is a flexible bi-modal format, wherein classes could be attended in-person or synchronously online (after the first 4 classes). Both groups of participants favoured giving choice (i.e., letting people pick if/when they want to attend classes in-person or online) as this would promote a sense of personal autonomy and hopefully capitalize on the advantages of both modes of delivery. Specifically, both groups of participants were of the opinion that in-person classes would provide face-to-face tailored feedback opportunities. Instructors conveyed that face-to-face classes would provide future instructors the ability to directly observe and provide *tailored* modifications (as people do not often turn their cameras on at-home making tailored modifications unlikely). Also, while adults diagnosed with gynecologic cancer saw in-person classes as a strategy for

developing a sense of group support, they shared that online classes could enable higher participation because online delivery helps address emerging challenges associated with in-person classes when people have physical limitations, concerns for infection, treatment-related side-effects, and geographical/environmental barriers.

3.3.4 Will the target population be at risk for mental or physical adverse events?

One important consideration when developing this program was safety. Instructors felt that making the first 2 weeks (or 4 classes) in-person only could help decrease the likelihood of participants experiencing adverse events because future instructors would be able to more fully assess participants' current capabilities, and in turn offer modifications and tailoring that would promote safety, competency, and mastery. Similarly, both groups of participants acknowledged the intake form and meeting as features that could reassure the target population and facilitate conversation for safety topics that they may not want to bring up on their own. In addition, the 'base session' was deemed appropriate and safe by both groups of participants. Nevertheless, instructors did acknowledge that it is difficult to instruct online because it is not always possible to see participants to ensure they are moving in a safe manner. This said, both groups of participants highlighted that it will be important for the program instructor to have experience delivering bi-modal classes to ensure they are comfortable and competent in this mode of delivery. In addition, both groups of participants noted a benefit to having an additional person to monitor people online to support the instructor (participants did not indicate specific qualifications for this person). Finally, participants raised concern that the instructor might try to "counsel" people during the group discussions, and as such, the instructor should receive guidance on how to facilitate conversation but not offer advice or counseling.

3.3.5 Will the target population value their experience in the program?

Participants identified several features of the program that will likely promote value. First, adults diagnosed with gynecologic cancer thought having the online classes delivered synchronously instead of asynchronously was valuable because it could help to promote engagement and enjoyment by fostering interactions with the instructor and other participants. Second, adults diagnosed with gynecologic cancer highlighted the value of formally including group discussion in the design of the program because having the opportunity to connect with others during a (potentially) lonely time could be beneficial for the target population. Third, adults diagnosed with cancer felt the provision of *optional* features was valuable because it could promote a sense of autonomy and comfort that would contribute to a pleasant experience in the program. Fourth, adults diagnosed with gynecologic cancer thought offering the program to mixed staging and mixed points along the continuum was valuable because it could provide an opportunity to learn from different experiences. However, participants noted 2 elements of the program that could detract from the value of the program. First, adults diagnosed with cancer acknowledged it could be difficult for individuals to connect online with the other participants; thus, detracting from the potential value of the group-based and synchronous elements of the program. Second, both groups of participants were concerned that group discussions could become negative if participants experienced physical or emotional hurdles during the practice.

3.3.6 Will the instructor guidebook offer adequate guidance for the delivery of the program?

The guidebook was considered a valuable asset for supporting future yoga instructors' delivery of the yoga program as intended. Both groups of participants valued the section dedicated to accessible and inclusive language practices (e.g., being inviting, accepting, and welcoming, offering choices, meeting the body where it is) to ensure that future yoga instructors

are able to engage with participants in a supportive manner. Yoga instructors appreciated the balance between visual and textual elements in the guidebook; they had initially been concerned about the length of the document (i.e., 36 pages) but they found the document easy to read, promoting the likelihood that future yoga instructors would read and use the manual to support delivery. This said, adults diagnosed with gynecologic cancer suggested providing more information pertaining to timing of treatments, diversity of treatments, and examples of patients' experiences practicing yoga to better prepare instructors on the needs and potential limitations of the target population. In addition, yoga instructors noted that specific training around (1) delivering a bi-modal program, (2) psychosocial outcomes and yoga, (3) trauma-sensitive approaches, and (4) cancer and treatment side-effects would be beneficial to feel more comfortable delivering the program. Since there is the convenience of attending training online, they suggested training on specific topics could be delivered online using modules.

3.3.7 Partner Organization Assessment

Health equity is a strategic goal and focus of the ORCF. Financial cost and limited language and cultural adaptation of programs and resources are key barriers to accessing supportive cancer care in the Ottawa (Ontario, Canada) region, especially for historically marginalized and under-resourced groups. Thus, partnerships, like the one described herein, are paramount for identifying and co-creating solutions to provide more inclusive and accessible community-based supportive cancer care programs and resources, for all people, families and caregivers in the Ottawa region facing a cancer diagnosis.

As such, the co-created program and guidebook align well with the ORCF's mission and will be an excellent addition to the suite of programs already offered at the ORCF. A key consideration with supportive cancer care is that social support is a key contributor to reducing

psychological distress and improving QoL (45, 46). Building social opportunity into ORCF activities and programs provides a co-benefit to programs, increasing the overall supportive value of the program beyond the primary goal of the program. The ORCF is a unique space where people with cancer, families, and caregivers can receive peer support in an informal and unstructured way should they choose, which is encouraged with environmental elements (e.g., a tea station, welcoming sitting spaces) and should be reflected in programs offered. Therefore, the social and therapeutic nature of the final part of the classes (i.e., the built-in group discussions) is in alignment with the needs of the ORCF and its clients. In addition, the ORCF intentionally offers programming that provides participants with the opportunity for free expression to help them explore and process their emotions, as such, the journalling and self-directed nature of the yoga is likely to support individual effectiveness within a context like the ORCF.

In addition, the section in the guidebook dedicated to accessibility and inclusivity was very helpful and thoughtfully written, especially the approach to modifying the poses for individual comfort and capacity. The ORCF is centring health equity as a strategic goal and reaching hard to reach populations in the Champlain region (and beyond) is a key focus in program delivery. Therefore, working towards adapting the program and guidebook both culturally and for languages of choice to reach more diverse and often marginalised populations to further expand the accessibility and inclusivity of the program is a key next step. This could be reflected in prioritizing diverse representation in instructors and language offerings once pilot implementation of the program shows support for the feasibility, acceptability, and benefit of the program to participants.

Table 5-7. Quotes from focus group participants (n=17) evaluating the program proposed and instructor guidebook.

Will the program meet the needs and wants of the target population

Approval

“The 12 weeks that was very good. I think it's long enough to encourage you to keep coming, I think that is the perfect length for getting back into things.”

“If I'm going to leave my house to get somewhere I also kind of want to maximize the time, but it's nice like the hour I think is also a little bit more reasonable for people to fit in to their day if they're doing it virtually.”

“I know a lot of my students who come for those twice a week classes, they get quite a lot more benefit out of it. [...] So twice a week, especially if they give like 2-3 days in between, it kind of motivates people to keep thinking about what they're doing.”

Suggestions

“I think 60 mins can be great, but it can be too long in some situations. But it's hard of course to have a one-size-fits-all perfect length. So I guess then it comes with the instructor, maybe to say if it's too long, ‘just rest or take it easy there’.”

Will the target population be able to do what is asked of them in the program

Approval

“Yeah, I'm a huge fan of those ones [short duration pre-recorded videos]. I think that's so helpful. I just think of my schedule during the week, I kind of run around like a crazy person. So even just like 20 mins like that just makes the world a difference.”

“I really, really like the idea of journaling. I think that it's a way to really connect with yourself, your thoughts, and how you're feeling. [...] The option is really nice that it's there and giving people the space to do this process at the end of the day.”

“If you're new to yoga or relatively new to yoga and you're after surgery, you're trying to get back into things, you're trying to get your body accustomed to getting back into these poses. You need to have that repetitive instruction. That it will allow your body time to become accustomed to doing these poses again.”

Suggestions

“The one that popped out to me was the cobra, that right after surgery, when you have an incision, all along the belly, then it's not, I think a thing to do.”

Will target population be able to engage with and use the program as intended

Approval

“I love the hybrid format that you're proposing. I think it meets people where they are.”

“I think the combination of classes offered in-person and online is perfect, because if you're at a stage where you may need to take breaks or something, then you can take the class from at-home and take the breaks wherever needed.”

Will the target population be at risk for adverse events related to the program

Approval

“There's the opportunity to do some training there, to go through those base shapes and say these are all the modifications, so that when people are at-home, they've already had that in-person experience or exposure putting themselves into poses with instruction specific for their body.”

“The opportunity to have some one-to-one with the teacher so as they're doing the class, they've got a really great understanding.”

“If you're new to yoga and you're after surgery, you're trying to get back into things, you're trying to get your body accustomed to getting back into these poses. You need to have that repetitive instruction. That it will allow your body time to become accustomed to doing these poses again.”

Suggestions

“People don't want to turn on their cameras and maybe they're getting into pose that you would think might be not the right place for them to go at the time. It's really hard for you to kind of navigate that virtually.”

Will the target population value their experience in the program

Approval

“It's [cancer and treatment] freaking lonely and it's isolating. [...] It's nice if hopefully after the 12 weeks people have found some of those relationships that stick.”

“I really love the opportunity being presented and knowing that it's an optional thing, so no one feels like they have to something if they don't want to.”

“During the classes, having not only the new people that were going or starting treatment but that there could be a couple of other people that have progressed to a different point, to show the newcomers that life does go on after having gynecological cancer, that there is a life after gynecological cancer, that it is not the end.”

Suggestions

“That's got to be very skillfully done, so that you don't have a great big downward spiral. Somebody says, ‘I found that really hard today’ and someone else says, ‘yeah, me too,’ ‘Me too,’ ‘Me too.’ And then people leave feeling defeated.”

Will the instructor guidebook offer adequate guidance for the delivery of the program

Approval

“I enjoyed a lot the way it was put together graphically. It helped to make sense of complex information in a very small format. When I first read 36 pages, I'm like ‘ohh no, I got to read 36 pages.’ But as I was going through it's like, ‘ohh well, this is going quite well. I'm easily going through this.’”

“It was very user-friendly.”

“I think you've done a wonderful job of synthesizing a lot of information from a lot of people in a very full day. And think it's very nicely organized. And will be a wonderful tool for instructors.”

Suggestions

“A little bit more detail around surgery, I'm thinking about a hysterectomy versus a hysterectomy and a debulking surgery, can be a lot more expansive.”

“I would be very interested in hearing more direct things from patients or people who have undergone any of these procedures. I want to hear about their experiences.”

“Some ongoing supervision and mentorship to make sure that it's coming alive in the right way.”

“It's not always very affordable and a lot of yoga teachers are maybe teaching one or two classes a week and the income they get from that is not going to afford them. The opportunity to travel to get a training so you know that online stuff, it would be helpful with that.”

Notes. Mins = Minutes.

4. Discussion

As previous research has demonstrated, it is not uncommon for current yoga programs to not fully address the needs and wants of participants (20). The purpose of the present collaborative project was for academics to partner with a non-for-profit community organization (i.e., ORCF) to collaborate with adults diagnosed with gynecologic cancer and yoga instructors to co-create a yoga program and inform the development of a feasibility trial to assess feasibility, acceptability, and benefits of the program. Through a 3-phase approach, participants shared their opinions on data collection (both for the current study and the feasibility trial), the structure of the program (e.g., program length, class duration, class dose), preferred mode of delivery (i.e., bi-modal), and optional supplementary features (i.e., group discussions, journalling, database of pre-recorded short duration classes). Participants also shared their opinion on the potential of the program to address the target population's wants and needs, as well as the usability, risk, and value of the program and features.

The co-created program shares several similarities with previously tested programs, including the structure of the program (i.e., length of program, duration and frequency of classes, type of yoga delivered, group-based; (47-49)) and provision of materials to support at-home practice (48, 50-52). However, to the authors knowledge, no programs have been delivered using a flexible bi-modal format, marrying the strength of both in-person and synchronous online delivery. Several decisions made during the co-creation process to elevate participants' experiences also have support from the literature. Specifically, the importance of tailoring the program to individual needs (53, 54), offering the program across the cancer continuum (50, 53-56), and incorporating opportunity for socialization among participants (50) have been

highlighted as wanted and/or valuable in previous yoga programs for women diagnosed with cancer. In addition, cautions raised during the co-creation process about online delivery, including technical difficulties and engaging participants online have been noted as challenges in previous studies (47, 49, 50). A unique concern raised was ensuring instructors remain within the scope of their practice and do not counsel participants during the social time at the end of classes, raising a valid concern about the training of yoga instructors for program delivery in clinical populations.

The training of yoga instructors or the training instructors receive to deliver programs to cancer survivors has received limited attention in the literature (19). This is a concern because instructors can deeply impact participants experiences in a yoga class. For instance, middle-aged women have reported that yoga instructors in the community domain (i.e., not a part of studies) can evoke feelings of frustration, anger, disappointment, and shame through instructional practices and behaviours that praise body-types that fit the thin-youth ideal, are not warm and welcoming, and do not prioritize accessibility (57). However, instructors who prioritize weight-inclusivity in their classroom spaces have demonstrated that there are behaviours that instructors can actively engage in to promote a sense of belonging, acceptance, and agency among participants, such as celebrating body diversity, using language that disrupts the hierarchy of bodies, and offering choices without assumption of abilities (21). The variation in participants' experiences indicate that, like most person-facing professions, there are differences in instructing style and instructors' behaviours that cannot be taken for granted within a research-context. Thus, as indicated by participants' responses, the guidebook is an important component of ensuring positive experiences in the program but should be supplemented with training. Train-the-trainer models are an educational model where an organizing institution that houses content-

area expertise identifies potential trainers with ties to the community targeted for training (58). These trainers are provided with education, instructional tools, and programmatic guidelines that enable them to, in turn, provide specific training to target audiences; still, it will be necessary to continue to refine the training process through post-training monitoring to ensure it meets the needs of instructors and adults diagnosed with gynecologic cancer and results in quality implementation of the program.

The major strengths of the yoga program, as identified by participants, include a dose that balances the potential for competency building and the target population's schedules, convenient and flexible delivery that considers safety, and opportunities to build social connections. However, the most notable strength of the program seems to be the opportunity for choice. Participants, particularly adults diagnosed with gynecologic cancer, identified the intrinsic value of providing prospective program participants with choice, whether that be in how they attend the program (i.e., in-person or via teleconference technology), if and to what extent they use the supplemental program features, and the manner in which the yoga is instructed (inclusive and non-prescriptive language). By seeking to provide the target population with choice, participants highlighted that the program has the potential to promote autonomy and empowerment. Promoting autonomy within a physical activity program, such as yoga, is valuable because more autonomously motivated behaviour (i.e., behaviour that is self-endorsed, volitional, and done willingly) is more likely to be considered valued, meaningful, consciously assimilated into the self, and brought into alignment with other values and goals (59). Promoting empowerment may stem from the participatory relationships, person-centredness, support, trust, and respect that choice offers within the program (60). As a result, facilitating empowerment in the program has the potential to enable conscious self-understanding, mastery, trustful relationships, and quality

of life (60). Indeed, Flanagan and colleagues (61) used the Power as Knowing Participation in Change theory in their yoga intervention for women diagnosed with breast cancer because, similarly, they acknowledged that promoting freedom and choice was paramount to participants engagement in the intervention. Accordingly, by prioritizing choice within the current program, it could not only lead to higher participation by increasing accessibility but could increase motivation and perceptions of empowerment. Moreover, this approach aligns with the person-centered mission and value of the ORCF, which emphasises a holistic view of wellbeing that is defined by the individual.

4.1 Limitations of Study

The limitations of this study should be kept in mind when interpreting the results. First, while the study incorporated a formal evaluation of the co-created program, there was no formal evaluation of knowledge user experience in the co-creation process (i.e., co-creators perceived engagement and enjoyment of the process). As a result, there may have been missed opportunities to improve the partnership or collaboration process. Moreover, evaluation of the program's feasibility and benefits were not conducted (but are underway). Second, as indicated by NP's feedback, there are still opportunities to increase the inclusivity of the program – active steps will be taken to improve this as the program is refined. Third, the study relied on 2 types of participatory research methods (i.e., consensus panel meeting, qualitative focus groups) for the creation of the program; several other participatory research methods (e.g., arts-based methods, citizen science, social audits, digital storytelling, photovoice, community mapping, walkabouts) are available and may have promoted more engagement and accessibility from a more diverse sample.

4.2 Implications

Though further investigative efforts are required to test the acceptability, feasibility, and preliminary benefits of the co-created yoga program, the findings from this study and the partnership have implications in the broader literature. For instance, several of the valuable features identified in this program (e.g., bi-modal delivery, inclusion of social interaction) are not unique to a yoga program. Thus, it is possible that other lifestyle interventions (e.g., physical activity and/or nutrition counselling) may benefit from the integration of these features into their program design. In addition, this study provides a roadmap for a successful partnership with a variety of community organizations and knowledge users (e.g., program users, delivery agents). Indeed, the transferability of this methodology as a model to co-design other programs aligns well with the ORCF's investment in collective community wisdom and strengths and the importance of lived experience as a key input that integrates context and content experts in program and resource development.

4.3 Conclusions

The objective of this study was to partner with a community organization that offers supportive care services to cancer patients and survivors to co-create a yoga program for adults diagnosed with gynecologic cancer with an accompanying instructor guidebook through collaboration with adults diagnosed with gynecologic cancer and yoga instructors. Using a 3-phase collaborative process guided by the KTA framework, a 12-week program that offers 2 60-minute group-based Hatha yoga classes/week to 5 to 7 participants/class, online or in-person, with optional supplemental features was co-created. Overall, participants deemed the co-created program and instructor guidebook to be reflective of their needs and preferences, though they did provide feedback to refine the compatibility, performability, accessibility, risk precautions, and value of the program as well as the instructor guidebook. The feasibility, acceptability, and

benefits of the program are being assessed in an ongoing feasibility trial. If deemed feasible, acceptable, and beneficial, the yoga program may support the QoL of adults diagnosed with gynecologic cancer, and thus show promise for broad distribution.

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Bridging Study 3 and 4

The purpose of *study 3* was to use a participatory-based methodology to guide the partnership between a research team (JP, JB, CH) and non-academics (the Ottawa Regional Cancer Foundation; ORCF) to collaborate with (1) adults diagnosed with gynecologic cancer and (2) yoga instructors to (a) facilitate the co-creation of a yoga program with an accompanying instructor manual, and (b) inform the development of a feasibility trial to assess the program's feasibility, acceptability, and benefits. Using a three-phase approach prioritizing end-users' needs, the proposed program is 12-weeks with 2 60-minute Hatha group-based yoga classes/week that uses a flexible bi-modal format to deliver the program in-person and online (starting week 3). The program also includes hybrid optional features: group discussions after class, journaling, and an online database of short videos to support at-home practice. Participants considered the proposed program to have: (1) a structure that was user centered, (2) content and features that promote accessible usability, (3) a delivery mode that could promote effective engagement, (4) safety considerations that support a lower risk environment, (5) synchronous delivery and optional features that have the potential to create valuable experience for participants, and (6) an instructor guidebook that is user friendly to facilitate use of the resource. Incorporating end-users in the development of the program helped ensure the program considered and included factors that contributed to intrinsic value and merit of the program. Moreover, by prospectively evaluating the acceptability of the program, it was possible to refine elements to improve the program prior to delivery. Building on the findings from *study 3*, *study 4* was designed to test the feasibility and acceptability of the program and study methods (article 5) as well as preliminary benefits (article 6) of the program at a community-based organization

(ORCF) to guide refinement of the program and evaluative methods prior to undertaking a definitive trial testing the effects of the program.

Chapter 6: Study 4 (article 5), Feasibility and Acceptability of Program

Evaluating the feasibility and acceptability of a community-based, co-created yoga program for adults with gynecologic cancer: A series N-of-1 feasibility study

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In preparation for submission to a Peer Review Journal

Abstract

Background: The aim of the current study was to implement a co-created 12-week bi-modal Hatha-based yoga program for adults diagnosed with gynecologic cancer in the community, and assess the feasibility and acceptability of the program and study methods for end-users.

Methods: Using a mixed methods series N-of-1 A₁BA₂ research design, participants were recruited from The Ottawa Hospital. Participants self-selected a morning or evening program, completed surveys 9 to 11 times (based on randomization for baseline phase), and were interviewed post-program. The yoga instructor was interviewed post-program about their experience delivering the program. Quantitative feasibility outcomes (i.e., recruitment, study retention, program adherence, and participant engagement rates) were tracked throughout the study. Qualitative acceptability outcomes (i.e., program relevance, suitability and perceived benefits, problems/concerns with the program and study methods) were explored during the semi-structured interviews. Audio- and video-recordings of the yoga classes and data from the instructor interview were used to assess fidelity outcomes (i.e., adherence to program protocol, interactions with participants) to determine whether the protocol could be adhered to consistently.

Results: Forty-one adults diagnosed with gynecologic cancer were screened for eligibility and 20 consented (recruitment rate: 48.7%), with 10 per program. One participant withdrew from the evening program due to time constraints. For retention, 85.0% (17/20) of participants completed the 8-week follow-up survey. For adherence, participants attended 83.1% (19.9/24) of classes. Engagement in three optional program features varied, with at-home videos and journals being used minimally while group discussions were used regularly. The instructor was 61.3% adherent to the prescribed protocol, using recommended behaviours 44.6% of the time.

End-users (i.e., participants and instructor) shared barriers and facilitators that influenced the success rate of the study methods and program.

Conclusions: Overall, the program was well-received, and the study methods were moderately successful. Additional refinements are warranted before a large-scale trial.

Keywords: mind-body, oncology, single-case, community

Trial Registration: ClinicalTrials.gov, no.: NCT05610982; November 3, 2022

1. Background

Yoga aims to achieve a harmonious balance between mind, body, and spirit (1, 2). A growing body of empirical research underscores yoga's benefits for clinical (3, 4) and non-clinical populations (5-7). Regular yoga practice can improve physical fitness, flexibility, balance, and muscular strength, while also fostering mental wellbeing by reducing stress, anxiety, and depression symptoms through its meditative elements (1, 4, 8). Additionally, yoga has been employed as a complementary therapy in managing conditions like cardiovascular disease (9), diabetes (10, 11), chronic pain (12, 13), respiratory disorders (14), and cancer (8, 15, 16), showcasing promising clinical outcomes. As well, studies reveal its efficacy in mitigating trauma-related symptoms (3, 17) and in the management of mood disorders (18, 19). The expansive benefits of yoga therefore span physical and psychological outcomes, and this may be attributable to yoga's holistic intention. Traditionally, yoga involves physical exercises, breath practice, and a comprehensive practice for the mind (1, 2). However, a meta-synthesis exploring women's experiences practicing yoga after a cancer diagnosis revealed much of North American and European practices center on physical exercises (e.g., postures, moving from pose to pose) and that there is a mismatch between what participants want and published yoga programs (8). Thus, there is a need to involve end-users in the development of yoga programs to ensure they are tailored to address the specific needs and preferences of diverse populations, increasing accessibility. This approach would not only enhance the relevance and effectiveness of yoga programs but also foster greater engagement and satisfaction among participants, leading to more meaningful and sustainable health outcomes.

In 2021, a formal interdisciplinary partnership between individuals interested in the implementation of an evidence-based, suitable yoga program for adults diagnosed with

gynecologic cancer was formed (20). Two researchers, 1 psychologist from The Ottawa Hospital, and 1 representative from the Ottawa Regional Cancer Foundation (ORCF; a community organization serving people diagnosed with cancer and their families) collaborated with intended end-users (i.e., adults diagnosed with gynecologic cancer and yoga instructors). This process sought to prioritize end-users' lived experiences and needs in the development of the yoga program and create a guidebook to assist instructors in delivering it as intended (20). The co-creation process was informed by the Knowledge-to-Action (KTA) framework (21, 22) and resulted in a 12-week bi-modal program featuring 2 weekly 60-minute Hatha yoga classes to a small group (5-7 participants), with 3 additional optional features participants could access: organized group discussions, journalling, and pre-recorded videos for at-home practice.

The program is evidence-based to ensure that its elements and features are rooted in research and expert consensus, increasing the likelihood it will lead to improvements in patient-reported outcomes [24,25]. It features Hatha yoga, emphasizing physical postures and breath control, which has been shown to improve physical fitness, flexibility, and balance, as well as reduce fatigue, a common symptom in cancer patients (23). Classes are group-based, meant to enhance social support (8), which can improve quality of life among adults diagnosed with cancer (24). This is especially the case when the group shares similar features (such as cancer type) that allow members to reach a common understanding (8, 25). Moreover, while the bi-modal format proposed has not been exclusively tested, online delivery can help overcome barriers to participation such as geographical distance, while in-person delivery provides opportunities for face-to-face support, guidance and tailoring, and a relaxing environment free of distractions (if offered at a location outside of the home) (25). As for the optional features, organized group discussions and journalling can further bolster psychosocial wellbeing and self-

efficacy (25-28). Journalling can promote emotional processing, reducing stress and anxiety (27, 28). Last, pre-recorded videos can offer participants opportunities to practice and reinforce skills learned during the group classes, foster a sense of routine and self-discipline (25), or simply practice more yoga. Despite the benefits of the individual features, to the authors' knowledge, no study has sought to test a program coalescing all these elements for delivery in a community setting for adults diagnosed with gynecologic cancer. Thus, though a definitive trial will be warranted to assess the direct and indirect effects of the yoga program on adults diagnosed with gynecologic cancer, it is not indicated at this time (21); it may be premature when testing a novel program (29). Rather, it is first necessary to establish *feasibility* (i.e., operational viability of study methods and program features), *acceptability* (i.e., end-users' perceptions of study methods and program features as congruent with their values, expectations, and preferences), and *fidelity* (i.e., alignment between the intended design and the actual execution of study methods and program features) of the program and study methods.

1.1 Current Study

This work builds on the previous co-creation process (20) and sought to address the remaining phases of the KTA framework (22), namely: monitor knowledge use (phase 5), evaluate the outcomes of using the knowledge (phase 6), and make recommendations for if/how to sustain ongoing knowledge use (phase 7). Therefore, the objectives of this study were to: (1) assess the feasibility and acceptability of study methods, (2) assess the feasibility and acceptability of the program, and (3) assess the fidelity and acceptability of the program protocol. As perceived benefits may influence participants' acceptance or attitudes towards the program, and in turn their willingness to participate in the program, this study also aimed to explore the perceived benefits of the program.

2. Methods

This manuscript was written in accordance with the Consolidated Standards of Reporting Trials (CONSORT) 2010 statement for N-of-1 trials (30) and the 21-item Checklist Standardising the Reporting of Interventions For Yoga (CLARIFY) reporting guidelines (31). The study was registered with the ClinicalTrials.gov database (no.: NCT05610982) on November 3, 2022, and a detailed description of the study methods are available elsewhere (32).

This N-of-1 study utilized a concurrent triangulation design, wherein quantitative and qualitative data were collected and analyzed concurrently (33). The quantitative feasibility and fidelity data offers insight into the efficiency and practicality of the study methods and program to better guide future resource allocation and timelines, and the qualitative acceptability data complements these metrics by delving into end-users' perspectives, uncovering barriers and perceived benefits, facilitating improvements and ensuring the study methods and program align with their lived experiences and needs. Ultimately, triangulation of quantitative and qualitative data provided a comprehensive understanding of study delivery and informs a refined study design to comprehensively address the research objectives.

2.1 Procedures

Ethics approval for the study protocol was granted by the Ottawa Health Science Network Research Ethics Board on September 27, 2022 (file no.: 20220544-01H) and by the University of Ottawa's Office of Research Ethics and Integrity on November 11, 2022 (file no.: H-10-22-8671). The N-of-1 trial was unblinded and used a repeated baseline approach with a follow-up phase – A₁BA₂ design (34-36). After enrolment, participants were randomized to a baseline phase lasting 3, 4, or 5 weeks, in a 1:1:1 ratio using the Clinical Trial Randomization Tool offered by the National Cancer Institute (<https://ctrandomization.cancer.gov/>). Accordingly,

participants completed surveys on a weekly basis during this period (Phase A₁). This approach was used to provide insight into the feasibility of an extended baseline phase. Then, participants took part in a 12-week yoga program phase and completed surveys 3 times during this period (Phase B), and then an 8-week follow-up phase where they completed another 3 surveys and 1 semi-structured interview (Phase A₂). No changes were made to the methods after trial commencement. Study duration varied between 23 and 25 weeks, depending on baseline randomization. For all phases, participants were asked to complete surveys within 48 hours of receiving the link. In addition, the yoga instructor completed an interview 2 weeks post-program. See Table 6-1 for the schedule of assessments.

Table 6-1. Assessment schedule for gynecologic cancer yoga program.

Phase	Timepoint(s)	Date(s)	Survey Package	Participant Interview	Instructor Interview
Recruitment Phase	-9 to -7 Week	Nov 28 – Dec 22, 2022			
Baseline Randomization	-6 Week	Dec 23, 2022			
Baseline A ₁ Phase	-5 Week	Dec 26, 2022	X*		
	-4 Week	Jan 2, 2023	X*		
	-3 Week	Jan 9, 2023	X		
	-2 Week	Jan 16, 2023	X		
	-1 Week	Jan 23, 2023	X		
Program B Phase	1 Week (class 1)	Jan 31, 2023	X		
	6 Week (class 12)	Mar 9, 2023	X		
	12 Week (class 24)	Apr 20, 2023	X		
Follow-Up A ₂ Phase	+1 Week	Apr 27, 2023	X	X	
	+2 Week	May 4, 2023		X	X
	+4 Week	May 18, 2023	X		
	+8 Week	June 15, 2023	X		

Notes. * = depending on allocation.

2.2 Participants

Adults diagnosed with gynecologic cancer were recruited via healthcare provider referral, registry mailout, posters, and word of mouth. Adults were eligible to participate if they were: (1) at least 18 years of age, (2) received a diagnosis of non-metastatic gynecologic cancer, (3) able to read, speak, and understand English, (4) had access to the Internet and an audio-visual device (e.g., computer, smart phone), and (5) able and willing to travel to the Ottawa Regional Cancer Foundation twice a week for 2 weeks when starting the yoga program. Exclusion criteria were: (1) being non-ambulatory (i.e., unable to walk or require the assistance of a mobility device), and (2) currently practicing yoga at least once a week or have practiced consistently in the last 6 months (i.e., once a week for 8 weeks).

2.3 Sample Size

The target sample size was 20 participants based on pragmatic considerations (32) and on end-users' recommendations (20). For the latter, they recommended capping class size at 7 participants per program, which was increased to 10 to accommodate an expected 30% dropout rate, and discussions with the ORCF representative, it was convened that 1 morning (9:30-11:00am) and 1 evening program (7:00-8:30pm) could be run concurrently to accommodate varying schedule needs (e.g., energy levels, work) and explore potential differences.

2.4 Yoga Program and Study Setting

Details of this first version of the yoga program (32) and the co-creation process (20) are presented elsewhere. Briefly, Version 1 of the yoga program was bi-modal, 12 weeks in length, and offered 2 weekly 60-minute group-based Hatha-style classes for a total of 24 classes. Two weeks pre-program, the yoga instructor emailed participants a 1-page intake form (not for data collection) and scheduled a 1-on-1 online 15-minute consultation via Zoom to review the form and discuss physical concerns or limitations. Week 1 and 2 classes were offered only in-person;

these were in a spacious basement room at the ORCF (see (32) for further description). At the start of Class 1, participants received a Lululemon yoga mat to use for the duration of the program and a journal and pen to keep. Week 3 to 12 classes, participants had the choice between in-person or online (i.e., synchronously via Zoom) classes. Participants were required to enter a password to join online classes via Zoom to prevent unauthorized persons from joining. Each class followed the same structure: (1) arrival, (2) warm-up with breath practice, (3) sequence 1, (4) sequence 2, (5) restoration with meditation, (6) group discussion (optional), and (7) departure. The classes were delivered in English using an established adaptable protocol continually tailored to participants' needs and abilities, as learned in the intake meetings and/or as they arose or changed during the program. The instructor cued participants through various sequences and included instruction on modifications using chairs, blocks, or alternative asanas. Participants were encouraged to modify practices themselves, ask for help, rest anytime, and/or consider imagining the practices (rather than completing them physically) depending on how they were feeling. The ORCF room was available to participants for 90 minutes so they could remain after the 60-minute class to socialize. See Table 6-2 for an overview of the modifiable protocol and an example modified class.

2.4.1 Optional Program Features

At the end of the restoration with meditation phase, the instructor invited participants to remain in the room to exchange with others about their experiences during the practice (optional group discussions), journal their experiences (optional journaling with the provided journal and pen), or gather their belongings and leave. At the start of week 3, JP also emailed participants a link with pre-recorded videos that they could use at-home and participants were reminded of these videos at the next yoga class.

2.4.2 Training - Instructor and Instructor Assistants

A certified yoga instructor, with experience working with clinical populations, was hired and trained. Two volunteer Human Kinetics undergraduate students assisted the instructor during classes (1 per program) to ensure participants attending in-person or online received support for a safe and seamless experience. The yoga instructor and volunteers completed 3-hours of in-person training with JP focused on gynecologic cancer treatment and side-effects, inclusive and supportive language and behaviours, and reviewed the protocol for delivering a class. They also received the training PowerPoint for their own review. To promote program fidelity, the instructor was given Version 2 of the Instructor Guidebook (which was modified slightly from Version 1 following prospective evaluation (20)), which contained information covered during the training. Ongoing supervision was provided via 30-minute team meetings every 2 weeks to:

- (1) discuss participants' progress, challenges, tailoring efforts, and feedback on class notes, and
- (2) hear the yoga instructor and volunteers' experiences delivering/assisting the delivery of classes. During the meetings, participant engagement and adverse events were reviewed to ensure participants' safety.

Table 6-2. Overview of yoga class

Segment	Intention	Modifiable Protocol	Example Class (class 4)
Arrival (5 minutes)	Instructor welcomes and connects with participants.	N/A	N/A
Warm-up (15 minutes)	Breath practice, followed by sequence intended to center participants and warm-up their bodies.	- Breath practice - Cross-legged forward fold - Seated side bend - Cat/cow stretch - Puppy pose - Balancing table - Low lunge (both sides)	- Satanama breathing practice. Using rhythmic hands, sound, combined with breath. - Warm up of head and neck - Side bend - Twist - Forward bend seated on floor or on a chair

Sequence 1 (10 minutes)	Structured sequence intended to connect movement with breath.	- Mountain - Forward fold - Half life - Plank - Low plank - Cobra - Downward dog - Half lift - Forward fold - Mountain	Adapted to be done from a chair: - Mountain - Forward fold - Half life - Plank - Low plank - Cobra - Downward dog - Half lift - Forward fold - Mountain
Sequence 2 (15 minutes)	Structured sequence intended to connect movement to breath at a higher intensity (e.g., faster, longer holds, posture requiring more engagement).	- Chair - High lunge (side 1) - Warrior II (side 1) - Reverse warrior (side 1) - Extended side angle (side 1) - Forward fold - Mountain - Chair - Repeat on side 2	- Tree - Goddess - Warrior II - Pyramid - Wide leg forward fold - Chair pose - Warrior I (both sides) - Repeat above, with moving tree and lifted leg doing hip circles
Restoration (20 minutes)	A sequence of movements intended to regulate breathing and begin the calming process, followed by a meditation.	- Reclined bound angle - Happy baby - Reclining knee hug - Reclining single-leg hug (both sides) - Meditation - Resting pose	- Baddha konasana, with option for support of legs with blocks, blankets, pillows - Meditation with imagery of a waterfall, allowing thoughts to pass by without judgment - Brief shavasana in position of choice, laying supine, in chair, in baddha konasana
Group discussion (10 minutes)	Instructor prompted conversation among participants to reflect on practice.	Topic: Highs and lows from the class	Topic: Sharing side-effects from treatment and impact of movement
Departure (5 minutes)	Instructor transitions participants out of	N/A	N/A

class and invites
individual
questions.

Notes. N/A: not applicable.

2.5 Measures – Feasibility and Acceptability of Study Methods

2.5.1 Feasibility

To assess the feasibility of the study methods, recruitment and study retention rates were tracked by JP. Recruitment rate was defined as the number of individuals who consented to participate in the study out of those who were assessed for eligibility; if $>50\%$ (CI=34.5-65.5%) of individuals assessed for eligibility consent to participate, recruitment would be deemed successful. Retention rate was defined as how many participants completed the final survey at week 20 (i.e., 8-weeks post-program) out of those who consented; if $\geq 75\%$ (CI=56-94%) of the sample complete the last survey, retention would be deemed successful. Of note, while 8-weeks post-program is the primary endpoint, the number of participants completing each survey was tracked and is reported.

2.5.2 Acceptability

To assess the acceptability of study methods, participants were asked to discuss their opinions on the suitability and problems/concerns with the methods, including their reasons for reaching out and enrolling in the study and facilitators/deterrents for completing study measures during a semi-structured interview via Microsoft Teams.

2.6 Measures – Feasibility and Acceptability of the Yoga Program

2.6.1 Feasibility

To assess the feasibility of the yoga program, program adherence rate and participant engagement were tracked by the volunteer assisting the yoga instructor and JP, respectively.

Program adherence rate was defined as the number of yoga instructor-led classes participants attended (out of 24) regardless of modality (i.e., in-person or online); if $\geq 75\%$ of the 24 yoga classes were completed by each participant (CI=70.7-79.3%), program adherence would be deemed successful. Participant engagement was defined as how many of the 24 group discussions participants took part in (including attending vs actively participating by engaging in discussion), how many journal entries participants' self-reported completing, and how many pre-recorded practices participants self-reported watching. If 50% of participants attend the optional group discussion (CI:28.1-71.9%), and of those, 50% spoke at least once during the discussion (CI:19.0-81.0%), 50% of participants complete at least 1 journal entry per week (CI:28.1-71.9%), and 50% of participants watch at least 1 pre-recorded video per week for at least 50% of the time they have access to the videos (5 weeks) (CI:28.1-71.9%) then participant engagement with the program would be deemed successful.

2.6.2 Acceptability – Participants

To assess the acceptability of the yoga program, participants were asked to share their opinions on the relevance of the program overall and its specific features (including its benefits), suitability of the program overall and its specific features, and problems/concerns experienced during the program while being interviewed via Microsoft Teams.

2.7 Measures – Fidelity to and Acceptability of Program Protocol

2.7.1 Fidelity

The instructor's fidelity to the program protocol is a critical component of the success of a study to determine whether the protocol can be adhered to consistently. The classes were audio- and video-recorded to assess the instructor's adherence to the program protocol which outlined the structure of the class (i.e., timing and sequencing of class phases aligns with the

program protocol) and recommended instructor language and behaviours (i.e., instructor's interacting style). For fidelity to be confirmed, 75% of phases had to be the prescribed length with appropriate content (i.e., delivery of breathwork and meditation align with program protocol) and 75% of the instructor's behaviours had to be the preferred behaviours.

2.7.2 Acceptability – Yoga Instructor

During an audio-recorded semi-structured interview via Microsoft Teams, the instructor was asked to discuss their experiences delivering the program, as well as their thoughts about the content of the program and guidebook, delivery and content of training, ongoing supervision, and whether they felt confident that they had enough knowledge to deliver the yoga program as intended. They were also asked whether there were any difficulties with delivering the program, any amendments required, and their views of fidelity to the guidebook.

2.8 Additional Measures

2.8.1 Personal and medical factors

Participants self-report sociodemographic [(self-report age, gender identity, ethnicity, civil status, work/education status, income, and comorbidities] and medical information [height, weight, cancer type and stage as well as the type and protocol of treatments received for their cancer (i.e., surgery, chemotherapy, radiation, immunotherapy, hormonal), and list of current medication(s), self-reported physical and mental health (via 5-point scale)] during the first survey only.

2.8.2 Adverse events

The instructor was asked to share adverse events with JP during the bi-weekly meetings. No adverse events were reported.

2.9 Data Analysis

All quantitative data (i.e., surveys, tracked feasibility outcomes) were imported into Excel, cleaned, subjected to quality checks (i.e., cross-validation), and analyzed using descriptive statistics. Qualitative data (i.e., transcribed semi-structured interviews) were imported into Nvivo and analyzed using reflective thematic analysis to explore the meanings and reality of participants' experiences (37). JP coded the transcripts using a deductive-inductive approach, and JB acted as a critical friend. Data were organized into manageable segments of text based on interview questions, and patterns and connections among them were identified. Codes were revisited and abridged into broader themes. At first, data from the morning and evening program participants were analyzed separately, but the 2 datasets were subsequently reviewed together to identify and map overarching themes after identifying common themes.

To examine the instructor's fidelity to the yoga program protocol and the language/behaviours she used, a duration and frequency analysis was conducted on audio- and video-recordings of all 48 60-minute classes. First, JP established the coding scheme for the class phases (i.e., arrival, warm-up, sequence 1, sequence 2, restoration, group discussion, departure) and instructor language/behaviours (e.g., invitational language, tailoring, extrospection). Second, to ensure the reliability of the coding scheme, 2 undergraduate students (BW, MP) were trained together using recordings from the first 4 classes until they achieved consistency in their coding. Then, they independently coded another 8 classes and attained an interrater reliability of 80%. Based on this validated coding scheme, BW proceeded to code the remaining 36 classes. Specifically, classes were dissected into one-minute increments and class phases were coded based on when the instructor transitioned to the next phase (e.g., began to explain the warm-up, signalling the transition from arrival phase to the warm-up phase). Additionally, every time the instructor used language/performed a behaviour defined by the coding scheme it was coded.

Descriptive statistics were calculated in Excel to ascertain the distribution and frequency of time dedicated to each phase and the frequency of specific language/behaviours. In addition, the recordings were reviewed to provide context when the frequencies did not capture enough usable detail to infer fidelity.

Qualitative and quantitative data were collectively interpreted using a mixed-methods convergence matrix. Components were assessed for convergence (agreement between both sets of results) or dissonance (disagreement between the sets of results).

3. Results

Table 6-3 summarizes the sociodemographic and medical characteristics of the 20 participants enrolled in the study. All participants self-identified as women, were on average 62.4 years of age (SD=11.79, range=34-80 years), self-identified as White (n=14, 70%), were married (n=14, 70%), had tertiary education (n=15, 75%), retired (n=10, 50%), and had at least 1 child (n=16, 80%). Most participants were diagnosed with endometrial/uterine cancer (n=9, 45%), stage 1 cancer (n=10, 50%), on average 7.6 years (SD=4.9) prior to the study, and had underwent surgery (n=17, 85%), radiotherapy (n=11, 55%), and chemotherapy (n=10, 50%). Most participants rated their mental health as “good” (n=8, 40%) and their physical health as “good” (n=12, 60%). Below, the quantitative results are presented with brief overview of the corresponding qualitative findings. Table 6-4 provides an overview of the qualitative findings and [Appendix E](#) presents the qualitative findings (including quotations) in greater detail.

Table 6-3. Summary of participants' characteristics.

	Combined n (%)	Morning n (%)	Evening n (%)
Age (mean years $\pm$ SD, range)	62.4 $\pm$ 11.7, 34-80	69.8 $\pm$ 6.1, 60-80	55 $\pm$ 11.5, 34-74
Civil status			
Married	14 (70)	7 (70)	7 (70)

In a relationship	2 (10)	1 (10)	1 (10)
Widowed	2 (10)	2 (20)	0 (0)
Never married	2 (10)	0 (0)	2 (20)
Education			
Completed Graduate School	4 (20)	2 (20)	2 (20)
Completed University/College	11 (55)	4 (40)	7 (70)
Some of University/College	3 (15)	2 (20)	1 (10)
Completed High School	2 (10)	2 (20)	0 (0)
Annual household income (\$CAD) ^a (mean $\pm$ SD, range)	112,909.10 $\pm$ 73,831.5, 12,000-300,000	107,428.5 $\pm$ 89,821.7, 12,000-300,000	122,500 $\pm$ 42,914.6, 85,000-180,000
Employment status			
Full-time	7 (35)	3 (30)	4 (40)
Part-time	4 (20)	1 (10)	3 (30)
Retired	9 (45)	6 (60)	3 (30)
Have children	16 (80)	10 (100)	6 (60)
Age of children ^b (mean $\pm$ SD, range)	32.7 $\pm$ 13.05, <1 - 50 years	37.3 $\pm$ 11.3, <1 – 50 years	24.31 $\pm$ 12.1, <1 – 38 years
Comorbid conditions			
Diabetes	4 (20)	1 (10)	3 (30)
High blood pressure	7 (35)	4 (40)	3 (30)
High cholesterol	6 (30)	2 (20)	4 (40)
Ethnocultural background ^{c*}			
White	14 (70)	8 (80)	7 (60)
South Asian	1 (5)	0 (0)	1 (10)
White and South Asian	1 (5)	1 (10)	0 (0)
Latin American	1 (5)	1 (10)	1 (10)
Time since diagnosis ^e (mean years + SD, range)	7.6 $\pm$ 4.9, 2.7- 22.1	7.3 $\pm$ 6.0, 2.7- 22.1	7.9 $\pm$ 3.4, 3.3- 11.3
Cancer type ^d			
Ovarian	5 (25)	3 (30)	2 (20)
Cervical	6 (30)	1 (10)	5 (50)
Vaginal	1 (5)	1 (10)	0 (0)
Endometrial/uterine	9 (45)	5 (50)	4 (40)
Cancer stage			
0	1 (5)	1 (10)	0 (0)
I	10 (50)	3 (30)	7 (70)
II	5 (25)	3 (30)	2 (20)
III	3 (15)	2 (20)	1 (10)
Do not know	1 (5)	1 (10)	0 (0)
Treatment type			
Surgery	17 (85)	8 (80)	9 (90)
Radiation	11 (55)	4 (40)	7 (70)
Chemotherapy	10 (50)	6 (60)	4 (40)
Current hormonal therapy	1 (5)	0 (0)	1 (10)

Changes in weight			
No change in weight	8 (40)	6 (60)	2 (20)
Lost >11lbs	6 (30)	2 (20)	4 (40)
Gained >11lbs	6 (30)	2 (20)	4 (40)
Self-rated mental health			
Okay	2 (20)	1 (10)	1 (10)
Good	8 (40)	2 (20)	6 (60)
Very good	5 (25)	3 (30)	2 (20)
Excellent	5 (25)	4 (40)	1 (10)
Self-rated physical health			
Okay	3 (15)	1 (10)	2 (20)
Good	12 (60)	5 (50)	7 (70)
Very good	5 (25)	4 (40)	1 (10)
BMI			
Underweight (<18.9 kg/m ²)	1 (5)	1 (10)	0 (0)
Normal weight (19-24.9 kg/m ²)	5 (25)	4 (40)	1 (10)
Overweight (>25 kg/m ²)	14 (70)	5 (50)	9 (90)

Notes. a = 11, b = 31, c = 19, d = 21 (1 participant had 2 primary gynecologic cancers), * = participants could select more than one option.

Table 6-4. Summary of categories, themes, and subthemes identified in the thematic analysis of yoga program participants' (n=19) post-program semi-structured interview

Themes	Sub-themes
<i>Theme 1: Recruitment - Reasons for reaching out and enrolling in the study and yoga program</i>	
Community and support	In-person programming post-pandemic Group-based programming with similar others Giving back to the cancer community
Health and lifestyle improvement	Timing of classes fit their schedule Convenient location Seeking program to cope with side-effects of cancer Start or get back into yoga Opportunity to test out a new lifestyle
<i>Theme 2: Retention - Factors that may have impacted the completion of data collection measures</i>	
Commitment to contribution and convenience facilitates data collection	Sense of obligation Altruism Convenience of online surveys
Difficulty navigating content and structure hinders data collection	Struggled with topic area of questionnaires Struggled with timeframe of questions Struggled with repetition in individual questionnaires
<i>Theme 3: Adherence - Why people choose to attend the classes</i>	
Accessibility and flexibility of attending classes	Convenient and hospitable location Flexibility of bi-modal delivery
Sense of community and relatability	Similar characteristics amongst peers

Personalized and supportive learning environment	Connection to peers An instructor that looked and struggled like them First 2 weeks of program in-person to set a foundation An instructor that was flexible in what they delivered and incorporated their wants and needs An instructional-style that was gentle, compassionate, and non-judgemental Content that supported them to connect with their body
<i>Theme 4: Program engagement - Value and use of optional program features</i>	
At-home videos were not utilized	No need for more yoga Recordings of full classes to support continuity of practice
The journals fit different needs Group discussions built connection <i>in-person</i>	Group discussions were motivating for attending class Group discussions supported progressive connection with peers Group discussions supported a sense of community Struggle to connect with online peers

3.1 Feasibility and Acceptability of Study Methods

3.1.1 Recruitment Rate

Study information letters were mailed to 500 people. Within 3 weeks, 55 people contacted the research team to express interest in the study (response rate: 11%); 41 people were screened for eligibility (74.5%), 2 could not be reached after 3 contact attempts (3.6%), and 12 were not screened for eligibility because the target sample was reached (and classes had reached maximum capacity) (21.8%). In general, participants reported during their interviews that they were shocked but appreciative and excited when they received the invitation to participate. They expressed several personal reasons for wanting to participate in the *study*, these included: giving back and contributing to future women's experiences, finding strategies to cope with side-effects, (re)starting yoga, and using the program as an opportunity to test out a new lifestyle, either by increasing their physical activity or working less.

Of the 41 people screened, 22 were eligible (53.6%; see Figure 6-1 for reasons for exclusion); however, 2 declined to participate because they were >10 years post-treatment and felt the program would be better suited (and more beneficial) to someone closer to treatment. The remaining 20 (90.9%) consented to participate, yielding a recruitment rate (i.e., the number of individuals who consented to participate in the study out of those who were assessed for eligibility) of 48.8%. Notably, the first 14 eligible participants screened had the opportunity to self-select to enroll in either the morning or evening program. Afterwards, the morning program had reached maximum capacity, and the remaining 6 eligible participants were only informed about the evening program; only 1 had expressed unprompted during the screening call that they would have preferred a morning class. There were several sources of motivation for the *program*. Being in-person and group-based with similar others was motivating because it reduced feelings of isolation from the pandemic: “I think it’s useful, particularly I’d say coming out of the pandemic, to have the group [...] I’ve had enough online stuff, and also, I mean when the pandemic first started I used to try and carry on some fitness classes online and I just get bored. So, I much prefer the in-person” (Mary, morning program). In addition, participants expressed that the timing of the program and location of the building in the city were facilitators. However, location distance (i.e., more than 30mins from home) did not preclude enrollment.

3.1.2 Retention Rate

The retention rate (i.e., the number of participants who completed the 8-week post-program survey) was 85.0%. Retention rates at other timepoints were also tracked. During the Baseline A₁ phase, the completion rate for the 3 timepoints was 96.2% (77 surveys of 80 completed); the missed surveys occurred at the end for 2 participants randomized to the 5-week group. During the Program B phase, 1 participant (Cheryl, evening program) withdrew from the

study after Class 3; she did not complete any program surveys during this period (or A₂ surveys), and 2 more participants did not complete a survey, resulting in a completion rate of 91.6% (55 of 60 surveys completed). During the Follow-up A₂ phase, survey completion was lower, with a completion rate of 81.6% (49 of 60 surveys completed) with 2 participants (1 morning, 1 evening) not completing any surveys post-program. In total, the survey completion rate was 90.5% (181 of 200 surveys completed). In addition, 18 participants (90.5%) completed the post-program interview (morning=9/10, evening=9/10).

Participants identified 2 main motivators (i.e., sense of obligation and altruism) and 1 facilitator (online) for completing data collection tasks. As Deborah (morning program) explains, “I liked it on the computer because then I can go at my own pace, or I could go back and forth between questions if I wasn't sure what I was feeling in one particular question, I'd go forward or back or just leave it.” Three main deterrents for completing the surveys were: struggles with questions pertaining to certain outcomes (i.e., general quality of life, female sexual distress, and self-discrepancy), timeframe for questions (i.e., last 7 days), and question redundancy.

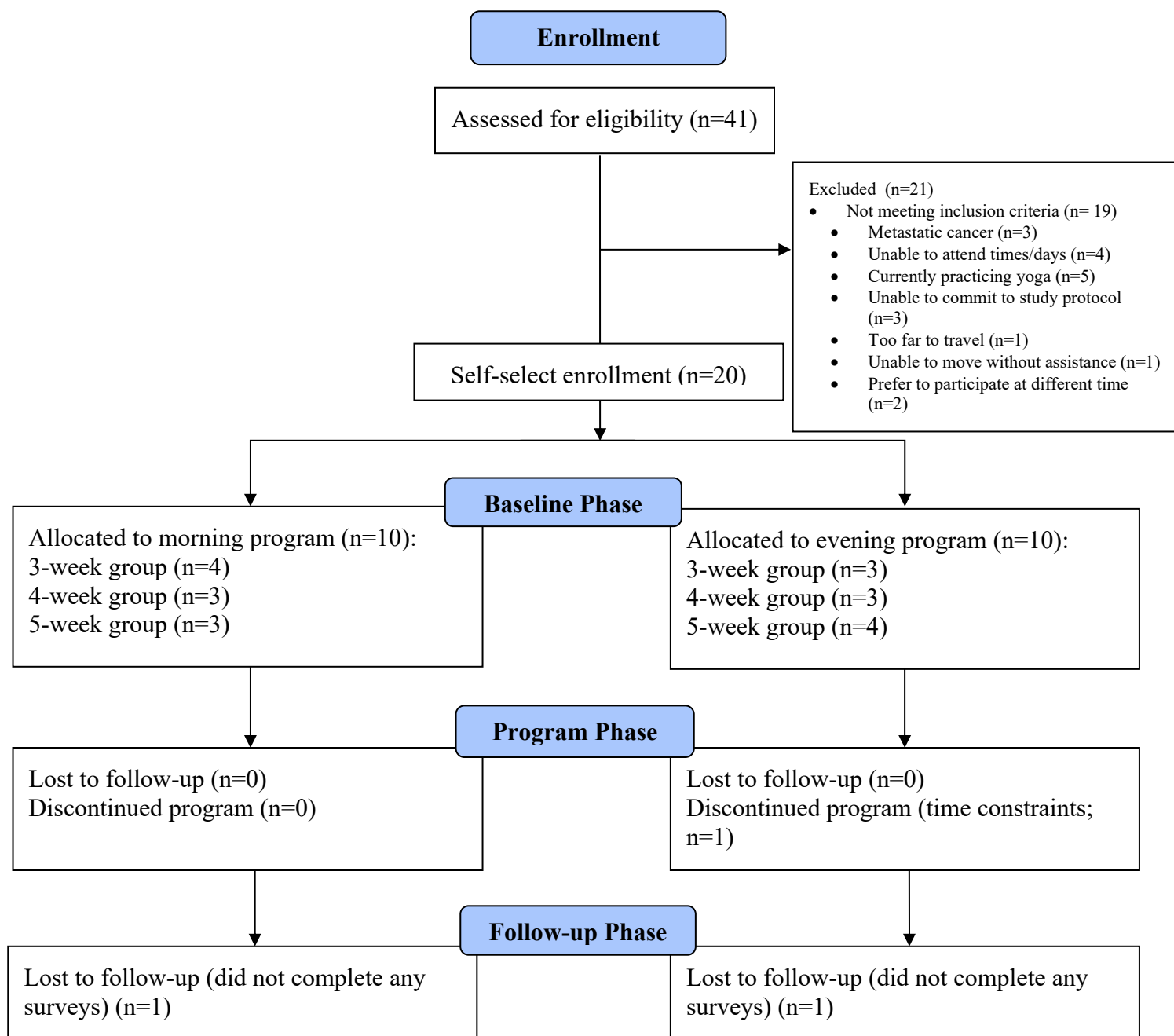


Figure 6-1. CONSORT flow diagram

3.2 Feasibility and Acceptability of Program

3.2.1 Adherence Rate

The adherence rate (i.e., the number of classes participants attended regardless of modality) was 83.1% (19.9/24) and 17 (89.4%) participants attended >75% of classes (18/24). Overall, participants attended in-person (51.9%) more often than online (30.7%). Morning program participants, on average, attended in-person (56.5%) more often than online (34.2%), and evening program participants also attended in-person (48.2%) more often than online (27.1%); however, the latter attended fewer classes overall (75.4%) compared to the former (90.7%). Five main elements emerged as fundamental to participants wanting to attend classes: (1) ideal amount of yoga congruent with lifestyle and needs, (2) in-person and group-based facilitated connection with peers, (3) mandatory in-person attendance for the first 2 weeks set foundation and connections to build upon, (4) knowledgeable and supportive instructor with a competent assistant, and (5) content supported them to connect with their bodies and supported their perceived wellbeing. As Janet (evening program) explained, being more in-tune with her body also lead to immediate health benefits: “I did find that it helped me be more in tuned to my body and listened to more signals and it helped lower my blood pressure.” For the 2 participants who attended below the threshold for successful adherence (i.e., 75% of classes), the only reason they expressed for missing classes was due to illness.

3.2.2 Optional Program Feature Engagement Rate

In addition to the yoga classes, participants could participate in optional features of the program. Overall, the pre-recorded videos were largely unviewed; only 5 (26.3%) participants reported watching a video during the program B phase for a total of 11 views (range=0-4). Participants explained the pre-recorded videos had little added value to the program. M9

explained that the classes fulfilled her needs and she did not have time to do more: “if I’m going twice a week, I don’t really feel the need to access it on top of twice a week. I’m busy enough, so it was just more than I was willing to consider”. Participants suggested recording the actual classes and making these available for viewing afterwards for when they were unable to attend as they enjoyed the full class and had become accustomed to the instructor’s style.

The number of reported journal entries varied across participants (range: 0-24 entries (1 after each class)). The engagement rate for the journals was 15.7%; only 3 participants wrote >1 journal entry per week and 5 (Q1;Q3=3.25;9.5) was the reported median number of journal entries completed. Overall, participants held different views of the journals; some sought to journal to remember their thoughts and class content, some avoided journalling in favour of processing experiences internally, and others forgot about the journals when they stopped receiving prompts to use it from the instructor. As Susan (morning program) explained: “At the beginning, Jody would say if you want to take out your journals and then we’d all scurry and get our bags and get our journals out and start writing in them, and then I don’t remember her saying that towards the last, maybe 4 or so classes so I’d go home and think ‘oh there’s my journal empty again, I didn’t do anything.’ Sometimes I’d go back to write something. I think it’s a good thing to have, just because I didn’t use it doesn’t mean it’s not a good thing to have, but that was just me.”

Attending the group discussions was the most used optional feature. Overall, 91.6% (44/48) of group discussions were attended by $\geq 50\%$ of participants (10/19 participants). For the morning program, $\geq 50\%$ participants attended 100% (24/24) of group discussions with 79.1% of group discussions having $\geq 50\%$ of attendees speak at least once per discussion. Whereas for the evening program, $\geq 50\%$ participants attended 83.3% (20/24) of group discussions with 66.6% of

group discussions having $\geq 50\%$ of attendees speak at least once per discussion. As noted above, the connection participants formed with each other was a motivating factor for attending the classes. Participants further shared that the group discussions allowed for progressive connections that grew with continuous sharing of similar experiences. The progressive connections facilitated physical and emotional comfort as participants learned that their post-cancer struggles and concerns were shared which helped them process their feelings. However, connections were more difficult to develop online. Participants found it difficult to connect with those who attended mostly online and those attending mostly online struggled to connect with those in-person. While some participants were disappointed about the lack of connection online, participants who attended primarily online acknowledged that the convenience outweighed the lack of connection: “Not so much because again, I was always at home. [...] If it would have been like mandatory 12 weeks, you got to show up, I would have done it and maybe the benefit for me would have been I met a few people, forced me to do it. While doing it online, hey, I don't have to do that, right?” (Elizabeth, evening program).

3.3 Fidelity to and Acceptability of Program Protocol

3.3.1 Fidelity to Class Structure

See Table 6-5 for a summary of fidelity to class structure. Overall, program fidelity (i.e., the instructor's adherence to the prescribed protocol duration for each segment of the class) was 61.3% when aggregating data from the morning and evening programs. The instructor adhered to the protocol for the evening program (62.5%) slightly more than the morning program (60.1%), which had been delivered first. The class segment with the highest fidelity was Sequence 2 with both the morning and evening program adhering 91.7%. There were notable deviations from the prescribed protocol for 4 class segments.

For both programs, the warm-up was consistently longer than the prescribed amount, attributable to the instructor using this time to educate participants on various parts of the body and the use of yoga in improving bodily function. As a result, the morning program's warm up was equal to or above the protocols planned 15 minutes for 95.8% (23/24 classes) of the program and 70.8% (17/24 classes) of the program for the evening program.

For both programs, there was a steady decrease in the amount of time spent in Sequence 1 which is attributed to the participants gaining experience with the sequence, requiring less explanation and faster execution. In classes 1-7, sequence length was 57.1% and 42.9% equal to or above the prescribed duration (i.e., 10 minutes) for the morning and evening programs, respectively. However, in classes 8-24, fidelity was 100% below the prescribed duration (i.e., 10 minutes) for both programs.

There was an unequal amount of time spent in group discussion across the 2 programs. For the morning program, group discussion was equal to or above the prescribed duration (i.e., 10 minutes) for 66.7% of the program. Moreover, in the last half of the program (classes 12-24) the duration of the group discussion was equal to or above the protocols planned 10 minutes 75% (9/12 classes) of the time. Whereas, for the evening program, group discussion was equal to or above the prescribed duration for 16.7% of the program.

In addition, it was clear that the departure segment of the classes was not consistently captured. The recordings would be stopped when the instructor thanked the participants for attending but did not capture whether participants continued to mingle or speak to the instructor. Thus, when calculating program fidelity without the departure component, the aggregated fidelity is 69.1%, the evening program fidelity is 66.7%, and the morning program fidelity is 65.3%.

Table 6-5. Yoga instructor's fidelity to class structure

	Total				Morning				Evening			
	Time		Fidelity		Time		Fidelity		Time		Fidelity	
	Avg min	SD	n	%	Avg min	SD	n	%	Avg min	SD	n	%
Arrival (5min)	7.5	5.0	30	62.5	6.1	2.5	15	62.5	8.9	6.3	15	62.5
Warm-up (15min)	20.0	6.6	25	52.1	21.6	6.0	14	58.3	18.4	6.9	11	45.8
Sequence 1 (10min)	<i>6.6</i>	<i>2.4</i>	<i>18</i>	<i>37.5</i>	<i>6.5</i>	<i>2.2</i>	<i>10</i>	<i>41.7</i>	<i>6.7</i>	<i>2.5</i>	<i>8</i>	<i>33.3</i>
Sequence 2 (15min)	15.0	3.7	44	91.7	14.5	4.0	22	91.7	15.5	3.5	22	91.7
Restoration (20min)	16.4	3.9	36	75.0	16.1	3.9	17	70.8	16.8	4.0	19	79.2
Group discussion (5-10min)	9.1	4.9	37	77.1	11.9	5.0	16	66.7	6.4	2.8	21	87.5
Departure (5min)	5.3	4.1	16	33.3	8.2	3.7	7	29.2	<i>2.3</i>	<i>1.5</i>	<i>9</i>	<i>37.5</i>

Notes. The allowable margin of error was $\pm 30\%$. Italicize text indicates the phase was $>30\%$ under the protocol. Bold text indicates the phase was $>30\%$ above the protocol.

3.3.2 Fidelity to Recommended Behaviours

See Table 6-6 for a list of recommended and non-recommended behaviours, along with fidelity data. Overall, instructor fidelity (i.e., the instructor's adherence to the recommended behaviours for each class) was 44.6% when aggregating the morning and evening program. The instructor engaged in recommended behaviours for the evening program (45.6%) slightly more than the morning program (43.6%). The most used recommended behaviour was prompting introspection (20.7%), with the instructor using this behaviour slightly more in the evening program (21.6%) than the morning program (19.8%). The instructor engaged in non-

recommended behaviours more than recommended behaviours (48.2%), with morning and evening being nearly the same (48.6% vs 48.0%). However, it is important to note that the most used non-recommended behaviour was dictating language (42.6%), which was used equally in both programs to guide participants through the asanas and sequences. The instructor clarified this behaviour during her interview; she would cue them through several variations and then encouraged them to take ownership of their practice by connecting with their bodies and choosing the most appropriate version for that moment: “I don't think in terms of modification so much like ‘how do I modify triangle pose,’ I don't really think in those terms. It's like, ‘OK, step your feet apart. Take them a little further. Take them a little narrower. What feels right?’ So they're finding their own modification in listening to their body. So I'm not having to tell them how to modify. They're learning that for themselves.” In addition, the instructor regularly engaged (9.5%) in sharing their personal experience practicing yoga, which was neither recommended or discouraged and thus, not captured in the initial codebook. Interestingly, this behaviour was often cited by participants as one behaviour which they appreciated the most. The instructor's age (middle age) and gender (woman) were noted as benefits for the participants because they saw themselves in her when she would do the physical postures with the participants and would admit when she was struggling with the postures. This created a sense of safety and comfort.

Table 6-6. Yoga instructor's fidelity to recommended behaviours

	Total		Morning		Evening	
	Total	Avg/class	Total	Avg/class	Total	Avg/class
Recommended						
Invitational language	172.5	7.2	147	6.1	198	8.3
Embracing	51	2.1	46	1.9	56	2.3
Choices	78	3.3	89	3.7	67	2.8
Self-compassion	132	5.5	137	5.7	127	5.3

Increase comfort	401	16.7	379	15.8	423	17.6
Introspection	497	20.7	476	19.8	518	21.6
Tailoring	27	1.1	29	1.2	25	1.0
Consent	0.5	0.0	1	0.0	0	0.0
Answering questions	25.5	1.1	31	1.3	20	0.8
Checking in	37.5	1.6	33	1.4	42	1.8
Not Recommended						
Dictating language	1023.5	42.6	1028	42.8	1019	42.5
Qualifiers	250.5	10.4	232	9.7	269	11.2
Extrospection	263.5	11.0	261	10.9	266	11.1
New Behaviour						
Sharing personal experience	227.5	9.5	247	10.3	208	8.7

Notes.

3.3.3 Instructor Acceptability

[Appendix E](#) provides additional quotations for the following. The instructor provided valuable insight into the facets of the yoga program and the elements of the protocol that were beneficial. From a preparation stand-point, the comprehensive training session and guidebook instilled both capability and confidence. The well-laid-out guidebook acted as a reliable resource, streamlining class structures and timings. The intake meetings and forms were valuable tools to understand participants' physical abilities and concerns, and ensured the instructor could tailor the content to participants' needs. The instructor felt the modifiable protocol allowed for autonomy on her part and kept the classes engaging for participants. The dosage (length and number of classes) was appropriate and well-paced, ensuring participants could genuinely connect with the practice, build group cohesion, and show noticeable progress over time. Finally, the volunteer assistant was an integral part of the protocol to ensure that the instructor was able to focus on the participants as opposed to having to split their attention with logistical

considerations (i.e., setting up equipment and camera, letting participants into the virtual classroom, troubleshooting technology concerns).

However, there were challenges noted. The instructor felt the class size (capped at 10 participants) limited their ability to provide individual attention to the fullest of her ability. The instructor also identified that the online bi-modal delivery, particularly for online participants, needs better facilitation, perhaps through formal check-ins or enhanced technical set-up like larger screens for better monitoring. She also shared additional content that could be incorporated into the program, such as additional breath awareness practices, instructor preparation guidance, class themes or topics, and pelvic floor education, for a more holistic approach. Suggestions for improvement included: adding a bit more time (15 minutes) for shavasana and offering an optional, pre-curated music playlist to elevate the sensory experience. For group discussions, using multidirectional microphones and having a peer-leader may alleviate some of the burden on the instructor and make the dialogues more seamless and impactful.

4. Discussion

The aim of this study was to assess the feasibility and acceptability of the study methods and program protocol from end-users' perspectives for a series N-of-1 trial assessing a 12-week bi-modal Hatha yoga program for adults diagnosed with gynecologic cancer. Though rates for retention, adherence, and use of the group discussion optional feature were better than targets set a priori, the recruitment rate and use of the journals and at-home videos were below targets set. Overall, participants had positive responses to the program in terms of dosage, modality, delivery, social connection, and its impact on their perceived wellbeing. While numerous yoga interventions and programs have been delivered in-person (38, 39) and there are a growing

number of online physical activity interventions being offered (40), the flexibility of the bi-modal delivery was unique to this program and population, and highly valued by participants. Further, participants provided valuable insight into the strengths and pitfalls of certain study methods and program features, ensuring refinements can be made accordingly to improve execution and effectiveness to further enhance participant experience in future iterations of the program.

The study methods were moderately successful but require refinement before replication. For recruitment, nearly 50% of individuals screened were ineligible and 21.8% were unscreened because the programs reached maximum capacity. Overall, these numbers suggest interest in a bi-modal community-based yoga program for adults diagnosed with gynecologic cancer, which is corroborated by the acceptability data. However, a surplus of ineligible or unscreened people is burdensome for those reaching out and a strain on research resources (41), thus, several refinements should be made. First, end-users should be involved in creating clearer recruitment materials to ensure eligibility criteria is easily understood (42). Second, more programs can and should be run concurrently to accommodate interest. Finally, the response rate should be taken into consideration to optimize recruitment letter quantities to avoid participant and research burden. Participants were asked to complete 9 popular surveys at 9-11 timepoints and a final retention rate of 85.0% is notably higher than many physical activity interventions targeted at adults diagnosed with cancer (43). Yet, it is important to note that participants were clear in their assessment of the measures – they did not like them and completed them because of obligation (from a sense of reciprocity) or altruism. While this study had more data collection points than most quasi- and experimental trials, participants did not raise concerns about the number of timepoints but their motivations for completing the research-related tasks bring into question the

generalizability of the retention rates. Indeed, research suggests that older adults, women, and certain psychosocial traits (e.g., empathy) predict altruistic behaviour (44-46). As such, this sample may have been more likely to complete unfavourable research tasks; refinements should be made to the survey package to address the concerns (e.g., shorten length, include open-ended questions) raised and retain the facilitators identified (e.g., online surveys) to ensure that more people are likely to complete them in the future.

The 12 week, bi-modal, Hatha-style group yoga classes, held twice weekly for 60 minutes were well-received, as evidenced by adherence and acceptability data. Acceptability data suggests the classes met the intended objectives of promoting perceived wellbeing and quality of life by allowing participants to focus on their physical and mental selves. The rate of engagement in group discussions and positive feedback underscore the importance of retaining this feature, while keeping participation optional. Conversely, the journals and at-home videos did not meet the engagement thresholds, warranting further investigation of their relevance in the program. Journals and expressive writing interventions have been evaluated as standalone body image interventions (47); however, they have rarely been integrated into yoga programs. A notable exception is the recent size-inclusive yoga and body gratitude journal intervention for undergraduate students (48); 71% of participants completed the journal $\geq 1-2$ times per week compared to 15.7% in this study. The difference in engagement may stem from the “mandatory” aspect of the journal or lack of previous journalling experience, as several participants in this study expressed previously trying journalling and finding it not useful. Similarly, the success of the at-home video component in other yoga interventions varies (25, 49). Participants suggested providing videos of the classes themselves as opposed to short clips and reminders to increase engagement. While engagement levels varied between features, offering features as optional

enhancements to the main program allows participants to tailor their experience (50), avoiding artificial inflation of user engagement with the features. In addition, it would be valuable to explore participants preferences for receiving access to and reminders about optional features (e.g., automated reminder emails).

Program fidelity is a lesser-studied, but crucial element in program design and implementation. The overall fidelity rates, especially those concerning the instructor's adherence to the class structure, were moderate. The instructor often diverged from the protocol to educate participants - a behaviour perceived as beneficial by participants. This suggests that an adaptive form of fidelity that prioritizes participant benefit over strict adherence to the protocol may be a valuable approach to assessing program fidelity in contexts like this. This resonates with debates in exercise psychology and program evaluation literature regarding the balance between fidelity and adaptability (51). In addition, by tracking the instructor's adherence to the protocol and querying the participants about the instructor's teaching, it was possible to elucidate additional instructor behaviours that were beneficial for promoting positive participant outcomes. Specifically, the instructor shared her personal experiences with the participants, which given her similar demographics to the participants, helped participants feel safe and confident trying new postures or techniques. Thus, assessing fidelity provided valuable insight into internal and external validity. In a future definitive trial or in real-world application, to assist instructors, program fidelity evaluation could include regular, non-filmed feedback sessions or forms where participants share their experiences and perceptions. This approach would offer instructors insights into the impact of their teaching style and content adaptability, helping them tailor their approach to better meet participants' needs and enhance overall program effectiveness.

The KTA framework (22) emphasizes the dynamic nature of knowledge creation and application, focusing on the transformation of knowledge into actions that can lead to an improvement in health outcomes, practices, and policies. This study sought to extend previous work focused on phases 1-3 of the KTA framework by implementing the program (phase 4), monitoring program use (phase 5), and evaluating outcomes of the program (phase 6) to inform program sustainability (phase 7). Monitoring implementation outcomes (i.e., acceptability, adoption, appropriateness, feasibility, fidelity, implementation cost, penetration, and sustainability; (53)) can help determine if a program's lack of success (e.g., lack of effectiveness) is due to program content or the implementation process (54, 55). In addition to the acceptability (including appropriateness), feasibility (including adoption), and fidelity outcomes formally assessed, findings also provide insight into penetration and implementation cost. First, adults diagnosed with cancer report lack of survivorship services (52), a gap addressed in this study through the partnership between The Ottawa Hospital for recruitment and the ORCF for program delivery, supporting penetration of the program by providing a pathway to access continued support. Second, the program was offered in the community at no charge because associated fees were covered by a research grant (i.e., instructor salary, research equipment, yoga equipment), in-kind contributions from the ORCF (i.e., free use of space and available yoga equipment), and donations from Lululemon (i.e., yoga mats). The study's research component is estimated at \$4200 Canadian (e.g., research equipment, personnel) while program implementation would have cost approximately \$18000 (e.g., instructor salary, yoga equipment, venue space). However, recurrent costs for an organization with the requisite space would mainly be the instructor's salary (~\$2000; region and experience dependent), making the cost per participant approximately \$200 for a 10-person program or \$8.33 per class. During the interview,

participants expressed their willingness to pay for the program increasing the likelihood of long-term implementation. Several hybrid models of funding have been previously explored, including a mix of fee-for-service (upfront, set cost per session) and subsidised costs (total session costs off-set through donations, sponsorship) (43). Forthcoming research will present the findings of participants patient-reported outcomes to address phase 7. The findings reported herein provide valuable insight into refinements that can be made to improve the likelihood of the program be sustained (phase 8). Nevertheless, in future definitive trials, assessing effectiveness and continued assessment of implementation outcomes is crucial for sustainability of the program.

4.1 Strengths and Limitations

The limitations of this study should be acknowledged. First, it was a relatively homogeneous sample, thus, findings may not generalize to younger or older women or other ethnocultural groups. Second, the morning and evening programs were delivered by the same instructor, therefore, a future study is needed to assess if the acceptability of the intervention and fidelity is the same across instructors to determine if specific instructor factors are important. Third, 2 participants did not participate in the interview and their perspectives may have differed from those willing to participate in the interview. However, the strengths of this study were its adherence to series N-of-1 trial design, independent evaluations of instructor adherence to the protocol through video recordings, delivery in the community to support ‘real-world’ evaluation of a co-created program, and training and regular supervision of the instructor and assistants.

4.2 Conclusion

In conclusion, this study successfully demonstrated the feasibility and acceptability of a co-created, community-based 12-week bi-modal Hatha yoga program for adults diagnosed with

gynecologic cancer. Despite facing challenges related to recruitment and engagement with certain program components, such as at-home videos and journals, the program itself was well-received by participants, who appreciated its flexibility, relevance, and the sense of community it fostered. High retention and program adherence rates further substantiated the program's value to the target population, underscoring the importance of tailoring interventions to meet the specific needs and preferences of end-users. The instructor's moderate adherence to the program protocol, coupled with their ability to connect with participants through shared experiences and personalized instruction, highlighted the critical role of instructor characteristics in the program's success. Moving forward, refinements are needed to enhance the recruitment strategy, optimize the use of optional program features, and ensure the program's sustainability in real-world settings. By incorporating feedback from participants and closely examining the implementation process, future iterations of the program can continue to build on the solid foundation established by this study, aiming to further improve health outcomes for adults diagnosed with gynecologic cancer. This work not only contributes to the growing body of evidence supporting the benefits of mind-body interventions in oncology settings but also emphasizes the significance of involving end-users in the development and evaluation of health interventions to ensure their relevance, effectiveness, and sustainability.

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Chapter 7: Study 4 (article 6), Benefits of Program

A single subject feasibility trial to evaluate implementation of a co-created yoga program for adults diagnosed with gynecologic cancer: Patient-reported outcome results

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In preparation for submission to a Peer Review Journal

Abstract

Background: Yoga has been identified as a mind-body physical activity that improves many physical and psychological outcomes, but its impact on adults diagnosed with gynecologic cancer remains underexplored. Only a few studies have evaluated and reported the variability in individual response to yoga. Prior work with key interested parties yielded a 12-week Hatha yoga program that allows for modification to assist the instructor in tailoring it to participants' needs and abilities and achieving optimal benefit on meaningful patient-reported outcomes. This study evaluated the effects of the yoga program on key patient-reported outcomes (i.e., quality of life, perceived cognitive abilities, fatigue, sexual distress, negative body image, perceived stress) among adults diagnosed with gynecologic cancer; overall effects as well as variability in response were assessed.

Methods: A mixed methods series multiple baseline N-of-1 trial design with an 8-week follow-up phase was followed. Participants were recruited from The Ottawa Hospital and self-selected to enroll in a morning or evening program. The 12-week yoga program comprised bi-modal (in-person and Zoom options from week 3 onwards) 60-minute Hatha yoga classes twice weekly, complemented by optional group discussions, journals, and pre-recorded videos for at-home practice. Self-report data were collected online during the Baseline A₁ (n=3-5 surveys at 1-week intervals depending on allocation), Program B (n=3 surveys after class 1, class 12, and class 24), and Follow-up A₂ (n=3 surveys at 1-, 4-, and 8-weeks post-program) phases. Visual analysis and hierarchical linear modeling were used to assess the overall effects of the yoga program and inter-individual variability in responses.

Results: For the overall effects, between-person analyses indicated that participants ($N=20$; $M_{\text{age}}=62.4$, $M_{\text{years since diagnosis}}=7.6$, 100% self-identified as women) showed improvements in

quality of life, perceived cognitive abilities, sexual distress, negative body image, and perceived stress during the program. Additionally, quality of life, cognitive function, sexual distress, and body image showed sustained changes during follow-up, whereas fatigue and perceived stress showed deterioration during follow-up. For inter-individual variability in responses, within-person analyses indicated some variability in participants' responses to the program.

Conclusions: This N-of-1 trial yielded valuable information to confirm the utility of a yoga program for improving select patient-reported outcomes among adults diagnosed with gynecologic cancer, though responses were variable. Overall, the program represents a promising line of inquiry to meet a pressing need for scalable programs to address the sequelae of cancer on adults. Moving forward, considering the phenomenon of variability and investigating specific mechanisms that could explain why adults have different responses to yoga is vital for tailoring interventions to improve effectiveness and inclusivity, ultimately enhancing health outcomes.

Keywords: mind-body, oncology, single-case, community

Trial Registration: ClinicalTrials.gov, no.: NCT05610982; November 3, 2022

1. Introduction

Every year, 12,000 adults will be diagnosed with a gynecologic cancer (i.e., vulvar, vaginal, ovarian, cervical, endometrial/uterine) in Canada, accounting for more than 11% of new cancer diagnoses [1]. The 5-year net survival rate ranges from 44% (ovarian) to 82% (uterine; [2]). The treatment for gynecologic cancer may involve a combination of surgery, chemotherapy, and radiation therapy [3]. Gynecological cancer and its treatment can cause long-term physical (e.g., fatigue, menopausal symptoms, incontinence, sexual difficulties, infertility: [4, 5]), psychosocial (e.g., anxiety, negative body image, stress, disconnection, isolation; [4, 6-9]), and cognitive (e.g., decreased concentration, cognitive fatigue) effects. Traditionally, the evaluation of treatment efficacy has centered on clinical metrics such as survival rates and disease-free intervals [10]. While these indicators are undeniably critical, they do not allow for conclusions related to the magnitude of the effects of *supportive care programs* on outcomes of interest to those diagnosed. Evaluating subjective experiences of health, encompassing physical, psychosocial, and cognitive domains, in response to programs is also imperative [11].

Physical activity programs, such as yoga, have been identified as a potential type of supportive care program that can positively impact subjective experiences of health [12]. Yoga aims to integrate physical, mental, and spiritual exercises to unite the individual self with universal consciousness [13]. Research demonstrates that this holistic approach, characterized by its emphasis on the mind-body connection, has a positive influence on subjective experiences as measured via limited patient-reported outcomes (e.g., quality of life, fatigue; [14-17]) among adults diagnosed with *breast* cancer. However, adults diagnosed with breast cancer vary with respect to health, physical function, work and leisure activities, and social environment from adults diagnosed with *gynecologic* cancer [18, 19]. Still, little attention has been given to

ensuring key parties are involved when developing yoga programs or identifying outcomes to measure, either for research or community use [20]. The rationale for the outcomes used in a given study is rarely tied to identified outcomes of interest for participants [21]. It is critical that outcome decisions for a given study are made based on the thoughtful opinions of end-users (in this case, adults diagnosed with gynecologic cancer) since overlooking such outcomes may fail to demonstrate improvements in areas of deep importance. As such, in recent work (Price et al., submitted⁷), a yoga program and accompanying instructor manual (see **Methods** for details) was co-created with key parties/end-users' (i.e., adults diagnosed with gynecologic cancer, yoga instructors) to draw on their unique experiences, interests, and needs, rendering it more feasible, acceptable, usable, and relevant (Price et al., forthcoming⁸). The co-creation process also yielded patient-reported outcomes to consider when evaluating the yoga program among adults diagnosed with gynecologic cancer; namely, quality of life, perceived cognitive abilities, fatigue, sexual distress, negative body image, and perceived stress.

While several systematic reviews and meta-analyses focusing on main effects and group differences suggest that yoga can positively affect quality of life and fatigue when compared to no intervention or other active interventions [22-25], the evidence is not uniformly conclusive, especially for the other identified patient-reported outcomes of interest [26]. The variation in yoga's effectiveness may stem from the large heterogeneity in programs (e.g., program factors [program length, number of classes, yoga type], environmental conditions; [27]). However, there has been some qualitative research to suggest that individual factors such as self-perceptions may impact how adults diagnosed with gynecologic cancer respond to yoga [28]. Studies in the

⁷ Price J, Praamsma N, Harris C, Brunet J: Co-producing a yoga program for adults diagnosed with gynecologic cancer: a consensus study, submitted.

⁸ Price J, Westlake B, Brunet J: Evaluating the feasibility and acceptability of a community-based, co-created yoga program for adults with gynecologic cancer: A series N-of-1 feasibility study, forthcoming.

general population reveal substantial variance in responses to physical activity based on inter-individual differences stemming from differences in individuals' preferences, body conditions, and psychological predispositions [29-31]. As the benefits of yoga in the context of gynecologic cancer are still being explored, both the main effects and individual differences in responses is needed to provide a broader understanding of the potential effects of yoga for an adult diagnosed with gynecologic cancer.

1.1 The N-of-1 Trial and Its Application Within Yoga Research

The N-of-1 trial (also referred to as single-subject or single-case) design is well-suited to examining the nuances of individual variability in responses to interventions such as yoga [32, 33]. The N-of-1 trial is characterized by a focus on individual behaviour, repeated measurements of an individual over time, and rigorous experimental control to allow for the detailed examination of causal relationships and intervention efficacy [32-38]. A N-of-1 trial can include one participant or multiple participants, wherein multiple participants represent a group whose performance generates a single score (e.g., problem behaviours in a classroom of students) or their scores are used for examining replication of outcomes within a single study (e.g., changes in quality of life in response to a physical activity program [32, 34-37]) which is known as a series N-of-1. While most experimental studies involve repeated measures, it is less common to measure outcomes repeatedly during baseline and follow-up. N-of-1 trials, on the other hand, focus on the responses of participants within and across the different conditions/phases in a given study. Consistent with recommendations, outcomes are measured at least 3 times per condition/phase to capture trends and variability in the data [33, 34, 40, 41]. Finally, experimental control is achieved via one of the several N-of-1 designs that exist (e.g., ABAB design, multiple baselines, or alternating treatment design [33, 34]). These designs help to rule

out alternative explanations for changes in outcomes (e.g., history, maturation, regression to the mean) while allowing each participant to serve as their own control [32, 34-37], and thus increasing confidence that the effects are the result of implementing the program (see [42-45] for overview of several types). While each study requires tailored measurements and phases, systematically manipulating conditions and monitoring individual responses offers a dynamic approach for observing variations within and between-persons (depending on study design). This methodology enables a clear understanding of causal relationships between programs and often variable patient-reported outcomes [42, 43].

The analysis of N-of-1 data is another consideration with clear implications for evaluating yoga programs (or otherwise). Traditionally, the analysis of data in series N-of-1 trials has relied upon visual analysis, thus requiring researchers to visually inspect graphed data to identify the presence of patterns and trends within and between persons across phases to discern program effects [32, 35, 46]. While this approach has provided valuable insights, a meta-analysis found low to moderate inter-rater agreement when interpreting graphed N-of-1 data [47]. Accordingly, the field is evolving and statistical analyses are increasingly being used to identify patterns and trends in (series) N-of-1 data [48]. When applicable, one promising strategy is the integration of multilevel modeling, particularly hierarchical linear modeling (HLM; [49-51]). HLM can account for the hierarchical structure inherent in series N-of-1 trials. When estimating fixed and random effects, HLM can provide a comprehensive understanding of the overall effects of an intervention for a given sample (akin to main effects) while giving attention to individual differences [49-51]. Indeed, the conduct of a series N-of-1 trial with several participants wherein data are analysed using HLM enriches the research landscape, offering a more nuanced understanding of program effects and fostering a comprehensive approach to

individual response analysis [34, 52, 53]. This methodological advancement is particularly relevant in areas like yoga given the potential role of personal factors (e.g., health status, physical function, social and psychological factors) in response to interventions. Therefore, the purpose of this article is to showcase a series N-of-1 trial featuring visual analysis and HLM to study the effects of a co-created yoga program among adults diagnosed with gynecologic cancer so as to highlight the merits of this approach to research. Outcomes identified with end-users were: quality of life, perceived cognitive abilities, fatigue, sexual distress, negative body image, and perceived stress.

2. Methods

2.1 Study Design

Data analyzed and reported herein were collected as part of a mixed-methods single-arm feasibility trial using a multiple baseline ABA design that aimed to: (1) assess the feasibility and acceptability of study methods and the yoga program, and (2) estimate the preliminary benefits and underlying mechanisms of the program. The feasibility and acceptability outcomes are presented elsewhere (Price et al., forthcoming). The trial was registered in the ClinicalTrials.gov database (NCT05610982; November 3, 2022) and a detailed description of the protocol has been published [54]. The Consolidated Standards of Reporting Trials (CONSORT) 2010 statement for N-of-1 trials [55] and the 21-item Checklist Standardising the Reporting of Interventions For Yoga (CLARIFY) reporting guidelines [56] were followed in the preparation of this manuscript to ensure complete reporting and transparency. A brief overview of the study design, intervention, and measures pertaining to this study are presented below.

2.2 Participants

Research Ethics Board approval was granted from the Ottawa Hospital (file no.:

20220544-01H) and the University of Ottawa (file no.: H-10-22-8671). To be eligible for inclusion, adults had to: be at least 18 years of age, have received a diagnosis of non-metastatic gynecologic cancer, be able to read/speak/understand English, have access to the Internet and an audio-visual device (e.g., computer, smart phone), and accept to travel to the Ottawa Cancer Foundation (Ottawa, Ontario, Canada) twice/week for the first 2 weeks of the program. Adults who self-reported being non-ambulatory (i.e., unable to walk or require assistance of a mobility devise) and currently practicing yoga at least 1/week or have practiced consistently in the last 6 months (i.e., 1/week for 8 weeks) were not eligible. Fifty-five people expressed interest in participating in the study, of which 41 were screened for eligibility; for the remaining, 2 could not be reached after 3 contact attempts, and 12 were not screened because the programs had reached maximum capacity. Of the 41 screened, 22 were eligible, of which 20 consented to participate and 2 declined to participate because they were >10 years post-treatment and felt the program would be better suited (and more beneficial) to someone closer to treatment. Further details on exclusion are presented elsewhere (Price et al., forthcoming). During the Program B phase, 1 participant from the evening group withdrew from the study without attending any classes because they were no longer able to commit to attending the classes. During the follow-up A2 phase, 2 participants (1 morning, 1 evening) did not complete any surveys and did not provide a reason.

2.3 Procedures

Recruitment was open for 3 weeks (November 28, 2022 – December 22, 2022). Healthcare provider referral, registry mailout to 500 patients, and community-based recruitment methods (e.g., postings on social media, sharing of study details in community partner newsletters) were used. Interested adults who contacted the first author were screened for

eligibility by telephone and provided detailed information about the trial. Eligible adults were asked to provide informed verbal consent to participate in the trial. After obtaining informed consent verbally, participants were randomized to a 3-, 4- or 5-week Baseline (control) A₁ phase, and on a weekly basis for 3, 4, or 5 weeks (depending on their group allocation), they received an email (at around the same approximate day/time to maintain equal spacing in-between assessments) with a link to a secure site to complete an online survey. Owing to the non-concurrent design, participants started the A₁ phase at different time points (depending on their randomization) so that the implementation of the program occurred at the same time for all. For the Program B phase, participants took part in a 12-week yoga program with data being collected via online surveys after the first class, the 12th class (i.e., mid-point), and the 24th class (i.e., final class). For the Follow-up A₂ phase, participants received an email with a link to a secure site to complete online surveys 1, 4, and 8 weeks after their last class. For each assessment, participants were asked to complete the survey within 48 hours of receiving the link and received 1 email reminder 24 hours later. See Figure 7-1 for a visual overview of the study procedures.

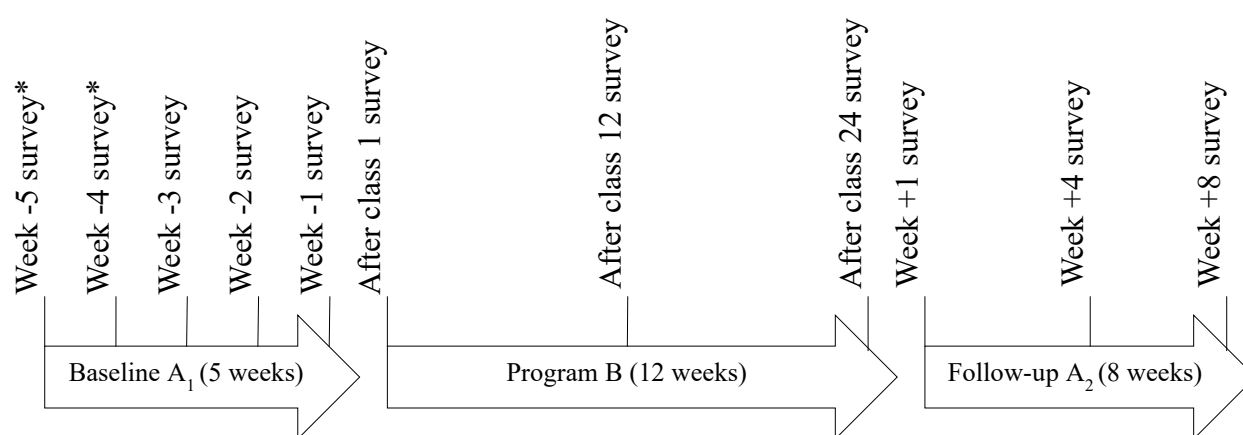


Figure 7-1. Study Procedures for series N-of-1 feasibility trial

Notes. *=participants completed the survey depending on their baseline allocation.

2.4 Yoga Program

The 12-week yoga program involved 2 weekly 60-minute Hatha group-based classes offered at the Ottawa Cancer Foundation in an atmosphere designed to be warm and respectful to promote physical and emotional safety. To support their participation, participants received a yoga mat at start of their first class and were able to bring it home for the duration of the program. The program was bi-modal; weeks 1-2 participants were asked to attend in-person and weeks 3-12 they had the option to attend in-person or via Zoom. As detailed elsewhere (Price et al., submitted) the program was developed and approved by certified yoga instructors (n=12) and adults diagnosed with gynecologic cancer (n=6). The classes followed an adaptable protocol that the instructor adapted as needed to promote participants' comfort, safety, and engagement. Participants had the option to engage in group discussions at the end of each class and were provided a journal in the first class and access to an online database of pre-recorded short-duration yoga practices to support their at-home practice starting week 3.

The program was delivered by 1 certified yoga therapist who had experience working with adults with chronic pain and 2 volunteer undergraduate students (1/program) in human kinetics assisted with set-up and monitoring of participants attending online. All 3 received a half-day training from the research team. One week prior to the first class, the yoga instructor asked participants to complete a brief 1-page intake form (not for data collection) and participate in a 1-on-1 online consultation (approximately 15 minutes in length via Zoom) to review the intake form and discuss any physical concerns or limitations.

2.5 Data Collection Measures

Primary outcomes were informed by adults diagnosed with gynecologic cancer who participated in the co-creation process (Price et al., submitted). At each timepoint, an online survey comprised of validated measures of subjective experiences, including quality of life

(Functional Assessment of Cancer Therapy-General [57]), perceived cognitive abilities (Perceived Cognitive Abilities sub-scale of the Functional Assessment of Cancer Therapy - Cognitive Function [58]), fatigue (Functional Assessment of Chronic Illness Therapy – Fatigue Scale [59]), sexual distress (Female Sexual Distress scale-Revised [60], modified for 7-day recall), negative body image (Body Image Scale [61], modified for 7-day recall), and perceived stress (Perceived Stress Scale [62], modified for 7-day recall). Additional questionnaires assessing potential underlying mechanisms not analyzed herein were also included in the surveys [54]. Questionnaires were scored and analyzed as recommended by the authors of the measures. Within the first survey, questions on sociodemographic and medical characteristics were included to describe the sample.

2.6 Sample Size

A conventional power calculation was inappropriate for this feasibility study given the novel nature of delivering the program at the Ottawa Cancer Foundation [63, 64]; rather, the target sample size was 20 participants based on end-user recommendations and pragmatic considerations [54]. Sample sizes for N-of-1 trials are generally small (i.e., average $N=3.64$, ranging=1-13; [65]) as a function of the repeated assessments, which results in a larger number of observations than other study designs. Moreover, authors have shown that a sample size of 3 offers sufficient statistical power to detect pre-to-post intervention effects using HLM, and HLM approaches have been validated with small sample sizes (e.g., $N=4-827$; [66, 67]). Thus, it was determined that there would be adequate statistical power with an N of 20 as the analyses involved HLM.

2.7 Data Analysis

Descriptive statistics were used to summarize baseline characteristics of the sample. Next, a visual analysis was conducted for a detailed examination of data patterns, trends, and variability within and across study phases for all outcomes. Visual analysis involved a systematic review of graphical representations of the data, plotted to depict each participants' outcome scores across the Baseline A₁ (during the 3-5-week baseline), Program B (during the 12-week program), and Follow-up A₂ (during the 8-week follow-up) phases. Key to this process was the identification of level, trend, and variability within each phase. Level refers to the data's central tendency within a phase, trend encompasses the direction and steepness of data points over time, and variability addresses the spread of data around the level. The first and second authors analyzed the first participant's data, examining level, trend, and variability in addition to evaluating the immediacy of effect following the introduction of the program (i.e., start of Program B phase), transition to Follow-up A₂, and the presence of overlapping data points between phases. Then, they used their notes to develop a narrative interpretation of the participant's experiences during the study. They repeated the above steps for the remaining participants, flagging patterns in the data that were recurrent or deviant. Finally, the narratives were compared to explore similarities and discrepancies to establish an overarching narrative for all participants' experiences for study duration. Discrepancies in interpretations between the 2 authors were resolved through discussion until a consensus was reached.

In addition to visual analyses, HLM was used to bolster the conclusions drawn. Data were analyzed using SPSS (version 28; IBM Corp, Armonk, NY, USA) and the level of statistical significance was set to $p < .05$. The statistical analyses involved estimating a series of multilevel models (also known as mixed-effects models) using Restricted Maximum Likelihood (REML) for each outcome (i.e., quality of life, perceived cognitive abilities, fatigue, sexual

distress, negative body image, and perceived stress) following a stepwise model building approach. Methods for imputing missing data were not required prior to analysis because HLM allows for the analysis of incomplete repeated measures data without restrictive assumptions on the covariance matrix. Thus, models were estimated using all available data under the assumption that the non-response could be considered random. Prior to estimating models, normality of the outcome data was confirmed.

For each outcome, 4 multilevel models were estimated and compared for each outcome separately. Model 1 was a fixed intercept effect only model (i.e., assuming no change) and it served as a baseline to assess the fit of more complex models. Model 2 was a piecewise model including a fixed intercept effect plus 3 fixed slope effects with homogeneous variances (i.e., assuming non-significant variability in responses). The slopes selected were based on the hypothesis that the rate of change could potentially be different during the Baseline A₁ (Slope 1: 3-5 weeks pre-program), Program B (Slope 2: 12-week program), and Follow-up A₂ (Slope 3: 8 weeks post-program) phases. Model 3 extended the piecewise model by including the same fixed effect as in Model 2, but the error component included random intercept effect to account for variability in outcomes between participants upon starting the intervention. Model 4 further extended Model 2 by adding three random slope effects to account for variability in the rate of change in outcomes between participants across the 3 phases. Models were compared using AIC and BIC values, with lower values indicating a better model fit.

3. Results

A total of 20 participants who self-identified as women were included in the analysis for this study. The participants reported that they were, on average 62.4 years of age (SD=11.79, range=34-80 years) and 7.6 years post-diagnosis (SD=4.9) upon enrolling into the trial. Across

the 20 participants, the most common diagnoses and treatments were for: endometrial/uterine cancer (n=9, 45%), stage 1 cancer (n=10, 50%), surgery (n=17, 85%), radiotherapy (n=11, 55%), and chemotherapy (n=10, 50%). See Price et al. (forthcoming) for more detailed sociodemographic and medical information.

3.1 Visual Analysis

An overarching narrative capturing participants' experiences in the program based on the visual analysis of the data is presented below. Noteworthy, 3 participants had marked divergences from others; their experiences are presented as case vignettes (identified with pseudonym names) to provide insight into the inter-individual differences that may exist across participants. Figures 7-2 to 7-7 present a graphical representation for the patient-reported outcomes for all participants to show how changes occurred for the sample as a whole (and depict between-person variability), whereas [Appendix E](#) presents each outcome with individual graphs for each participant.

3.1.1 Overarching Narrative

Visual analysis comparing morning and evening participants illustrated mostly similar trends; the only exception was for perceived stress. Overall, quality of life remained steady during Baseline A₁ phase, had a positive trend during the Program B phase, and an immediate negative trend at the first timepoint of Follow-up A₂ phase that increased at subsequent timepoints. Perceived cognitive abilities remained steady during Baseline A₁, had a slight positive trend during the Program B phase that remained steady during the Follow-up A₂ phase. Fatigue remained stable during the Baseline A₁ and Program B phases, but displayed a negative trend during the Follow-up A₂ phase. Sexual distress had a relatively constant negative trend throughout all phases. Negative body image remained stable across all phases. Perceived stress

remained generally stable through all phases for the morning group while the evening group presented a stable trend in Baseline A₁ phase, a negative trend during the Program B phase, followed by a positive trend in the Follow-up A₂ phase.

3.1.2 Case Vignette 1: Sarah

Sarah was a 71-year-old White widowed retiree with 2 adult children, who had been diagnosed with stage III ovarian cancer 11.6 years before enrolling in the morning program. Her cancer treatment involved surgery and chemotherapy, she reported no changes to her weight due to treatment and ranked her mental health as “excellent” (5/5) and her physical health as “good” (3/5). While her self-reported perceived cognitive abilities, fatigue, sexual distress, negative body image, and perceived stress followed the same trends as the other participants, her quality of life did not. While she showed an increase in her quality of life from Baseline A₁ to after the first and mid-point classes in the Program B phase, it declined immediately after the last class, but rebounded in Follow-up A₂ at 1-week post-program then continued to trend downwards again at 4- and 8-weeks post-program to be lower than her Baseline A₁ levels. Her adherence was 91.6% (22/24 classes), she attended all classes in-person, and stayed to participate in the group discussions.

3.1.3 Case Vignette 2: Madeline

Madeline was a 70-year-old White married retiree with 1 adult child, who had been diagnosed with stage III ovarian cancer 3.3 years before enrolling in the morning program. Her cancer treatment involved surgery and chemotherapy, she reported no changes in her weight due to treatment and ranked her physical and mental health as “very good” (4/5). Her transition from Baseline A₁ to Program B was marked by an improvement in all outcomes; however, she reported a deterioration in quality of life, perceived cognitive abilities, fatigue, and perceived

stress at the mid-point and last class, whereas her sexual distress and negative body image only deteriorated after the last class, then all outcomes proceeded to improve again in the Follow-up A₂ phase. After the first 2 weeks of attending in-person, she attended the remainder of the program online. In addition, the first half of the program she had 100% adherence rate which dropped to 41.6% (5/12 classes) for the second half of the program. For all classes she attended, she also stayed to participate in the group discussions.

3.1.4 Case Vignette 3: Suzanne

Suzanne was a 50-year-old White woman, who was married, working full-time with 1 adult child, and was diagnosed with stage II cervical cancer 6.8 years before enrolling in the evening program. Her cancer treatment involved surgery and radiation therapy, she had lost more than 11lbs due to her treatment and ranked her physical and mental health as “okay” (3/5). While her quality of life, perceived cognitive abilities, and sexual distress followed the same trends as the other participants, her negative body image, fatigue, and perceived stress did not. During the Baseline A₁ and Program B phases, her negative body image, fatigue, and perceived stress showed improvements, which continued into the Follow-up A₂ phase. Her adherence was 83.3% (20/24 classes) and she attended the majority of classes in-person, only attending online for the 11th week. For all classes she attended, she attended all the group discussions except for 2.

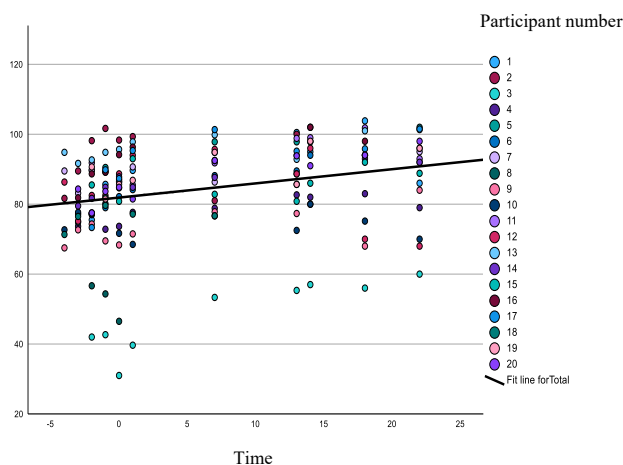


Figure 7-2. Participant scores for quality of life (assessed using the Functional Assessment of Cancer Therapy - General; FACT-G)

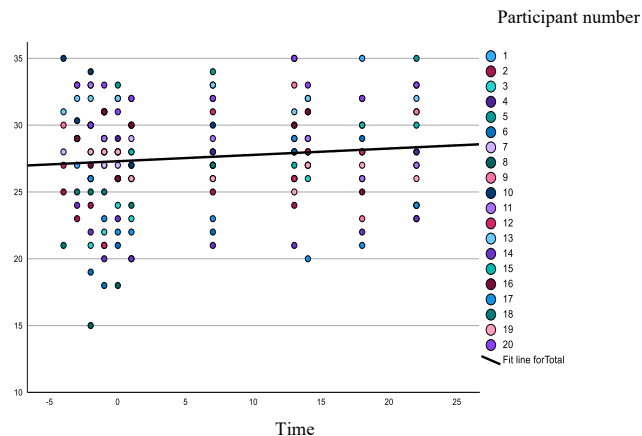


Figure 7-3. Participant scores for cognitive abilities (assessed using the Perceived Cognitive Abilities sub-scale of the Functional Assessment of Cancer Therapy - Cognitive Function; FACT-Cog)

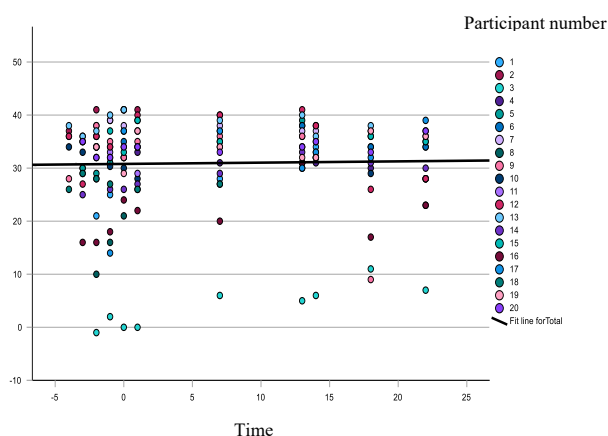


Figure 7-4. Participant scores for fatigue (assessed using the Functional Assessment of Chronic Illness Therapy – Fatigue; FACIT)

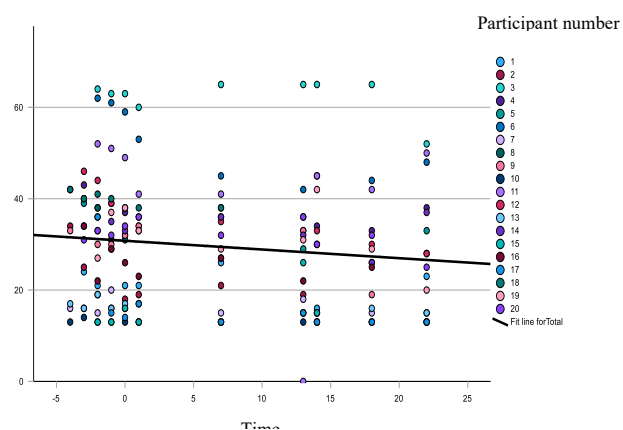


Figure 7-5. Participant scores for sexual distress (assessed using the Female Sexual Distress scale-Revised; FSDS)

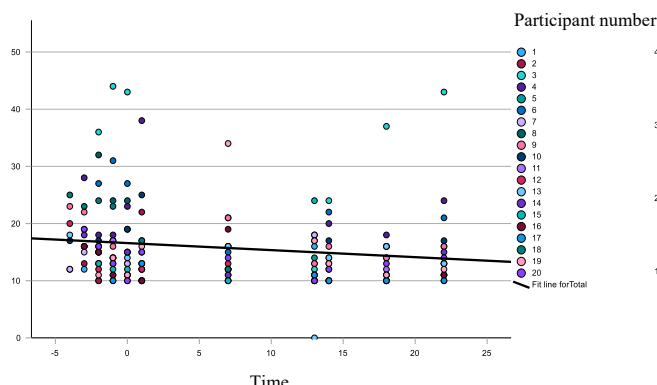


Figure 7-6. Participant scores for body image (assessed using the Body Image Scale; BIS)

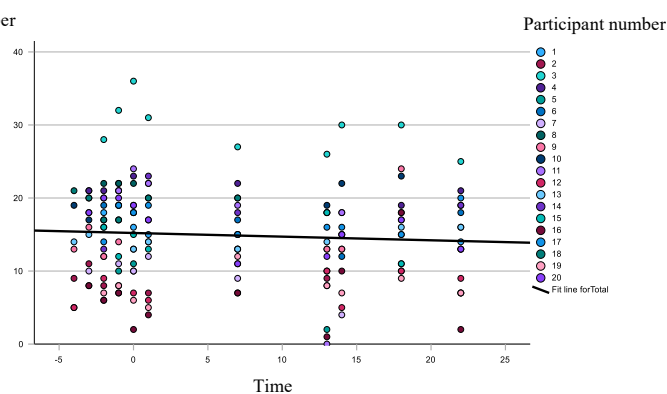


Figure 7-7. Participant scores for perceived stress (assessed using the Perceived Stress Scale; PSS)

Note. Coloured dots represent participants' data at each timepoint; solid line shows the mean rate of change.

3.2 Multilevel Modelling

A comparison of models (not reported) suggested that Model 3 – the piecewise model including fixed intercept and slope effects and a random intercept effect – fit the data best based on smallest AIC and BIC values or estimation problems for more complex models. Table 7-1 displays the fixed effects from the final models. In the model for quality of life, the fixed

estimates indicated that there was a significant mean intercept (estimate=81.5, $p<.001$), such that the average initial value was 81.5 upon starting the program (on a scale ranging from 0 to 108) and that 95% of the sample would be expected to score between 75.8 and 87.2. As well, the fixed estimates indicated significant mean linear slopes during the Baseline A₁ (estimate=0.96, $p=.03$) and Program B phases (estimate=0.44, $p<.001$), but not during the follow-up A₂ phase (estimate=0.05, $p=.5$). These values reflect that the levels improved by 0.96 units at each timepoint during Baseline A₁ phase and then 0.44 units during the Program B phase. In addition, the random intercept effect (not tabled) indicated that there was significant variability in quality of life (estimate=155.39, $p=.003$), which confirms the presence of between-person differences in quality of life across timepoints.

As for the remaining outcomes, each model showed a significant fixed mean intercept ($ps<.001$). Cognitive function showed a significant mean slope for the Program B phase, such that levels improved by 0.12 units at each timepoint; significant variability in levels upon starting the Program B phase was observed (random intercept effect estimate=11.56, $p=.005$). Fatigue showed a significant mean slope for the follow-up phase, such that levels decreased by -0.12 units at each timepoint (note; this indicates increased fatigue post-program); significant variability in levels upon starting the Program B phase was observed (random intercept effect estimate=64.43, $p=.003$). Sexual distress showed a significant mean slope for the baseline A₁ and Program B phases, decreasing by -0.93 and -0.25 at each timepoint during these phases, respectively; significant variability in levels upon starting the Program B phase was observed (random intercept effect estimate=163.62, $p=.002$). Body image showed a significant mean slope for the Program B phase, decreasing by -0.22 at each timepoint; significant variability in levels upon starting the Program B phase was observed (random intercept effect estimate=20.22,

$p=.008$). Perceived stress showed a significant mean slope during the Program B phase and Follow-up A₂ phases, decreasing by -0.24 then increasing by 0.1, at each timepoint during these phases, respectively; significant variability in levels upon starting the Program B phase was observed (random intercept effect estimate=31.65, $p=.003$).

Table 7-1. Results of 2-level hierarchical linear models

	Estimate (SE)	95% CI	df	p
Quality of Life				
Intercept	81.5 (2.9)	75.52, 87.58	20.90	<.001
Baseline A ₁	0.96 (0.44)	.09, 1.84	159.11	.031
Program B	0.44 (0.11)	.21, 0.66	158.91	<.001
Follow-up A ₂	0.05 (0.07)	-.10, 0.19	158.78	.543
Perceived Cognitive Abilities				
Intercept	26.54 (0.84)	24.81, 28.78	23.79	<.001
Baseline A ₁	-0.23 (0.19)	-0.62, 0.16	159.12	.243
Program B	.12 (0.05)	0.02, 0.22	158.55	.025
Follow-up A ₂	-0.03 (0.03)	-0.09, 0.04	158.25	.383
Fatigue				
Intercept	30.34 (1.89)	26.41, 34.26	21.76	<.001
Baseline A ₁	0.39 (0.33)	-0.26, 1.04	159.34	0.24
Program B	0.15 (0.09)	-0.02, 0.32	159.07	0.08
Follow-up A ₂	-0.12 (0.06)	-0.23, -0.01	158.90	0.04
Sexual Distress				
Intercept	30.94 (2.96)	24.78, 37.11	10.44	<.001
Baseline A ₁	-0.93 (-0.93)	-1.78, -0.08	-2.16	0.03
Program B	-0.25 (-0.25)	-0.47, -0.03	-2.26	0.03
Follow-up A ₂	0.001 (0.07)	-0.14, 0.14	0.01	0.99
Negative Body Image				
Intercept	16.45 (1.24)	13.92, 18.97	13.27	<.001
Baseline A ₁	-0.66 (0.40)	-1.45, 0.13	-1.65	0.10
Program B	-0.22 (0.10)	-0.42, -0.01	-2.11	0.04
Follow-up A ₂	0.09 (0.07)	-0.04, 0.23	1.39	0.17
Perceived Stress				
Intercept	16.19 (1.34)	13.43, 18.96	12.12	<.001
Baseline A ₁	0.22 (0.25)	-0.27, 0.71	0.88	0.38
Program B	-0.24 (0.06)	-0.37, -0.12	-3.81	<.001
Follow-up A ₂	0.10 (0.04)	0.02, 0.18	2.46	0.02

Notes. Baseline A₁=Slope 1, Program B=Slope 2, Follow-up A₂=Slope 3. Quality of life, scale range=0-108. Perceived cognitive abilities, scale range=0-72. Fatigue, scale range=0-52. Sexual distress, scale range=0-52. Negative body image, scale range=0-30. Perceived stress, scale range=0-40. Higher scores indicate better outcomes for quality of life, perceived cognitive abilities, and fatigue, whereas lower scores indicate better scores for sexual distress, negative body image, and perceived stress.

4. Discussion

To date, the effects of yoga on adults diagnosed with gynecologic cancer remain unclear. This series N-of-1 trial sheds light on the potential impact of a yoga program that was co-created with key parties/end-users' (i.e., adults diagnosed with gynecologic cancer, yoga instructors) for delivery in the community. A priori, it was expected that participation in the program might lead to improvements in quality of life, perceived cognitive abilities, fatigue, sexual distress, negative body image, and perceived stress among adults diagnosed with gynecologic cancer. Coalescing the results of the visual analysis and statistical analysis, participants experienced a significant improvement in their quality of life, perceived cognitive abilities, sexual distress, negative body image, and perceived stress, but despite this, there was inter-individual variance in responses to the program.

The overall results, based on the HLM fixed effect results, suggests that the 12-week yoga program increased quality of life (encompassing physical, social, emotional, and functional wellbeing) and perceived cognitive abilities and decreased sexual distress and negative body image, with participants maintaining these improvements for at least 8-weeks post-program. These results are in line with quantitative [16] and qualitative [68] reviews synthesizing the effects of yoga on patient-reported outcomes. As prior studies have primarily included adults diagnosed with *breast* cancer, this provides support for the idea that positive effects extend to other groups diagnosed with cancer, namely adults diagnosed with gynecologic cancer. Findings suggest yoga might have impacted a range of psychological *and* physical mechanisms that underpin wellbeing, supporting the assertion that yoga is a mind-body activity [e.g., 69]. In addition, yoga may have reshaped participants' perceptions of their bodies and sexuality, by helping to reduce sexual distress and negative body image issues. As it is increasingly recognised

that these key issues are central to the overall wellbeing of individuals, these findings underscore the program's capacity to address some of the unique challenges faced by adults diagnosed with gynecologic cancer, adding to the small body of literature for this population [28, 68, 70].

Moreover, the sustained benefits observed up to 8-weeks post-program also emphasize the lasting impact of yoga, suggesting that such programs can provide enduring support beyond immediate treatment periods making it a valuable supportive care program. However, perceived stress and fatigue levels deteriorated during the 8-weeks post-program, suggesting that for adults diagnosed with gynecologic cancer to sustain improvements in these outcomes, they may need to maintain a regular yoga practice beyond a structured program. Collectively, these results reflect the main effects of the program and add to the evidence supporting the benefits of participating in yoga for a prolonged period of time [71].

While main effects are crucial, they reflect the effects of yoga on outcomes across the sample (possibly concealing a wide range in responses), and may not be representative of the potential benefit (or lack thereof) for each individual. The divergent inter-individual experiences presented herein suggest there is variability in response to the program, which can occur for several reasons. First, several reviews that have sought to identify the underlying mechanisms of yoga include psychology (e.g., positive affect, mindfulness, self-compassion, self-regulation; [72-77]), neuroscience (e.g., posterior hypothalamus, neuroplasticity; [72, 75, 77]), physiology (e.g., interoception, bottom-up input; [74]), cardiology (e.g., metabolism, circulation, atherosclerosis; [73, 77]), endocrinology (e.g., interleukin-6, C-reactive protein, cortisol; [72, 73, 77]), and physical health (e.g., body mass index, muscular strength; [73]). Variability in responses to the yoga program could thus occur via its differential effect on any of these mechanisms. Second, drawing from the behavioural sciences, and given the flexibility in how the

program was delivered and attended, differences in program parameters (e.g., program length, class length, class frequency, mode of delivery; [27]) may have implications for responses to yoga, as well. For example, there is a growing number of yoga programs being delivered online [e.g., 78, 79, 80] and a recent qualitative meta-synthesis on women's motives, barriers, and preferences for participating in yoga after a cancer diagnosis suggests that yoga programs may not adapt well for participants attending online [27]. This could be particularly relevant here to explain variance in responses as some participants were in-person and others online. Plausibly, it may explain why Madeline experienced a deterioration in all of her outcomes once she transitioned to attending entirely online. Third, the context of individual participants' lives may play a role in the observed inter-individual variations, such as differences in work status. For example, the visual analysis of data indicated that the yoga program might have had a more pronounced effect on reducing perceived stress levels in the evening group compared to the morning group. This disparity could stem from the Baseline A₁ conditions, as the evening group initially reported higher levels of perceived stress. A potential explanation for this difference is the higher proportion of evening participants who were employed ($N_{\text{morning}}=3$, 30%; $N_{\text{evening}}=7$, 70%) and might have been experiencing work-related stress [81]. Consequently, this subgroup could have benefitted more substantially from the stress-reducing effects of the yoga program. Future research should aim to examine the prevalence of variability in response to yoga (or otherwise) and unravel the web of factors that contribute to the observed benefits of yoga, thereby informing more targeted and effective therapeutic strategies for adults diagnosed with gynecologic cancer.

4.1 Methodological Considerations

There is a significant shortage of studies in which variability in response to yoga (or physical activity) has been evaluated [82]. Given the variability in health status, physical function, engagement in work and leisure activities, the surrounding social environment, and the specific parameters of yoga programs themselves—ranging from the type and intensity of yoga to the frequency and duration of sessions and programs—it is crucial to understand the factors that could have a meaningful impact on the response to yoga among adults diagnosed with gynecologic cancer. The utilization of study designs and analytical techniques, encompassing both descriptive methods and inferential statistics, provides the opportunity to examine how general conclusions based on main effects are generalizable. In this study, visual analysis and HLM were used to examine intra- and inter-individual differences and there appears to be variability among participants. This variability, while challenging to compare directly to other studies due to heterogeneity of study designs and outcomes measures, exposes a critical gap in understanding how and why yoga benefits certain individuals more than others, an area in which additional research is needed.

Moreover, when evaluating effect, sample size and missing data in studies evaluating yoga programs are key issues that have been raised [16, 83, 84]. However, HLM utilizing repeated measures data from series N-of-1 trials can be used to analyze small sample sizes and incomplete databases, underscoring the adaptability and robustness of this approach in the face of common research challenges such as participant recruitment and retention [85]. Yet, without analysing the inter-individual data, the divergent experiences of some participants may have gone unnoticed, which provides support for continued investigation into the variable and individual-level experiences of adults diagnosed with gynecologic cancer participating in yoga. In addition, researchers rarely consider the inclusion of multiple baseline and multiple follow-up

timepoints to investigate changes beyond the primary timepoints of interest (i.e., pre-to-post-program). This series N-of-1 trial was uniquely suited to evaluate key timepoints, given its inclusion of different study phases that allowed for the assessment of sustainability and variability associated with maintaining benefits for up to 8-weeks after the removal of the program. For instance, the visual analysis suggests that quality of life may deteriorate for participants immediately after program cessation but rebound as time continues. This may explain some of the heterogeneity in outcomes reported among yoga programs and interventions [14, 16, 24] as studies relying on a single post-program assessment may be capturing participants responses at different times (i.e., after last class vs 1-week post-program vs ≥ 2 -weeks post-program). In addition, the inclusion of a 3-5 week baseline phase helped to ensure the observed response to the program was related to genuine improvements in outcomes by reducing the risk that initial levels of outcomes are the result of temporary fluctuations or external factors. This approach yields valuable information to fully understand outcomes across a study's duration, thereby enhancing the precision and applicability of its findings. Finally, for researchers and practitioners in the field of oncology and physical activity, this study provides a methodological and practical blueprint. It emphasises the value of co-designing programs with end-users and implementing alongside community partners for a wide range of interventions relying on personalized and adaptive delivery, facilitating the generation of high-quality evidence needed to guide clinical practice and policy-making in the area of supportive care for clinical conditions and beyond.

4.2 Implications for Practice

Whilst it is necessary to note that not all yoga programs (including this one) are effective for every individual, the findings underscore the potential benefits of a structured yoga program

for addressing concerns identified by adults diagnosed with gynecologic cancer. The results of the fixed effects provide evidence the program can help to improve quality of life, perceived cognitive abilities, sexual distress, and negative body image, which can assist healthcare practitioners, policymakers, and end-users in oncology care searching for programs that allow for their patients to receive supportive care tailored to their specific needs to improve wellbeing. The feasibility (as previous reported in Price et al., forthcoming) and preliminary benefits observed herein suggest that allocating resources towards implementing programs could enhance patient care and potentially reduce long-term healthcare costs by improving the quality of life of adults diagnosed with cancer [86]. Moreover, although future research is needed to evaluate factors that could explain why individuals have different responses, by continuing to consider the phenomenon of inter-individual variability in working with gynecologic cancer it allows for modification to help more participants achieve beneficial outcomes.

4.3 Limitations

It is important to note the limitations of the study. First, it was a relatively homogeneous sample and few reported co-morbid conditions (i.e., diabetes, high blood pressure, high cholesterol); thus, findings may not generalize to younger or older adults, adults of different ethnocultural groups, or adults with more severe illness or health problems. Second, the morning and evening programs were delivered by the same instructor to estimate the variability associated with the individual participants, therefore, a future study is needed to assess if the effect of the program is the same across instructors to determine if specific instructor factors are important. Third, 2 participants did not provide complete data for the Follow-up A₂ phase and their experiences may have differed from the other participants. Fourth, while the Baseline A₁ phase length (i.e., 3-5 weeks) was sufficient to capture all necessary data points for the study design

(i.e., ≥ 3), a longer length may have provided more insight into the potential variability in outcomes prior to the program.

4.4 Conclusion

This series N-of-1 trial has provided valuable insights into the potential benefits of a co-created yoga program for adults diagnosed with gynecologic cancer. By integrating visual analysis and HLM, the study demonstrated significant improvements in quality of life, perceived cognitive abilities, sexual distress, negative body image, and perceived stress among participants. However, individual responses varied, highlighting the need for further exploration into the factors contributing to this variability. The sustained benefits observed up to 8 weeks post-program suggest that yoga can offer enduring support, although continued practice may be necessary to maintain improvements in perceived stress and fatigue. This study underscores the importance of involving end-users in the development of supportive care programs and emphasizes the utility of N-of-1 trial designs in capturing individual variability in responses. Future research should aim to identify the underlying mechanisms of yoga's effects and explore how program parameters and individual characteristics influence outcomes. These findings can guide the implementation of personalized and adaptive yoga programs in oncology care, ultimately enhancing patient wellbeing.

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Chapter 8: General Discussion

More than 12,000 women are diagnosed with gynecologic cancer (e.g., uterine, ovarian, cervical, vaginal, vulvar) each year in Canada [1]. The disease and its treatment (including surgery, chemotherapy, and radiation therapy) often lead to short- and long-term sequelae that impair quality of life (QoL; [2]). Changes in self-perceptions related to changes to body appearance and body function (hence forth referred to as body image; [2-4]) and biopsychosocial sexual function have emerged as critical for QoL among adults diagnosed with gynecologic cancer [5, 6]. Limited, yet compelling, data from non-clinical populations [7] and breast cancer populations [8-11] suggest yoga can be beneficial for addressing health-related outcomes, such as fatigue, depression, and anxiety, as well as for improving self-perceptions. However, it remains unclear if and how yoga may support the overall QoL and wellbeing of adults diagnosed with *gynecologic cancer* – which is a unique, multifaceted disease with various manifestations that require nuanced understanding for effective survivorship support. Traditionally, yoga programs are developed based on researcher opinion and available resources (e.g., time, financial). This is problematic for two reasons. First, it has resulted in a literature base with significant variability in program structure (i.e., program length, class duration and frequency), delivery mode (i.e., in-person, online asynchronous, online synchronous), content, and delivery-style of classes [12-15] that warrant tailored approaches. Second, by not including end-users in the development of the programs, participants raise similar concerns that reduce the acceptability (and potential effectiveness and sustainability) of the program [16]. Thus, this research program sought to address these shortcomings in the literature and pave the way for more targeted and tailored yoga programs by using a participatory-based knowledge translation approach to: (1) explore the role of yoga in cultivating positive experiences with self and others, and (2)

determine the feasibility, acceptability, and benefits of a co-created yoga program among adults diagnosed with gynecologic cancer. To achieve this, the PRECEDE-PROCEED model (PPM; [17]) was used to guide the overall conceptualization of the program of research while the Knowledge-to-Action (KTA) framework [18, 19] was used to guide the creation of the yoga program. Considerations of using the PPM and KTA are discussed on Pages 333-334.

Summary of Findings

A comprehensive literature review was conducted to both inform the research undertaken and to be able to contextualize the results. This review identified profound QoL concerns, highlighting body image and sexual health as pivotal areas of health to address in this research program (social diagnosis, phase 1). This literature review supported yoga as an appropriate mind-body intervention to target. The results of *study 1* (article 1) and *study 2* (article 2 and 3) contributed to the identification of the behavioural (e.g., comprehensive practice [physical postures, meditation, and breathwork], mindset and expectations, lifestyle habits) and environmental (e.g., detailed and tailored instruction, peers with shared experience) factors likely to influence QoL, body image, and sexual health for adults diagnosed with gynecologic cancer while practicing yoga (epidemiological, environmental, and behavioural diagnosis, phase 2). The findings from *study 2* (article 3) and *study 3* (article 4) identified key predisposing (i.e., interest in physical rehabilitation, physical activity, and social support), reinforcing (i.e., group discussions, shared characteristics, supportive and knowledgeable instructor, tailored instruction), and enabling (i.e., accessible community location, bi-modal programming, optional supplemental features, appropriate dosage) factors to take into consideration in the development and implementation of the program (educational and ecological diagnosis, phase 3). In addition, during *study 3* (article 4), through the qualitative focus groups and partner consultations,

organizational (e.g., personnel required, availability of space, technology, equipment, and materials) factors were considered to ensure the program's feasibility within a community organization (administrative and policy assessment and intervention alignment). Last, a mixed-methods series N-of-1 feasibility trial was conducted to evaluate implementation, immediate impact, and longer-term effects (i.e., up to 8 weeks) of the program to provide detailed insights to help refine the program and scaling for future initiatives (implementation, process evaluation, impact evaluation, outcome evaluation, phases 5-8). The comprehensive approach used in this feasibility trial underscored the utility of the PRECEDE-PROCEED model in developing a nuanced and effective health intervention tailored to the specific needs and conditions of adults with gynecologic cancer.

Collectively, the four studies and six articles presented in this dissertation advance knowledge and provide a starting point for understanding the role and value of yoga in cultivating positive subjective experiences among adults diagnosed with gynecologic cancer. In particular, they make noteworthy conceptual, methodological, and practical contributions related to body image and sexual health as well as knowledge mobilization for the field of oncology and yoga. Each type of contribution is considered in turn.

Conceptual Considerations

Current research on QoL and body image among adults diagnosed with cancer often overlook the role of sexual health, resulting in a limited and fragmented understanding of overall wellbeing [20, 21]. The limited attention paid to sexual health within QoL research may reflect the influence of social stigma and culturally shaped understandings of sexuality, particularly within the context of illness – a perspective supported by the work of Foucault on sexuality and power [22]. This oversight not only perpetuates the stigma surrounding sexual health but also

hampers the development of beneficial programs, especially for populations like adults diagnosed with gynecologic cancer whose sexual health may be particularly impacted by the disease and the treatments received [4]. *Study 1* (article 1) incorporated exploration of sexual health into the discussion of body image and yoga to provide a more holistic and nuanced perspective of the lived experience of adults diagnosed with gynecologic cancer. As a result, the findings from *study 1* emphasised that sexual health is a paramount concern that has a reciprocal relationship with body image and that yoga can influence this relationship. The limited assessment of sexual health among women diagnosed with cancer was further supported as *study 2* (article 2) reinforced that sexual health is not an outcome often explored in previous yoga programs. Yet, participants in *study 3* (article 4) identified sexual health as key outcome to evaluate to determine the success of the co-created yoga program. *Study 4* (article 5) showcased that sexual health is a concept amenable to change as yoga positively impacted psychosocial dimensions of sexual health. The findings of this research program are in line with assertions of theories of embodiment that posit that an individual's experiences of the world are fundamentally shaped by their physical bodies [23, 24] and support the continued exploration of the reciprocal relationship between sexual health, body image, and yoga. By addressing this often-neglected aspect of human health, this research program enriches the field's conceptual understanding of sexual health and body image and has the potential to impact both academic discourse and practical healthcare applications.

The importance of program evaluation is increasingly being acknowledged [25], yet related concepts are seldom reported on. Irrespective of advancements in this area, most studies base program evaluation on an intervention's efficacy (i.e., success of an intervention when evaluated in a controlled research environment) or effectiveness (i.e., real-world impact and

success of an intervention when implemented in a practical, everyday setting) on key patient-reported outcomes. However, focusing on patient-reported outcomes is only one facet of determining the success of a program [26]. Few studies have prioritized acceptability constructs when evaluating yoga programs (e.g., merit, worth, value, impact; [27]). Which, as *study 2* (article 3) demonstrated, is likely hindering progress in this area as yoga interventions and programs continue to not adequately meet the needs of participants. Although preliminary, the findings from *studies 3* (article 4) and *4* (article 5) highlight the importance of prospectively and retroactively evaluating acceptability. For instance, in *study 3*, participants provided keen insight into the feasibility of delivering a bi-modal class and the (negative) impact of a poorly managed class. Thus, an instructor assistant was built into the program. Which, as the results of *study 4* indicated, was a valuable change that improved the overall acceptability of the program for both the instructor and the participant. By prioritizing acceptability as a key outcome, this research aligns with the principles of patient-centered care, which emphasize the critical role of patient perspectives in shaping and evaluating supportive care programming [28]. Thus, the findings of these studies emphasize the conceptual importance of robustly evaluating acceptability concepts (before, during, and after the program) in addition to effects on biopsychosocial concepts.

Methodological Considerations

In recent years, there has been a growing recognition of the unique and varied experiences individuals have when engaging with yoga, a physical activity that intertwines the body and mind. The four studies discussed here utilized methodologies that focus on the individual, each employing methods to delve into the personal idiographic experiences of adults participating in yoga after a cancer diagnosis. Their methodological contributions reflect a commitment to capturing the nuanced nature of yoga practice and the importance of participant-

centered research in appreciating and leveraging the variability inherent in people's interactions with yoga.

Qualitative reviews in exercise psychology report a predominance of retrospective accounts when exploring participants' experiences engaging in physical activity [29, 30], and this is certainly the case within the yoga literature as well [16, 31]. Relying on retrospective accounts can lead to a generalization of experiences and distort the context or nuances of complex activities like yoga that combines physical and psychological processes [32]. *Study 1* (article 1) addressed this limitation by combining multiple retrospective interviews with real-time data collection through journals. By utilizing both methods as well as interpretative phenomenological analysis, *study 1* (article 1) findings highlighted the overall positive experience but also the nuances that come with practicing yoga after a gynecologic cancer diagnosis. The findings underscore that methods triangulation not only enhances the validity and reliability of findings but also provides a richer, more comprehensive understanding of the complexities involved in activities like yoga.

Additionally, systematic reviews of yoga predominantly synthesize quantitative research, despite many acknowledging the variability in intervention, samples, and outcomes measured that make aggregating quantitative data difficult or even misleading [33, 34]. *Study 2* (articles 2 and 3) addressed this limitation by acknowledging the diversity of individual experiences in yoga and using a qualitative meta-study methodology to synthesize findings from varied study designs, participant groups, and outcomes. The findings highlighted the vastness of experiences that yoga can provide and offers critical insights into the individual experiences surrounding yoga. In the context of a review, *Study 2* (articles 2 and 3) showcases how to effectively integrate large amounts of qualitative data gathered from people of diverse backgrounds participating in

different studies using varied data acquisition and analysis techniques. Methodologically, it thus offers a blueprint for future research to meet the need for synthesizing the increasing amount of qualitative research exploring physical activity experiences among clinical and non-clinical populations [35]. At the same time, empirically, it provides an important contribution to our understanding of the full spectrum of participants' perspectives and experiences (as discussed in articles 2 and 3).

Moreover, *study 2* (article 3) further affirmed a need to involve end-users so as to 'fit' the research and its output (e.g., interventions) to better meet the needs of those using the program. A recurring concern identified in *study 2* (article 3) among participants in the primary qualitative articles was the mismatch between their needs and the design/delivery of the program. The design of yoga interventions and programs for women diagnosed with cancer have predominantly taken a top-down approach (i.e., researcher-driven) which can result in interventions that are theoretically sound but do not meet the needs of the target population, which has the potential to lead to lower adoption rates, reduced efficacy, and ultimately, a limited impact of the intervention [36]. Embracing the potential for individual experience was also highlighted as particularly valuable in *study 3* (article 4) during the 3-phase collaborative approach to designing the yoga program. By actively engaging end-users, the lived experiences and specific needs of not only future program participants (i.e., adults diagnosed with gynecologic cancer) but also future program facilitators (i.e., yoga instructors) were addressed before a costly trial. This methodology sets a precedent for future research, demonstrating how to effectively integrate end-user perspectives to develop more effective and acceptable interventions. Although the extant literature often mentions doing so, few detail the process. Believing others may benefit from seeing the process 'in action,' the process was detailed in

article 4 to provide insight into the development and execution of a collaborative design methodology that can be replicated and adapted in similar settings.

Supportive care programming aiming to improve QoL among adults diagnosed with cancer is often evaluated using (quasi-) experimental trials to determine their effectiveness [37]. However, these study designs result in the analysis of participants' outcomes at the group-level and often evaluate changes in participant outcomes via a single pre- and post-intervention survey [8, 14, 38]. As a result, the unique intra-experiences of participants and sustained impacts can be overlooked. *Study 4* (articles 5 and 6) utilized a series N-of-1 trial to evaluate the preliminary benefits of the yoga program to capture potential variability in response to the program. The findings of *study 4 (article 6)* extend what we already know (e.g., yoga is generally beneficial), but crucially, they highlighted the potential for individual variability of participating in the program and the impact it has on participant-reported outcomes that had been identified by participants in *study 3* (article 4) as valuable. More common in other fields (e.g., education, medicine; [39, 40]), showcasing how a series N-of-1 trial can help to advance the field will allow more researchers with limited resources to undertake important research on personalized interventions and their unique effects on individual patient-reported outcomes. Thus, *study 4 (articles 5 and 6)* methodologically is a valuable complement to traditional group-based studies in the literature, offering a more personalized evaluation metric that can be particularly informative in a field with potential for individual variability, like yoga. Moreover, it illuminates the value of integrating personalized approaches to enhance the ecological validity and applicability of research findings in real-world settings beyond the traditional randomized controlled trial.

Finally, the integration of the PPM [17] and KTA framework serves as an example of how this well-known model and framework can be integrated to address the complexities of designing supportive care programs that are both evidence-based and practically implementable. While the PPM is a comprehensive framework that assists in identifying intervention targets, it does not detail the specific steps on how to apply these principles, particularly lacking a framework for the concrete development of the intervention [41]. As such the integration of the structured approach for translating research findings into practical interventions of the KTA framework was vital [42]. This synergy allowed this research program to harness the PPM's ability to systematically identify health issues and their determinants while leveraging the KTA framework's methodology for moving knowledge into action through a series of well-defined steps. The iterative nature of both frameworks was complementary and proved instrumental, as the program could be refined based on ongoing feedback and emerging data, adhering to the co-creation lens of the research program. This iterative process, crucial for developing an evidenced-based program intended to address the specific needs and contexts of the participants, represents a practical application of the model and framework in a real-world setting. This integration also underscores a significant challenge: the difficulty of reporting such a complex and iterative process within the confines of traditional academic structures. Academic reporting typically favors linear narratives and discrete outcomes, which can obscure the dynamic and cyclical nature of interventions and programs developed based on iterative models and frameworks. Moreover, this integration highlighted the importance of maintaining a balance between the rigor of structured frameworks and the flexibility required to adapt to real-world conditions. This balance was particularly evident in the challenges faced in aligning the structured steps of the KTA with the broader, goal-oriented strategies of the PPM. The

experience garnered from this research program emphasizes that while frameworks provide a valuable roadmap for program development, the nuances of practical implementation often demand adaptability and responsiveness to the evolving context of supportive care landscape.

Practical Considerations

There are practical contributions that emerged from this research program that are particularly relevant for adults diagnosed with gynecologic cancer – a group often overlooked in supportive care research [43]. *Studies 1* (article 1) and 2 (article 2 and 3) provided the foundation for the creation of an evidence-based program (*study 3*, article 4) to enhance participants' self-perceptions via guidance and content that emphasizes a connection to one's body, which was supported by the reported improvements in body image and sexual health in *study 4* (article 6). For adults diagnosed with gynecologic cancer, who are likely to experience some form of shift in their self-perceptions post-treatment, this focus is crucial. Furthermore, as illustrated in *study 4* (article 5) participants who feel a deeper connection to their bodies may be more likely to find the program meaningful and continue practicing yoga, thus increasing adherence and maximizing the program's long-term benefits [44]. This aligns with self-determination theory [45] which posits that autonomous forms of motivation (i.e., engaging in a behaviour because it aligns with one's intrinsic goals and emanates from the self) are strong predictors of health behaviour change [46]. These findings can inform the development of community-based yoga initiatives that align with participants' needs and desires, making them more appealing and accessible.

In the area of yoga research, recruitment and retention in trials have been identified as a significant concern [36]. However, as *studies 1* (article 1), 3 (article 4) and 4 (article 5) demonstrated, partnership between university researchers, hospital-based practitioners, and

community organization administrators can bolster identification and enrollment of participants into studies. Specifically, all three studies relied on the hospital for recruitment through the “consent to participate in research” system allowing for quick and efficient recruitment (i.e., <4 weeks to reach sample size). Leveraging social networks and social capital, these partnerships facilitate access to participants and promote trust between research partners [47]. Moreover, as the findings from study 4 (article 5) highlighted, the ability to attend programming in the community was a significant motivator to enrol in the yoga program but participants were generally unaware of the community organization and the programs they offered. Thus, from a practical standpoint, this type of partnership allows researchers to benefit from the timely and efficient implementation of the study, hospital practitioners are able to refer their patients to research programs that align with patient needs, and community organizations see increased program awareness. Most importantly, the leveraged partnership filled a critical knowledge gap among adults diagnosed with gynecologic cancer in Ottawa, enhancing the overall impact and relevance of the research within the community. A growing body of literature is advocating for partnerships between academic researchers and community representatives, such as practitioners and administrators, to improve ecological validity of interventions [18, 48, 49]. However, this approach is not without its challenges, which present opportunities for future research. For instance, managing the timelines and expectations between academia, hospital research ethics boards, and community organizations often requires negotiation and adaptation, necessitating clear expectations and responsive communication. Additionally, sustaining these partnerships beyond the duration of a single study poses challenges in terms of funding, administrative support, and continued interest from all parties involved, which can be difficult to plan for from the on-set when testing the suitability and effectiveness of a novel program. These issues can

impact the consistency and longevity of research impacts in the community. Future research should explore strategies to balance these dynamics and ensure that collaborative efforts remain mutually beneficial.

Limitations

Although the studies comprising this research program make a number of conceptual, methodological, and practical contributions, there are limitations. As with most studies conducted in psychosocial oncology, the studies included in this dissertation are limited by an overrepresentation of participants who self-identify as White, middle-age to older, cis-gendered and heterosexual, who were married with children, and had a tertiary education. Limited amounts of research in the field of psychosocial oncology have been conducted on (and rarely with) participants who do not reflect the “majority.” Consequently, next steps will benefit from an inclusive framework focused on implementation and sustainability, to continue to adapt and refine the program so that it is supportive of more adults diagnosed with gynecologic cancer. As well, the impact of COVID cannot be estimated. While no study was directly impact *during* its course, the pandemic likely influenced participant accessibility, engagement levels, overall mental and physical health, and expectations for program parameters, which could affect the generalizability and outcomes of *studies 1, 3, and 4*. Moreover, some participants in *study 4* did express a desire for in-person group-based programming to combat feelings of isolation experienced during the pandemic. In regard to more specific study limitations, each has been described with relevant study articles (i.e., chapters 2-7).

Conclusions

In conclusion, the four studies presented in this dissertation significantly advance our understanding of how yoga relates to adults’ experiences and their relationships with themselves

and others after gynecologic cancer treatment. This research fills a critical gap in the literature by exploring this understudied topic. *Study 1* (article 1) uncovered the importance of participants' expectations and mindsets in shaping their self-perceptions during yoga practice. *Study 2* (articles 2 and 3) synthesized qualitative research, expanding our knowledge of how yoga influences QoL outcomes and highlighting factors that may enhance or mitigate its benefits. To advance this research, *Study 3* (article 4) employed a participatory approach, developing an evidence-based yoga program tailored to participants' needs. Finally, *Study 4* (articles 5 and 6) demonstrated the feasibility and acceptability of the co-created yoga program and its associated research methods as well as providing insight into its' potential benefits for quality of life, perceived cognitive abilities, sexual distress, body image, and perceived stress. This work underscores the value of participatory approaches and ongoing comprehensive evaluation in refining program design and maximizing impact. Collectively, these findings provide valuable guidance for researchers and practitioners seeking to develop effective programs that improve the lives of those affected by gynecologic cancer.

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Appendix A – Protocol for Meta-Synthesis (study 2, article 2 and 3)

**Exploring women's experiences participating in yoga after a cancer diagnosis: A protocol
for a meta-synthesis**

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Published in *Systematic Reviews*

Final publication is available from Springer Nature:

<https://doi.org/10.1186/s13643-022-02042-y>

Abstract

Background: The benefits of yoga for clinical and non-clinical populations have been summarized in published systematic reviews. The vast majority of systematic reviews on the topic are syntheses of quantitative research that evaluated the effects of yoga. As qualitative research related to women's experiences participating in yoga after a cancer diagnosis is growing in quantity, systematic synthesis and integration of qualitative research is necessary to facilitate the transfer of knowledge. This paper describes the protocol for a planned meta-synthesis of qualitative research exploring women's experiences participating in yoga after a cancer diagnosis.

Methods: Using a meta-study methodology, six electronic databases were searched to identify relevant articles. Additionally, the reference lists of relevant articles retrieved during the electronic database search were scanned to identify other relevant articles. Two reviewers independently screened the titles and abstracts; retaining those that appeared to relate to the review objective. Next, they reviewed the retained full-text articles to assess eligibility according to four inclusion criteria. They will extract data from eligible studies and assess the quality of included studies. Data analysis will involve three main analytical steps: meta-data analysis, meta-method analysis, and meta-theory analysis. Findings from the three analytical steps will be interpreted collectively to generate additional insights beyond the findings of the primary studies to facilitate a more comprehensive understanding of women's experiences participating in yoga after a cancer diagnosis.

Discussion: By systematically collecting, analysing, and interpreting findings across multiple primary qualitative studies, we will develop an overarching narrative and interpretation of the role and value of yoga for women diagnosed with cancer. A synthesis of qualitative research is

vital as it embraces the heterogeneity of the research so as to provide important context for understanding the experiences of various women participating in yoga.

Systematic review registration: PROSPERO; registration number: CRD42021229253;

February 17, 2021.

Keywords: Qualitative; Oncology; Yoga; Women

Background

Globally, more than eight million women are diagnosed with cancer each year [61]. The cancer burden continues to grow, exerting tremendous physical, emotional, and financial strain on individuals, families, communities, and health systems [62, 63]. Survival rates for many types of cancers have improved in high-income countries due to accessible early detection, improved treatment, and better survivorship care. In Canada, the predicted five-year net survival rate for all cancers combined is 65% for women [1]. However, approximately one in three women who complete treatment for cancer report acute and chronic adverse effects that may be visible (e.g., scarring, disfigurement, physical deconditioning, hair loss; [64, 65]) or nonvisible (e.g., hot flashes, nausea; [66, 67]), which can have a lasting impact on their overall wellbeing and quality of life [68, 69]. Moreover, women report significant alterations to their thoughts, feelings, and behaviours towards their body, self, and others [67, 70-73], which can also impair their wellbeing and quality of life [74-78]. There is a need to identify strategies to help support women's wellbeing and quality of life after they receive a cancer diagnosis.

Yoga is classified by the National Institutes of Health as a form of complementary and alternative medicine [79]. Investigation of the benefits of yoga for individuals diagnosed with cancer began in the 1990's and took off in the following decade. There is now evidence that yoga can effectively promote wellbeing and quality of life through its positive influence on physical (e.g., decreases fatigue, increases physical functioning) and psychological (e.g., reduces anxiety and depression) health outcomes during and after cancer treatment [7, 80-83]. Additionally, there is evidence that participating in pleasurable activities that encourage a mind-body connection, such as yoga, can foster positive thoughts, feelings, and behaviours towards the body, self, and others after a traumatic experience (e.g., cancer; [64, 65]).

The use of qualitative research is proliferating in the area of sport and exercise psychology [84] as qualitative methods (e.g., interviews, focus groups) are valuable means to gather knowledge that may not be accessible using methods relied on in quantitative research (e.g., surveys with close-ended questions). Qualitative research provides detailed explanations and meanings given by the individuals who take part in an activity (e.g., yoga). Consequently, it offers a thick description of a phenomenon, which is when researchers are able to delve deeper into the nature of a phenomenon by considering contextual information when observing and interpreting participants' explanations and meanings [85]. Thick description thus not only provides a description of a phenomenon under investigation, but attempts to document the complexity and multiplicity of individuals' experiences and meanings [86]. Although valuable, primary qualitative studies are rarely used on their own to contribute to practical knowledge [87]. To enable qualitative research to contribute to practical knowledge, a systematic review and integration of findings from the collective body of qualitative research is critical. Yet, most published systematic reviews on yoga present syntheses of quantitative research that evaluate the effects of yoga. Moreover, these reviews have generally focused on specific outcomes. For example, O'Neill et al. [88] focused on the effects of yoga on cancer-related fatigue and quality of life. Whilst such reviews address essential questions about the magnitude of effects for specific outcomes, they are subject to limitations. Most notably, the statistical combination of findings from multiple independent studies to obtain an overall statistic that summarizes the effect of an experimental intervention (e.g., yoga) on an outcome (e.g., quality of life) can mask important differences within and across studies [89, 90], and thus can be misleading. In addition, when data are sparse (e.g., small sample sizes in primary articles, small number of included articles), the estimate effect size may be biased. Moreover, quantitative evidence syntheses do

not necessarily include all available evidence that may provide insight into the benefits of a certain activity; there are many published studies where authors have used qualitative methods to gather such insight that are not included in reviews. Although these qualitative data cannot be expressed numerically, there is concern with their exclusion because qualitative research plays an important role in deepening our understanding of the context for which these interventions are conducted [87]. This is one of the key motivations for doing qualitative evidence synthesis.

Qualitative evidence synthesis is a valuable tool for understanding the experiences of individuals who take part in an activity, both comprehensively (due to the qualitative approach) and broadly (due to the integration of studies from different contexts and participants), so as to draw conclusions about the benefits of an activity (e.g., yoga) based on several studies.

Qualitative evidence synthesis is especially important considering variations across studies in terms of the participants, interventions, theoretical perspectives, study design, and outcome measurement tools. This variability, often described as clinical diversity and methodological diversity, produces highly heterogeneous data that can be misrepresented in quantitative evidence syntheses [91]. However, heterogeneity arising from the clinical and/or methodological diversity across studies is welcomed in qualitative syntheses, whereby it is appropriate to review, analyze, and synthesize studies with diverse clinical and methodological factors to provide a meaningful summary of participants' perspectives on the role and value of an activity. The use of qualitative evidence synthesis to explore the explanations and meanings given by individuals participating in different activities, including yoga, is growing. For example, Capon et al. [92] reviewed 11 articles reporting on studies investigating the lived experiences of people with mental health conditions who participated in yoga for mental health outcomes (e.g., post-traumatic distress disorder, depression, anxiety). Despite clinical diversity across the primary qualitative articles

reviewed, Capon et al. [92] formulated three overarching themes, namely self as an agent of change, alleviation of suffering, and healing as a process. Their findings provide necessary insight into the process of healing for people with mental health conditions as well the potential mechanisms underlying this process to offer suggestions for clinical practice. Nevertheless, there remains a gap in the synthesis of qualitative evidence on women's experiences participating in yoga after a cancer diagnosis.

Current study

In spite of a proliferation of primary qualitative articles on women's experiences participating in yoga after a cancer diagnosis, an analysis, synthesis, and interpretation of the collective findings is lacking. Capitalizing on the potential of qualitative research is necessary to provide a meaningful summary of participants' experiences to develop theory and provide direction for practice or policy development. Thus, the aim of this paper is to describe the protocol for a planned meta-synthesis using a meta-study methodology to analyse, synthesize, and interpret qualitative evidence from research on the experiences of women who have participated in yoga after a cancer diagnosis to generate a full understanding of their experiences. The specific research objectives are to: (1) integrate findings from primary qualitative articles exploring the accounts of women who participated in yoga after a cancer diagnosis, (2) compare and contrast the findings to elucidate patterns or contradictions in conclusions, and (3) develop an overarching narrative of women's experiences participating in yoga after a cancer diagnosis.

Methods

Conducting a qualitative evidence synthesis

Qualitative evidence synthesis, described as narrative synthesis, qualitative synthesis, meta-ethnography, or meta-synthesis, refers to methods used to synthesize a number of

qualitative research studies within a particular field of study [93]. As with methods used to conduct quantitative evidence synthesis, qualitative evidence synthesis methods use a staged approach (e.g., identify, screen, appraise quality) to analyse and synthesize relevant articles. For this review, a meta-synthesis using a meta-study methodology [87] is appropriate because there is a need to analyse the findings, methods, and theory used in primary qualitative research before a complete synthesis is conducted to generate new understandings and theories in this evolving field of research. Meta-study entails two distinct phases: (1) analysis and (2) synthesis. There are three types of analysis: meta-data analysis, meta-method analysis, and meta-theory analysis. Findings from the included articles will be coded to identify patterns and themes in the data, and then interpreted to provide additional insights, beyond what is offered in the primary studies, into the phenomenon from the point of view of women diagnosed with cancer who participated in yoga.

Procedures and analysis

To complete this meta-study meta-synthesis, recommendations outlined by Paterson et al. [87] will be used. Their recommendations are organized into six distinct but overlapping steps: (1) formulating a research question, (2) selection and appraisal of the primary research, (3) meta-data analysis, (4) meta-method analysis, (5) meta-theory analysis, and (6) meta-synthesis. Steps three to five do not necessarily unfold sequentially and are frequently conducted concurrently. The details of these six steps are described below, and reporting herein follows the Preferred Reporting Items for Systematic review and Meta-Analysis Protocols (PRISMA-P; [94]) guidelines (see Supplemental File 1 for checklist). The protocol for this review has been registered on PROSPERO (registration number: CRD42021229253). The Preferred Reporting

Items for Systematic review and Meta-Analysis (PRISMA; [95]) guidelines will be followed when reporting the results from this review to ensure complete and transparent reporting.

Step 1: Formulating the research questions

Before conducting the literature search, the purpose of this review and the specific research questions were established, leading to the clarification of the inclusion criteria. The specific research questions are: (1) what are the experiences of women who have participated in yoga after a cancer diagnosis, (2) what elements of yoga contribute to participants' positive or negative experiences, and (3) what are participants' barriers, motives, and preferences for their participation in yoga interventions and programs? In addition to answering these research questions, the review will also aim to describe knowledge gaps and make recommendations for future research.

Step 2: Selection and appraisal of the primary research⁹

Step 2a: Identifying relevant articles

Articles were retrieved by searching six electronic databases: Medical Literature Analysis and Retrieval System Online (MEDLINE), Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsycINFO, Scopus, SPORTDiscus, and Web of Science. With the help of a university librarian, a sensitive search strategy was developed drawing on Medical Subject Heading (MeSH) terms and keywords that have been used in published reviews [e.g., 96]. MeSH terms and keywords used covered the population (i.e., women diagnosed with cancer) and terminology associated with yoga (e.g., yoga, mindfulness, breathing exercises, meditation). No MeSH terms and keywords covering methods (e.g., interviews, focus groups) were used, as these

⁹ In line with submission requirements, screening and data extraction were not completed prior to submission (January 21, 2021). However, screening was completed during the review process (January 2021-May 2022); this is reflected in the verb tense of the following section.

have undergone little validation [97], and qualitative articles have been known to produce poor descriptors of the research methods, with neither the title nor abstract explicitly stating the methods used [98, 99]. The search strategy was pilot tested and finalized in MEDLINE (see Appendix D for the final MEDLINE search strategy) before being translated for use in the five other databases. This search for articles from database inception onwards was completed in November 2020, and results were exported into Covidence software [100] for automatic removal of duplicates. In August 2021, this search was supplemented by scanning the reference lists of relevant articles retrieved during the electronic database search (i.e., reviews, included studies) to ensure all pertinent studies were identified. The database search was replicated in October 2021 to retrieve citations published during the previous 11 months. Covidence software was used to store, organise, and manage all the references.

The inclusion criteria emerged directly from the research questions guiding this meta-synthesis and were set a priori. The inclusion criteria are: (1) primary studies conducted with adult women (≥ 18 years) diagnosed with cancer, regardless of type of cancer, stage of the disease, and phase on the cancer continuum (e.g., diagnosis, treatment, post-treatment, palliation), (2) used qualitative methods to collect data (e.g., interviews, focus groups, observations, journaling, open-ended survey questions), (3) report on participants' experiences engaging in yoga of any type and intensity, and (4) were original research published in English language in a peer-reviewed journal. No restriction was placed on year of publication and study design (i.e., observational or experimental). The exclusion criteria are: (1) the sample is composed of $>50\%$ men diagnosed with cancer (to ensure that the sampling method does not introduce bias in the analysis because excluding articles that have $>50\%$ women could result in a biased sample as not all women would have equal chance to have their experiences considered in

the synthesis), (2) qualitative findings are not presented, (3) do not report on participants' experiences engaging in yoga, and (4) abstracts from conference proceedings, unpublished theses, books, and reviews. Finally, no restriction was imposed for type of cancer to allow for breadth of experiences to be captured in the synthesis.

Step 2b: Study selection

After the removal of duplicate records, two reviewers independently screened the titles and abstracts. They retained those that appeared to relate to the eligibility criteria (defined above) and tracked reasons for exclusion otherwise. They retained records of titles and abstracts that were vague for full-text review. Next, the same two reviewers reviewed the full-texts of remaining records to assess eligibility according to the above eligibility criteria and tracked reasons for exclusion. At both steps, a third reviewer made the final decision when disagreements arose. Cohen's kappa, a statistic reflecting level of agreement among independent people assessing qualitative data, will be calculated for both screening steps to report on inter-reviewer reliability and presented with the results. For this review, Cohen's kappa was chosen as the marker for reliability as it accounts for the possibility of agreement occurring by chance, and thus is generally considered a more robust measure of reliability than simple percent agreement calculation [101]. Coefficients will be interpreted as follows: 0-0.20 = none, 0.21-0.39 = minimal, 0.40-0.59 = weak, 0.60-0.79 = moderate, 0.80-0.90 = strong, >0.90 = excellent agreement [101]. A PRISMA diagram of the search results and reasons for exclusion will be prepared and presented in forthcoming results manuscripts.

Step 2c: Data extraction

Data extraction will be conducted by two independent reviewers using a template for collecting data housed on Covidence. After uploading the full-texts to Covidence, both reviewers

will independently extract the following information from each eligible article: authors, country where data were collected, year of publication, study objective(s), sample characteristics (i.e., age, percent female/women), sampling method(s), sample size, type of cancer(s), disease stage, phase on the cancer continuum, reported yoga characteristics (i.e., length, duration, frequency, location(s) of practice, style, group or individual), methodology (e.g., constructivist, interpretivist), data collection methods (e.g., semi-structured interview, focus group), analysis methods (e.g., grounded theory, interpretative phenomenological analysis, thematic analysis, content analysis), conceptual/theoretical approaches, and key qualitative findings. In studies that used an experimental design, data on the trial will also be extracted. If the information presented in the original article is unclear or missing, the corresponding author of the article will be contacted via email for clarification (maximum two attempts).

Step 2d: Quality assessment

Although there is no consensus about whether quality criteria should be applied to qualitative research, a growing number of researchers are choosing to appraise qualitative studies in meta-syntheses [102]. Included studies will be appraised using the Consolidated Criteria for Reporting Qualitative Research (COREQ) 32-item checklist [103]. The checklist consists of items specific to the research team and reflexivity (i.e., personal characteristics, relationship with participants), study methods and context (i.e., theoretical framework, participant selection, setting, data collection), analysis, findings, and interpretations. As there is no empirical basis to rate the quality of reporting of qualitative research, studies will not be excluded from analysis on the basis of the COREQ results; rather, the intention is to allow readers to evaluate the quality of reporting of studies conducted thus far based on our appraisal results [102]. Therefore, the results

of the COREQ checklist assessment will be narratively presented for all studies included in the synthesis [102].

Step 3: Meta-data analysis

The first analytical step involves an analysis of the findings presented in the primary qualitative articles. Thematic synthesis, which draws on methods of thematic analysis for primary qualitative research, is a common approach to qualitative evidence synthesis in health and related disciplines [104]. Thematic synthesis involves three steps. First, extracted text reflecting findings from the included articles will be coded line-by-line to search for patterns and themes in the data within and across included articles. Second, similarities will be grouped together into themes, and a narrative summary of the results describing the themes will be written. Finally, these themes will be interpreted to explore the implications for understanding the phenomenon. The thematic synthesis will be carried out by two reviewers, and disagreements in coding will be resolved through discussion with a third reviewer; initial codes and themes will be revisited or refined accordingly.

During the meta-data analysis, themes will be entered as columns into a table, and coded data from each article will illustrate the themes in rows to facilitate comparison within and across articles. The aim of this table is to demonstrate themes with illustrative data and capture similarities and differences within the data where possible—that is, to show how themes are similar but also show divergence of findings in each theme, where it applies. This table also serves as a transparent link between the reviewers' analysis and interpretation and the findings of the primary articles reviewed.

Step 4: Meta-method analysis

The second analytical step involves an analysis of the methods used in the primary qualitative articles. This step determines how the interpretation and implementation of qualitative research methods have shaped the research findings and the emergent ideas in this area of research [87]. Meta-method analysis involves four steps. First, data on the methods extracted from the included articles during Step 2c will be entered as columns into a table with primary qualitative articles as the rows to allow for comparison between articles, as well as to allow for assessment of coherence of methods within studies. Second, the methods used will be analysed to determine frequency of use and any potential patterns of use. Third, the results from the COREQ checklist assessment from Step 2d will be discussed to furnish conclusions about the appropriateness of methods used in the primary studies. Finally, these findings will be analysed to determine whether the use of certain methods has changed over time, drawing attention to the impact of these changes on how researchers have designed their research, and ultimately on the findings reported in the primary qualitative articles.

Step 5: Meta-theory analysis

The third analytical step is the analysis of the conceptual/theoretical approaches used in the primary qualitative articles. A meta-theory analysis is an important component of a meta-synthesis because the subtle differences between theories within the same field of scholarship can make significant differences in what is studied, how it is studied, and why it is studied [87]. Extracted theories from the articles reviewed will be examined to identify any major paradigm(s) or ontological approach(es) that may have informed the selection of said theories. Findings will be interpreted to explore any limitations, strengths, or ambiguities that may be influencing the use of theory and interpretation of findings in primary qualitative articles exploring women's experiences participating in yoga after a cancer diagnosis.

Step 6: Meta-synthesis

In this last step, the results from the proceeding steps will be aggregated to create an overarching narrative of women's experiences participating in yoga after a cancer diagnosis. Specifically, the goal will be to "go beyond" the findings of the primary studies identified in the previous three steps and generate additional concepts, understandings, and hypotheses that answer the research questions. Further, there will a deliberate attempt to identify possible contradictions in conclusions across studies. Finally, if necessary, the reviewers will propose alternative conceptual and theoretical structures within which existing knowledge can be interpreted. To achieve this, the meta-data analysis findings will be explored in the context of the meta-method and meta-theory results to: (1) identify the nuances in the various methods that have been applied and the patterns in how and why such approaches may have been used; (2) consider the kinds of knowledge that may not have been included in current conceptualizations as a result of methodological choices; (3) understand why the authors of primary research may have reported different findings at different times; and (4) explore new conceptual/theoretical alternatives that might account for a more comprehensive, accurate, or credible interpretation of women's experiences participating in yoga after a cancer diagnosis.

Rigour

Several strategies will be used to enhance the quality and rigour of this meta-synthesis [105]. First, findings will be arrived at through triangulation. Specifically, multiple reviewers with different backgrounds and experiences will bring different perspectives to the analysis and synthesis of the primary qualitative findings. Similarly, there are no restrictions placed on the methods, methodology, epistemological and ontological stances, or theoretical frameworks used in the primary qualitative articles; thus, allowing for a breadth of perspectives to be presented

and analyzed. Second, an expansive and exhaustive search was conducted across several databases to help ensure all relevant published articles were identified. This is in keeping with the goal to saturate findings and to ensure a broad interpretation of the research topic. Third, an audit trail is being maintained throughout the process to keep an accurate and detailed report on retrieval, tracking, and selection. Similarly, memo writing will be used in the classification, analysis, and synthesis of findings and decisions made, while direct quotations from the primary qualitative articles will be presented to support conclusions.

Discussion

Quantitative evidence syntheses have provided data on the benefits and outcomes of yoga for adults diagnosed with cancer [7, 80-83]. Beyond the fact that they omit key findings from the literature by focusing mostly on randomized controlled trials and relying on the aggregation of studies with similar parameters to draw conclusions [89, 90], they face challenges because there is wide clinical and methodological diversity (i.e., there is variability in contexts and populations, a lack of standardized approach in conducting yoga interventions, a multiplicity of outcome measures, and varying doses of interventions (e.g., frequency, length, duration)). Such diversity gives rise to heterogeneity, which is a troublesome aspect of many quantitative evidence syntheses as it might influence the conclusions of the synthesis [89, 90]. However, the epistemological and methodological considerations of qualitative studies lend themselves well to embracing heterogeneity in an evidence synthesis. Therefore, qualitative evidence syntheses represent a valuable approach to synthesize research in this evolving field to continue to drive forward important questions and future endeavours, as well as practice. The current manuscript describes the protocol for a planned meta-synthesis using a meta-study methodology to analyse,

synthesize, and interpret qualitative research on the experiences of women who have participated in yoga after a cancer diagnosis.

Systematic reviews are lauded as the best evidence for answering health research questions, particularly those about intervention effectiveness [95]. This is because they use pre-specified methods and analyses that allow for a rigorous, methodical approach to synthesising research evidence. Yet, concerns have been raised that it can be difficult to discern whether decisions made during the review process are arbitrary or that the decision to include/exclude studies/data in a review were made in light of knowledge about individual study findings [94]. Consequently, there have been calls to provide detailed, concise, and transparent descriptions of the steps used for data collection and analysis [94]. This is especially important for qualitative evidence synthesis as there are several approaches (e.g., narrative synthesis, qualitative synthesis, meta-ethnographies, meta-synthesis) that use different methods for aggregating, synthesizing, and reporting data. Thus, it is necessary to describe the steps being used in this review.

There are several strengths associated with the procedures detailed herein. Multiple gold standard guidelines were followed in the preparation of the review protocol and will be adhered to when reporting the results. By incorporating elements from different guidelines, a solid framework and structure was created by which the research questions can be answered. Second, rigorous and systematic methods will be used, which will ensure a broad range of concepts are captured and will allow for replication of the review. For example, a systematic and explicit search strategy, along with COREQ checklist assessment of the included articles, in line with standard qualitative practice [102, 106], will be used. As well, a university librarian with experience conducting meta-syntheses assisted with database selection and reviewed the search strategy. Third, whilst generalisability is not a goal of qualitative research, meta-syntheses give a

depth of understanding across more diverse populations, thereby giving a wider reach than could be achieved in a primary qualitative study. Indeed, by not limiting to a specific cancer type and phase on the cancer continuum, the findings from this meta-synthesis may be relevant to the wider population of women diagnosed with cancer. Finally, the synthesis of primary qualitative studies will allow the voice of women to guide future research decisions around women's needs, gauge the suitability of interventions, and appreciate the implications of yoga for women after a cancer diagnosis.

Notwithstanding the strengths, there are three key challenges associated with conducting a meta-synthesis using a meta-study approach. First, like many qualitative evidence syntheses, meta-study relies on decontextualizing concepts to attain greater generalizability [87, 105]. This is at odds with many of the epistemological approaches often employed in qualitative work, which stress the importance of context; however, the value of a meta-study lies in its ability to understand the broader pattern of data in this field by interpreting its varying context. Moreover, similar to primary qualitative studies, readers can apply findings to their own research contexts, as they see fit. Second, the quality of the meta-study is heavily reliant on the researchers' ability to articulate and further interpret the findings of primary studies. As a result, the forthcoming themes and subthemes developed may be different from those developed by other authors. Nonetheless, the inclusion of multiple independent individuals involved in the collection, analysis, synthesis, and interpretation of the qualitative findings will ensure multiple perspectives, backgrounds, and epistemological stances are considered during the construction of the final themes and subthemes. Finally, although the appropriateness of assessing the quality of studies in qualitative evidence syntheses is debated, an increasing number of reviewers are performing critical appraisals [102, 107], shifting the discussion in the literature from 'should

we' to 'how can we' appropriately evaluate (and improve) the quality of reporting in primary qualitative studies [102]. Thus, since the focus of a meta-study meta-synthesis is to analyse the methods and theories involved in interpreting the data of primary qualitative studies, the COREQ checklist [103], which evaluates the explicit and comprehensive reporting of qualitative studies, was chosen to appraise articles reviewed.

In conclusion, there is a need to collate the perspectives of women who have participated in yoga after a cancer diagnosis explored via qualitative research. To ensure that all the important decisions and steps taken related to the conduct of this meta-synthesis are reported with transparency and sufficient detail, this manuscript presents in detail the protocol for a meta-synthesis aimed at exploring women's experiences participating in yoga after a cancer diagnosis. Additionally, this will improve trustworthiness of this review. Publication of the protocol, along with registration on PROSPERO, will also help to avoid wasted research effort by preventing duplication in case other researchers want to conduct a similar review.

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Appendix B – Protocol for Series N-of-1 trial (study 4, article 5 and 6)

**A single subjects research design evaluating a co-created yoga program for adults with
gynecologic cancer: Feasibility study protocol**

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Published in *Pilot and Feasibility Studies*

Final publication is available from Springer Link:

<https://link.springer.com/article/10.1186/s40814-023-01435-7>

Abstract

Background: Worldwide, >1.3 million adults are diagnosed with a gynecologic cancer each year, affecting their wellbeing and quality of life. This manuscript describes the protocol for a study that sought to assess the feasibility, acceptability, and fidelity of a community-based co-created yoga program and proposed evaluative methods, and estimate program effects on self-report outcomes.

Methods: Using a multiple baseline single subject research design with a follow-up phase (ABA), quantitative and qualitative data were collected from program participants and the instructor. Participants were randomly assigned to baseline length, and completed weekly surveys for 3-5 weeks pre-program. Then, participants engaged in a bi-modal 12-week hatha yoga program consisting of 2 60-minute group classes a week, with optional supplemental features (Jan – April, 2023). Participants completed surveys after classes 1, 12, and 24. Post-program, participants completed surveys 1, 4, and 8 weeks after the last class, and took part in a semi-structured interview 1 week after to discuss program acceptability, suitability, relevance, and potential benefits. Feasibility outcomes (i.e., recruitment, retention, and program adherence rates, engagement with optional program features) were tracked by the instructor and study team during the study. The yoga instructor was interviewed about their experience delivering the program 2 weeks after the last class. Instructor fidelity was measured using duration coding to compare recorded yoga classes to the program protocol based on class layout, content delivered, and interactions with participants.

Planned Analysis: Feasibility outcomes will be analyzed using descriptive statistics. Interview transcripts will be coded using reflexive thematic analysis. Class recordings will be coded using

duration coding. Survey responses on self-reported outcomes will be analyzed visually and using multilevel modelling.

Expected Outcomes: Data will help determine refinements, if any, required to the program and instructor guidebook, implementation approach, and proposed evaluation methods before scale up projects and definitive trials are started.

Keywords: mind-body, oncology, single-case, community

Trial Registration: ClinicalTrials.gov, no.: NCT05610982; November 3, 2022

Background

Adults diagnosed with a gynecologic cancer report physical (1, 2) and psychosocial (3-6) side effects associated with their cancer and its treatment, which can have a lasting impact on their quality of life (QoL) (7-10). Physical activity programs have been identified as means of supporting QoL after cancer treatment due to potential improvements in physical and psychological outcomes (11). Often though, these adults report low levels of physical activity (12) (e.g., any voluntary bodily movement, encompassing all activities at any intensity) and note that treatment side effects can reduce their ability to participate in physical activity (13). Many have therefore sought to establish that yoga, a mind-body practice, can be a form of physical activity that can be done by persons with physical limitations and confers physical and psychosocial benefits during and after cancer treatment (14-17). Specifically, a meta-synthesis of 24 articles indicates yoga helps women manage the adverse side effects of cancer and its treatments, rediscover strength and physical abilities, embrace a positive outlook and relationship with themselves, develop strategies for coping with stressors, foster social connections and support, and become more attentive and mindful (18). Yet, offering yoga programs without involving end-users (i.e., those who might be interested in, or affected by, research findings) in the whole research process (i.e., from conception to evaluation) can lead to suboptimal engagement and user experience (19). Involving end-users in the whole research process is beneficial to help identify and prioritize user-relevant topics for the research agenda and research questions, offer pragmatic criticism on the extent to which the research is relevant or appropriate for users across each phase of the research, and can lead to programs that meet the needs and wants of participants (20).

In 2021, a formal inter-disciplinary partnership between 2 researchers, a psychologist at The Ottawa Hospital, and a representative from a community organization (the Ottawa Regional Cancer Foundation; ORCF) serving people diagnosed with cancer and their families was established to co-create a contextually relevant and suitable yoga program. The partners collaborated with adults diagnosed with gynecologic cancer and yoga instructors to involve end-users and elicit their feedback in the development of the yoga program and a guidebook to assist instructors in delivering it as intended (21). The co-creation process resulted in a 12-week bi-modal program featuring 2 weekly 60-minute Hatha yoga classes to a group of 5 to 7 participants, with 3 additional optional features participants can participate in: organized social time, journalling, and pre-recorded videos for at-home practice. Though a definitive randomized controlled trial (RCT) will be warranted to assess the direct and indirect effects of the yoga program on adults diagnosed with gynecologic cancer, it is not indicated at this time (22); rather, it is first necessary to establish feasibility, acceptability, and fidelity of the program and evaluative methods.

There are several ways to assess these parameters. Feasibility involves evaluation of (a) recruitment capability and sample characteristics, (b) data collection procedures and measures, (c) acceptability and suitability of a program and study methods, (d) resources and ability to manage and implement a program and study, and (e) preliminary data on participants' responses to a program (23). Acceptability involves evaluation of the extent to which people delivering or receiving a program consider it to be appropriate based on anticipated or experienced cognitive and affective responses to a program (24). Last, fidelity involves evaluation of the extent to which people delivering a program under study implement it with accuracy and conformity (25). Given the scarcity of resources, it is necessary to establish these parameters to ensure study

outcomes are due to participation in the program and not due to other factors (e.g., high dropout, biased sample, lack of reliable and valid outcome assessments, poor program adherence, compliance, or fidelity).

Although there are multiple study designs for evaluating feasibility, acceptability, and fidelity of programs and evaluative methods, the trend has been to use feasibility- or pilot-trials (26, 27). Pilot- or feasibility-RCTs may not be the most appropriate or cost-effective choice when exploring the suitability of an untested group-based yoga program in a community setting (28). Without knowledge of end-users' interest and engagement in the program, it is not possible to estimate with confidence the number of *eligible* individuals that a program will have, meaning that the sample size required for a RCT may not be met. As well, RCTs are vulnerable to many types of bias (e.g., selection bias, ascertainment bias, observer bias). Single-subject research design (SSRD) studies have been offered as valuable for assessing feasibility, acceptability, and fidelity whilst minimizing needed resources and implementation time (29-33). Moreover, SSRDs offer a rigorous approach to understanding individual variability when examining causal relationships between a program and outcomes in clinical and applied settings (30, 32, 33).

Purpose and Study Objectives

The purpose of this article is to describe the protocol (Version 1, November 3, 2022) for a feasibility study delivering a group-based yoga program to adults diagnosed with gynecologic cancer using a bi-modal format (in-person and online), and aiming to: (1) assess trial methods and program feasibility, (2) assess trial methods and program acceptability, (3) assess researcher and yoga instructor fidelity to trial methods and program protocol, and (4) estimate the effects of the program on end-user prioritized self-report outcomes. The practice of publishing protocols is growing owing to a lack of high-quality reporting in articles detailing yoga interventions and

programs (18). Protocol publication also makes replication easier, promotes transparency, enhances awareness of the trial to avoid duplication efforts, and serves as reference for forthcoming publications of results (34).

Methods/Design

This manuscript was written in accordance with the SPIRIT (Standard Protocol Items: Recommendations for Interventional Trials) guidelines ((35); see Additional file 1). Trial results will be reported according to the Consolidated Standards of Reporting Trials (CONSORT) 2010 statement for N-of-1 trials (36) and the 21-item Checklist Standardising the Reporting of Interventions For Yoga (CLARIFY) reporting guidelines (37). Any modifications to the study methods or program will be reported with the results.

Trial Design

This was a SSRD study (unblinded), employing a multiple baseline approach with a follow-up phase (an ABA design; (33, 38, 39)), wherein quantitative and qualitative data were collected from people receiving the program (i.e., adults diagnosed with gynecologic cancer; participants) and those delivering it (i.e., yoga instructor(s)). In this design, ‘A’ refers to a baseline (control) or non-intervention (follow-up) phase, and the ‘B’ refers to the intervention phase wherein participants participate in the program. The key to this design was that participants were randomly assigned to baseline length, varying from 3 to 5 weeks following guidelines (39), wherein they completed weekly surveys online. As minimal change was anticipated during this observation A phase, assessments were weekly to minimize phase length. Then, the yoga program was introduced to all participants and participants completed surveys online at the start (week 1), mid- (week 6), and end-of (week 12) program to observe trends in outcomes during the program. After the program ended, participants completed surveys online 1-

, 4-, and 8-weeks post-program to continue observing trends in outcomes post-program. To maximize research participation from enrollment to study completion whilst considering possible latency effects, the follow-up period was 8 weeks.

Participants, Program, and Outcomes

Eligibility Criteria

Inclusion criteria were: (1) at least 18 years of age, (2) received a diagnosis of non-metastatic gynecologic cancer, (3) able to read, speak and understand English, (4) access to the Internet and an audio-visual device (e.g., computer, smart phone), and (5) able and willing to travel to the Ottawa Regional Cancer Foundation twice a week for 2 weeks at the start of the yoga program. Exclusion criteria were: (1) being non-ambulatory (i.e., unable to walk or require the assistance of a mobility device), and (2) currently practice yoga at least once a week or have practiced consistently in the last 6 months (i.e., once a week for 8 weeks).

Yoga Program and Study Setting

The approach and methods (i.e., consensus panel meeting, focus groups) used to co-create the yoga program with end-users are presented elsewhere (21). Version 1 of the yoga program was 12 weeks and offered 2 weekly 60-minute group-based Hatha-style classes (a total of 24 classes) and up to 10 participants could enrol in the program. For this study, 2 programs were offered concurrently at different times of day (i.e., 9:30-11:00am and 7:00-8:30pm). Two weeks prior to the first group yoga class, the yoga instructor asked participants to complete a brief one-page intake form and participate in a 1-on-1 online consultation for approximately 15 minutes via Zoom to review the intake form and discuss any physical concerns or limitations. The purpose of the intake form and meeting was to ensure the safety of participants by assisting the instructor to better tailor the program to suit each participants' concerns and limitations. It

also served to familiarize participants with Zoom and offer technological assistance, if needed. Weeks 1 and 2, participants had to attend classes in-person. Starting week 3 through to week 12, the program became bi-modal such that participants could choose to attend the classes in-person or live online via Zoom. Participants were required to enter a password to attend online classes to prevent unauthorized persons from joining. The in-person classes were offered in a spacious room at the ORCF (Ottawa, Ontario, Canada) located in the basement. The room had windows to let in natural light, wooden floors, high ceilings, ceiling lighting, was void of mirrors, and was located in close proximity to non-gendered washrooms. The ORCF lent participants chairs, blocks, bolsters, yoga blankets, and yoga straps during in-person classes. The research team offered participants a yoga mat donated by Lululemon at the start of the first class to use during in-person classes and at-home for the duration of the program (i.e., they could take it home with them); they were asked to return it after the last class for re-use in future studies.

Class Aims and Content. The safety and wellbeing of participants was at the forefront of the program, such that the elements of the practice could be tailored to suit the needs of each participant so as to make it inclusive and accessible. Participants were encouraged to connect movement with breath as they engaged in dynamic movement, engaged multiple muscle groups as they moved through a series of postures, and regulated their breathing and heart rate through breath practices and meditation. To promote program fidelity, the instructor was given the Instructor Guidebook (Version 2), which contained guidance on gynecologic cancer, inclusive language and behaviours, program and class structure, and a flexible and adaptable base class plan for the instructor to use. Each class included moving, stretching, and balancing through a series of poses (asanas), awareness of breath (breathwork; pranayama), and cultivating the connection between mind and body (meditation; dhyana and dharana) (40, 41). During the yoga

sequences, introspection was central – that is, participants were encouraged to focus on their body’s activity and the internal sensations of their bodies. Breathwork provides a foundation for the calming of the mind, and meditation encourages them to observe their present-moment experiences with openness, acceptance, and nonjudgment (42-46). See Table 1 for an overview of the class layout.

Table 1. Overview of class layout for the yoga program for adults diagnosed with gynecologic cancer.

Activity	Description	Timing
Arrival	The instructor seeks to make the class environment welcoming and connect with participants as they transition into the class.	5 minutes
Warm-up	Starts with a breath practice, followed by a structured sequence of movements from a seated position intended to help participants center themselves in the present, get their heart elevated, and prepare their mind and body to fully engage in the class by tuning into their body, heart rate, breathing, energy level.	15 minutes
Sequence 1	A structured sequence of standing movements intended to help a participant connect their movement with their breath as they engage in dynamic movement.	10 minutes
Sequence 2	A structured sequence of standing and balancing movements intended to help a participant connect their movement with their breath, engage multiple muscle groups as they flow through a series of shapes.	15 minutes
Restoration	A structured sequence of movements to help participants regulate their breathing and heart rate and begin the calming process and transition into a meditation practice.	20 minutes
Social Time	The instructor prompts conversation among participants intended to promote reflection and connection.	5-10 minutes
Departure	When participants conclude their social time or the scheduled class time ends, the instructor transitions participants out of the class by thanking them for attending and inviting any individual questions.	5 minutes

Supplemental features. Based on end-user input, the program also included organized group discussions, journalling, and pre-recorded videos that participants could engage with, if

they chose. For the former, participants could remain in the ORCF or on the Zoom call at the conclusion of the class to socialize with the other participants and ask the instructor questions to allow participants to develop feelings of relatedness and belongingness while sharing with others. The yoga instructor initiated this by announcing the beginning of the group discussion and asking participants to share, if they wanted, but was instructed to not facilitate conversations; however, the instructor deviated from the protocol and engaged in conversation to facilitate conversation with online participants (when necessary). For journaling, participants received a journal and pen during the first class to use as they saw fit to record self-reflections, express their thoughts, and release emotions that may have surfaced during the class. The instructor encouraged participants to bring their journal to each class and write in it at the end of class. Finally, starting week 3, participants had access to an online database of 10 pre-recorded short-duration yoga practices (10-15 minutes) with videos for breathwork, meditation, warm-up, main sequences, and restoration, to support their at-home practice. The pre-recorded classes allow participants to self-select the intensity, frequency, and duration of the practice to meet their needs in-between classes guided by the instructor.

Instructor and instructor assistants. A certified yoga instructor, with experience working with clinical populations, was hired and trained. The yoga instructor was supported by a volunteer undergraduate student in kinesiology or a related field to ensure participants attending in-person or online were receiving the necessary support required for a safe and enjoyable experience. Given their pivotal role, the yoga instructor and instructor assistants completed a 3-hour training class facilitated by JP. Training topics and practical activities included: observations, feedback on delivering a mock class, relevant information on gynecologic cancer treatment and side-effects, discussions on inclusive and supportive language and behaviours such

as using inviting, accepting, and welcoming language, offering choices, avoiding qualifiers, empowering introspection, tailoring according to participants' needs, seeking consent, and encouraging participants to meet their bodies where it was. Ongoing supervision was provided; it consisted of 30-minute team meetings every 2 weeks to discuss participants' progress, challenges, tailoring efforts, and feedback on class notes, as well as hear about the yoga instructor and instructor assistants' experiences delivering/supporting the delivery of classes. During the meetings participant engagement and adverse events were reviewed to ensure participants' safety as a data monitoring committee was not needed for the yoga program because the intervention was non-invasive with minimal risk of harm.

Participant Timeline

Study duration varied between 23 and 25 weeks, depending on baseline length. Recruitment took place from November 25, 2022 to December 22, 2022 with JP screening potential participants by phone to ensure eligibility criteria was met. Informed verbal consent was obtained from interested and eligible participants during the call to reduce burden of coming in-person prior to online data collection; they were emailed a copy of the consent form for their records. Then, 6 weeks prior to the start of the program (December 23, 2022), participants were randomized by JP into a 3, 4, or 5 week baseline length for A phase, in a 1:1:1 ratio using the Clinical Trial Randomization Tool offered by the National Cancer Institute (<https://ctrandomization.cancer.gov/>). Starting December 26, 2023, on a weekly basis, they received an email (at around the approximate same day/time to encourage equal spacing in-between assessments) with a link to a secure site to complete an online survey for 3, 4, or 5 weeks (depending on baseline length allocation). Once baseline A phase ended, the program B phase began (January 31, 2023). Participants took part in the 12-week yoga program and were

asked to complete a survey package after the first class (week 1), after the 12th class (i.e., mid-point of program; week 6), and after the 24th class (i.e., end of program; week 12). With participants' consent, classes were audio- and video-recorded to track participants' engagement in the classes and the instructor's fidelity to the program. For the follow-up A phase (started April 27, 2023), participants were asked to complete a survey online 1, 4, and 8 weeks after the last class. For all phases, participants were asked to complete surveys within 48 hours of receiving the link. All participants (regardless of adherence to the program) were asked to complete all program B phase and follow-up A phase surveys. Participants were invited to take part in an acceptability interview 1 week after their last class. Interviews took place virtually via Microsoft Teams. The yoga instructor was invited to take part in an interview by videoconferencing technology approximately 2 weeks after the last class. See Table 2 for the schedule of assessments. The CONSORT flow diagram will be completed and presented in a forthcoming publication to summarize the process of recruitment and follow-up of participants within the study.

Table 2. Schedule of Assessments

Measures	Throughout study	Pre-data collection	Baseline					Program			Follow-up			Program end
Timepoints	Nov 25, 2022 – Jun 16, 2023	Nov 25 – Dec 23, 2022	Dec 26, 2022 – Jan 23, 2023					Jan 31– Apr 20, 2023			Apr 27 – Jun 16, 2023			May 1 – May 12, 2023
			-t ₅ *	-t ₄ *	-t ₃	-t ₂	-t ₁	t ₁	t ₂	t ₃	t ₄	t ₅	t ₆	
Eligibility screen		X												
Informed consent		X												
Baseline length allocation (3, 4, or 5 weeks)		X												
Feasibility metrics	X													
Participant interview														X
Instructor interview														X
Fidelity monitoring								X**	X**	X**				
Primary definitive trial outcomes			X*	X*	X	X	X	X	X	X	X	X	X	
Secondary definitive trial outcomes			X*	X*	X	X	X	X	X	X	X	X	X	
Sociodemographic and medical characteristics			X*	X*	X*									
Adverse events								X**	X**	X**				

Notes. * = depending on group allocation. ** = tracked continuously throughout the program.

Sample size

A conventional power calculation was inappropriate for this feasibility study given the novel nature of delivering the program at the ORCF (47, 48); rather, the target sample size was 20 participants based on end-user recommendations and pragmatic considerations. During the co-creation process, end-users recommended that class size be capped at 7 participants per program to allow for the instructor to provide adequate feedback to participants, which was increased to 10 per program to account for up to 30% attrition based on the research team's previous experience delivering group-based physical activity programs. In addition, end-users recommended running programs in the morning and evening to accommodate varying schedule needs (e.g., energy levels, work). Pragmatically, due to the group-based nature of the program, the novelty of the program, and the context of the study (i.e., Covid-19-related shifts in lifestyles, priorities, and preferences), it was necessary to establish recruitment and enrollment rates as well as acceptability of novel program features prior to committing resources to run multiple iterations of the program. Thus, a SSRD was chosen as the study design wherein an appropriate sample size is generally small (e.g., range from 1-13; (33, 49)). Repeated assessments helped to ensure there were a sufficient number of data points to perform statistical analyses with sufficient power (33). See Feasibility Outcomes for pertinent confidence intervals (CI).

Recruitment

Adults diagnosed with gynecologic cancer were recruited via: (1) healthcare provider referral, (2) registry mailout, and (3) posters and word of mouth. For recruitment strategy 1, a psychologist at The Ottawa Hospital asked her colleagues to inform potentially eligible patients about the study and share contact information for those interested in learning more to JP. For recruitment strategy 2, adults diagnosed with gynecologic cancer who provided consent to be

contacted for research purposes at The Ottawa Hospital were contacted by mail and invited to participate (and thus a Data Use Agreement was established between the University of Ottawa and The Ottawa Hospital). Interested individuals self-referred by contacting JP. For recruitment strategy 3, recruitment posters and brochures were placed at The Ottawa Regional Cancer Foundation and shared via their newsletter and website. Finally, individuals enrolled in the study were encouraged to share JP's contact information with people whom they believed could be interested in participating.

Outcomes

Primary: Feasibility [throughout the trial]. Feasibility outcomes were: (1) *recruitment rate*, (2) *study retention rate*, (3) *program adherence rate*, and (4) *participant engagement*. (1), (2) and (4) were tracked by JP; (3) was tracked by the yoga instructor assistants. Recruitment rate was measured by recording the number of individuals who consented to participate in the study out of those who were assessed for eligibility. Retention rate was measured by recording how many participants completed assessments, with the primary endpoint at the final assessment at week 20 (i.e., 8 weeks post-program) as this will provide valuable data about whether participants were willing to continue data collection after the program for future large-scale trials. Adherence rate was measured by recording the number of classes participants attended (out of 24) regardless of modality (i.e., in-person or online), though a breakdown of modality use will be presented. Participant engagement was measured by recording how many of the 24 group discussions participants took part in (including attending vs actively participating by engaging in discussion), how many journal entries participants' self-reported completing, and how many pre-recorded practices participants self-reported watching.

Based on recent yoga programs with cancer survivors (50-53), targets were set a priori. Feasibility of the study methods and program will be deemed if: (a) recruitment: >50% of adults who were assessed for eligibility consent to participate (CI=34.5-65.5%); (b) retention: final follow-up assessment at week 20 completed by $\geq 75\%$ of the sample (CI=56-94%); (c) adherence: $\geq 75\%$ of the 24 yoga classes completed (CI=70.7-79.3%); and d) participant engagement: (1) 50% of participants attended the optional group discussion (CI:28.1-71.9%), and of those, 50% spoke at least once during the discussion (CI:19.0-81.0%), (2) 50% of participants completed at least 1 journal entry per week (CI:28.1-71.9%), and (3) 50% of participants watched at least 1 pre-recorded video per week for at least 50% of the time they had access to the videos (5 weeks) (CI:28.1-71.9%).

Primary: Acceptability – Participants [1-week post-program completion]. All participants were invited to complete an in-person or virtual semi-structured interview with JP 1 week after the last class (May 2023). Acceptability of the study methods and program were assessed. Interviews included closed (i.e., quantitative) and open-ended (i.e., qualitative) questions about participants' experiences, thoughts, and perspectives on: (1) relevance of the program overall and its specific features, (2) suitability of the program overall and its specific features, (3) perceived benefits of the program overall and its specific features, (4) problems/concerns experienced during the program, and (5) suitability and problems/concerns with trial methods.

Primary: Acceptability – Yoga Instructor [at program cessation]. Within 2 weeks of teaching their last class, the yoga instructor took part in an audio-recorded semi-structured interview to explore their experience delivering the program, as well as their thoughts about the content of the program and guidebook, delivery and content of training, ongoing supervision, and

whether they felt confident that they had enough knowledge to teach the yoga program as intended. As well, they were asked to share any difficulties with delivering the program, offer suggested amendments, and their views of fidelity to the guidebook. Their responses will be taken into account when reflecting on if/what changes/modifications should be considered to optimize the program and facilitate its implementation.

Primary: Fidelity [throughout trial]. The classes were recorded and will be used to assess the instructor's fidelity to the program protocol, including: (1) layout of the class (i.e., timing and sequencing of class phases aligns with the program protocol) and (2) interactions with participants (i.e., instructor engages with the participants in manner that aligns with pre-specified preferred behaviours identified in the Instructor Guidebook). Instructor fidelity will be measured using duration coding to compare recorded yoga classes to the program protocol. Fidelity will be considered if: (1) layout of the class: 75% of phases were the prescribed length and 75% of class phases were in the prescribed order, and (2) interactions with participants: 75% of instructor behaviours were preferred behaviours.

Effectiveness Outcomes to Inform Future Trial

Several patient-reported outcomes and putative mechanisms of change have been identified based on end-user feedback and literature. Thus, participants were asked to complete pertinent questionnaires to provide preliminary data on the benefits of the program and inform measurement decisions for a future definitive trial. All of the questionnaires and assessments have been used and/or validated previously with cancer survivors. They have been chosen on the basis of empirical evidence showing yoga can affect these outcomes, theories, and end-users and partners' input. The study measures were collected at the time points listed below using SurveyMonkey.

Primary – patient reported outcomes [baseline A phase, program B phase, follow-up A phase]. Patient reported outcomes were assessed using the following questionnaires: Functional Assessment of Cancer Therapy-General (QoL; (54)), Perceived Cognitive Abilities sub-scale of the Functional Assessment of Cancer Therapy - Cognitive Function (cognitive functioning; (55)), Functional Assessment of Chronic Illness Therapy - Fatigue Scale (fatigue; (56)), Female Sexual Distress Scale-Revised modified for 7-day recall (feelings and problems regarding sexuality; (57)), Body Image Scale modified for 7-day recall (body image; (58)), Perceived Stress Scale modified for 7-day recall (perceived stress; (59)).

Secondary – putative mechanisms of psychosocial outcomes [baseline A phase, program B phase, follow-up A phase]. Testing mechanisms of change was central to understand how the program works. Thus, several theoretically grounded outcomes were assessed at each timepoint using the following measures to ascertain feasibility of data collection: Acceptance and Action Questionnaire II modified for 7-day recall (psychological flexibility; (60)), Integrated Self-Discrepancy Index (self-discrepancy; (61)), Experiences of Embodiment Scale modified for 7-day recall (embodiment; (62)).

Additional Outcomes

Personal and medical factors [baseline A phase; single timepoint]. Participants self-reported sociodemographic [(self-report age, gender identity, ethnicity, civil status, work/education status, income, and comorbidities] and medical information [height, weight, cancer type and stage as well as the type and protocol of treatments received for their cancer (i.e., surgery, chemotherapy, radiation, immunotherapy, hormonal), and list of current medication(s), self-reported physical and mental health (via 5-point scale)] within the first survey only.

Adverse events [throughout the trial]. Becoming more physically active, through yoga, is very safe for most adults diagnosed with cancer and can yield many health benefits (18, 63, 64). Though the risk of injury was estimated to be very low, the yoga instructor educated participants on the warning signs that may indicate a problem as per Canadian Society for Exercise Physiology guidelines (e.g., chest discomfort, unusual shortness of breath, dizziness or light-headedness, heart rhythm abnormalities) and told participants to seek immediate medical attention should 1 of these signs occur. Adverse events (i.e., any unfavourable and unintended sign, symptoms, or disease) definitely, probably, or possibly related to engaging in yoga were tracked. To this end, all adverse events occurring during participation in the study were documented by the yoga instructor. Each class, the yoga instructor recorded adverse event shared by participants (if any) in their notes and reported them immediately to JP via email. At the time of reporting, the program was paused for the participant reporting the adverse event until clearance from an appropriate healthcare provider to resume the program was obtained. All reported adverse events were shared with Institutional Review Boards and will be reported in forthcoming publication of study results. Beyond participating in the yoga program, there was a risk that participants experience distress in response to certain questions included in the online survey and/or posed during the interviews; participants received a list of free resources to consult in case this occurs during the consent process (e.g., Canadian Cancer Society–Peer support / cancer information specialist: 1- 888-939-3333).

Data Management and Analysis

Quantitative data will be downloaded from SurveyMonkey, imported into Statistical Package for the Social Sciences (SPSS) for analysis, cleaned, and subjected to quality checks. Descriptive statistics will be computed to describe the sample at baseline and to report on

feasibility and acceptability outcomes. Categorical variables will be described using proportions and frequencies, and continuous variables with means and standard deviations (or with medians and interquartile ranges for data that were not normally distributed). CIs will be reported along with point estimates for each outcome.

Audio recordings from qualitative interviews will be transcribed verbatim, imported into NVivo for analysis, and coded using a hybrid approach of deductive and inductive reflexive thematic analysis (65).

Additional analyses (i.e., descriptive analyses, visual inspection) will be performed to describe overall levels and the extent to which patient-reported outcomes and putative mechanisms of psychosocial outcomes (i.e., anticipated primary and secondary definitive trial outcomes, respectively) change. Additionally, although exploratory, multilevel modeling will be used to estimate change in primary and secondary outcomes. Restricted Maximum Likelihood will be used instead of Full Maximum Likelihood because Restricted Maximum Likelihood has been shown to lead to better estimates with smaller sample sizes. Models will be estimated with no Level-2 covariates to maximize power. This said, effect sizes (e.g., measures of variance explained, measures of standardized effect size) will be reported for primary and secondary outcomes as this was a feasibility study that was not designed to test the efficacy of yoga. Because there are a number of ways to approach multilevel modeling and each model tested proceeds by estimating and comparing a series of unconditional and conditional models, full technical details and estimation methods will be described when reporting results.

Finally, once the main analyses are conducted to address the study aims, exploratory analyses may be undertaken to address subsequent research aims that will make unique theoretical and empirical contributions.

Ethics and Dissemination

Research Ethics Approval and Protocol Amendments

Ethics approval for the yoga program protocol was granted by the Ottawa Health Science Network Research Ethics Board on September 27, 2022 (file no.: 20220544-01H) and by the University of Ottawa's Office of Research Ethics and Integrity on November 11, 2022 (file no.: H-10-22-8671). The yoga program was registered with the ClinicalTrials.gov database (no.: NCT05610982) on November 3, 2022. Any important protocol modifications (e.g., changes to eligibility criteria, recruitment procedures) will be reported promptly to relevant parties (e.g., team members, Institutional Review Boards, trial registry) and will be reported in forthcoming publication(s).

Consent and Confidentiality

Verbal informed consent was obtained from participants over the phone prior to data collection, and the yoga instructor prior to completing the interview. All data (i.e., interview recordings/transcripts, survey responses) are considered confidential and electronic files containing personal information can only be accessed by the investigators and study staff who sign a confidentiality form. A unique code is produced for each participant and used on all corresponding documentation and files to ensure anonymity. Furthermore, personal information that may enable participants to be identified will be removed from interview transcripts upon transcription.

Access to Data

Data sharing is restricted. No data will be deposited within public data repositories as participants and the yoga instructor were assured that their data would be kept private and confidential to the extent permitted by law, and that only the research team would have access to

their data. De-identified electronic files containing anonymized quantitative and qualitative data are only be shared with the research team for analysis. All quantitative and qualitative electronic data files are password-protected and stored on password-protected computers/laptops, a shared drive/server (i.e., the Ottawa Hospital server), and a web-based secure and encrypted data storage service (i.e., SurveyMonkey's Canadian Data Centre); files will be kept for at least 5 years and possibly longer. Paper materials will be stored for 5 years following the completion of the study in locked cabinets in locked offices whose access is limited, after which point these will be destroyed securely (i.e., shredding).

Dissemination Plans

Study results will be shared with academic audiences via presentations at scientific meetings and publications in peer-reviewed journals. Results will be submitted to clinicaltrials.gov no later than 1 year after study completion. To facilitate communication of results to non-academic audiences, presentations will be made to the ORCF board of directors and results will be presented in a publicly available report on the ORCF website. In addition, results will be shared via social media and a video summarizing the trial will be posted on the corresponding author's website. As well, yoga instructors interested in using the Instructor Guidebook will be able to request access through the corresponding author's website.

Discussion

Yoga is a promising form of physical activity that can support psychosocial outcomes for women diagnosed with cancer when practiced regularly and safely (18). Yet, most programs have some form of disconnect between program characteristics and participants' needs (19); thus, highlighting the need to co-create programs with end-users (i.e., yoga instructors, adults diagnosed with a gynecologic cancer). Prior to a definitive trial to assess the effects of the

program and effort to scale up implementation, it was necessary to assess the feasibility, acceptability, and fidelity of the study methods and program as well as potential benefits of the program to ensure viability and value.

Deliverables and implications

The results of the study described in this article will provide valuable knowledge and insight to refine the current program, materials to facilitate its delivery as planned (i.e., instructor guidebook), and the methods used to evaluate it. Further, data on patient-reported outcomes and putative mechanisms of change will support the design of a sufficiently powered future trial. In the long term, if successful, the deliverable of this study will be a yoga program suitable for delivery in a community setting. This program will aim to provide yoga instructors and community organizations with a resource for adults diagnosed with a gynecologic cancer to support bio-psycho-social outcomes related to QoL.

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Appendix C – Research Ethics Board Approvals (in chronological order)

Study 1 (article 1)



**Ottawa Health Science Network Research Ethics Board (OHSN-REB) / Conseil
d'éthique de la recherche du réseau de science de la santé d'Ottawa (CÉR-RSSO)**

Date: June 22, 2021
Principal Investigator: Dr. Cheryl Harris, TOH/OHRI
Protocol ID: 20210260-01H
Study Title: Body image, relationships with others, and yoga: A study to understand women's experiences after a gynecologic cancer diagnosis
Submission Type: Initial Application
Review Type: Delegated
Date of Approval: June 22, 2021
Approval Expiry Date: June 22, 2022

Dear Dr. Harris,

An **Institutional approval (OHRI and/or UOHI) letter is required prior to the conduct of the study** at this site. The institutional approval letter is an indication that you have satisfied ethics, contracts, departmental notifications, as applicable.

Thank you for submitting the above referenced study. The Ottawa Health Science Network Research Ethics Board (OHSN-REB) has reviewed the application and granted approval for your study. This approval is granted until the expiration date noted above. This research study is to be conducted by the investigator noted above.

The **OHSN-REB ethics approval** is applicable only for The Ottawa Hospital and University of Ottawa Heart Institute.

Documents Approved:

Document Name	Document Version Date
English Verbal Consent Script	May 25, 2021
English Information Sheet	June 17, 2021
English Interview Guide 1	January 29, 2021
English Interview Guide 2	January 29, 2021
English Journal Prompts	January 29, 2021
English Media Post	January 29, 2021
English Poster	May 4, 2021
English Recruitment Letter	May 27, 2021
English recruitment Script	January 29, 2021
English sociodemographic and medical characteristics questionnaire	January 29, 2021
Protocol	May 12, 2021

No deviations from, or changes to, the protocol should be initiated without prior written approval of an appropriate amendment from the OHSN-REB, except when necessary to eliminate immediate hazard(s) to study participants.

REB members involved in the research project do not participate in the review, discussion or decision.

If the study is to continue beyond the expiry date noted above, a Continuing Review Form must be received by the OHSN-REB on or prior to the full board submission deadline date of the meeting scheduled to occur a minimum of 30 days prior to the study expiry date. If the study has been completed by the expiry noted above, a Study Closure Report must be received by the OHSN-REB.

The OHSN-REB operates in compliance with, and is constituted in accordance with, the requirements of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2); International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use; Integrated Addendum to ICH E6 (R1): Guideline for Good Clinical Practice E6 (R2); Part C, Division 5 of the Food and Drug Regulations; or with the definition in the Interim Order Respecting Clinical Trials for Medical Devices and Drugs Relating to COVID-19; Part 4 of the Natural Health Products Regulations; Part 3 of the Medical Devices Regulations; and the provisions of the Ontario Personal Health Information Protection Act (PHIPA 2004) and its applicable regulations. OHSN-REB is qualified through the CTO REB Qualification Program and is registered with the U.S. Department of Health and Human Services (DHHS) Office for Human Research Protection (OHRP).

Please do not hesitate to contact us if you have any questions.

Sincerely,

Francine F.-A. Sarazin, Ph.D., C.Psych (Retired)
Vice Chairperson
Ottawa Health Science Network Research Ethics Board

/gb



June 22, 2021

Dr. Cheryl Harris

Ottawa Hospital Cancer Centre - General Campus
 Psychosocial Oncology Program
 501 Smyth Rd, Box 918
 Ottawa, ON
 K1H 8L6

Re: OHRI Institutional Approval for Ottawa Health Science Network Research Ethics Board (OHSN-REB) Submission

Protocol ID#: 20210260-01H;

Body image, relationships with others, and yoga: A study to understand women's experiences after a gynecologic cancer diagnosis

Dear Dr. Cheryl Harris,

This letter serves as **Ottawa Hospital Research Institute (OHRI)** Institutional Approval for the above-referenced study. Please maintain this documentation in your investigator study file.

Based on the information you provided about this study through the Clinical Research Registration Form, you have satisfied the requirements for institutional (OHRI) approval. This includes initial research ethics approval by OHSN-REB, appropriate departmental/service area notifications and execution (fully signed versions) of all agreement(s) required to begin the study locally. Please note there may be additional agreement(s) pending execution that are required to send funds, samples, or data to external sites, but are not required for you to begin your study locally.

Changes and/or additions to your study that may require additional agreement(s) or revisions to existing agreement(s) must be communicated to the OHRI Contracts Office. This should be undertaken simultaneously with any related OHSN-REB amendment submission.

Changes and/or additions to your study that affect various hospital/institution departments (e.g., pharmacy, Department of Medical Imaging, EORLA, EEG, etc.) must be communicated to the relevant departments.

As mentioned in the 'Response' tab of the Ethics application, you have 3 months from the date of initial OHSN-REB approval to submit French documents including the translation certificate to OHSN-REB through the Translated Documents section of the ethics application (if applicable).

Should you have any questions, please contact REBadministration@ohri.ca or 613-798-5555 extension 16719.

Nancy Camack, BScN RN MBA CCRP
 Director, Clinical Research Administration
 Ottawa Hospital Research Institute | Institut de recherche de l'Hôpital d'Ottawa

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07/07/2021

Université d'Ottawa

Bureau d'éthique et d'intégrité de la recherche

University of Ottawa

Office of Research Ethics and Integrity

Lettre d'approbation administrative | Letter of administrative approval

Numéro de dossier / Ethics File Number

H-06-21-7167

Titre du projet / Project Title

Body image, relationships with others, and yoga: A study to understand women's experiences after a gynecologic cancer diagnosis

Type de projet / Project Type

Thèse de doctorat / Doctoral thesis

CÉR primaire / Primary REB

Réseau de science de la santé d'Ottawa (RSSO) / Ottawa Health Science Network (OHSN)

Statut du projet / Project Status

Approuvé / Approved

Date d'approbation (jj/mm/aaaa) / Approval Date (dd/mm/yyyy)

07/07/2021

Date d'expiration (jj/mm/aaaa) / Expiry Date (dd/mm/yyyy)

22/06/2022

Équipe de recherche / Research Team

**Chercheur /
Researcher**

Affiliation

Role

Jenson PRICE

École des sciences de l'activité physique / School of Human Kinetics

Chercheur Principal / Principal Investigator

Jennifer BRUNET

École des sciences de l'activité physique / School of Human Kinetics

Superviseur / Supervisor

Conditions spéciales ou commentaires / Special conditions or comments:

OHSN REB Protocol ID: 20210260-01H (PI: C.Harris)

550, rue Cumberland, pièce 154 550 Cumberland Street, Room 154
Ottawa (Ontario) K1N 6N5 Canada Ottawa, Ontario K1N 6N5 Canada

613-562-5387 • 613-562-5338 • ethique@uOttawa.ca / ethics@uOttawa.ca
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07/07/2021

Université d'Ottawa

Bureau d'éthique et d'intégrité de la recherche

University of Ottawa

Office of Research Ethics and Integrity

L'Université d'Ottawa a signé une Entente, conforme aux exigences de la plus récente version de l'EPTC et tout autre règlement ou législation applicable, permettant au CÉR ci-haut nommé d'être désigné comme CÉR primaire pour les projets de recherche où

1) les activités principales de recherche sont menées sous l'autorité ou sous les auspices de l'établissement lié au CÉR primaire et

2) Une partie du projet est également réalisé sous l'autorité ou sous les auspices de l'Université d'Ottawa.

Cette lettre confirme que l'Université d'Ottawa a autorisé que le CÉR primaire soit le CÉR officiel pour l'évaluation et la supervision de ce projet de recherche. Ceci n'est pas une approbation éthique.

Afin de nous aider à garder votre dossier à jour, veuillez soumettre une copie de toutes demandes de modification, renouvellement d'approbation éthique etc. soumis à et approuvé par le CÉR primaire dès qu'elles sont disponibles.

Cette approbation administrative est valide pour la durée indiquée ci-haut et est sujette aux conditions énumérées dans la section intitulée « Conditions spéciales ou commentaires ».

The University of Ottawa has signed an Agreement, compliant with current TCPS guidelines and any other applicable guidelines or legislation regarding multisite review, allowing the REB named above to serve as Board of Record (BoR) for research projects where

1) the main research activities are conducted within the auspices or jurisdiction of the BoR's institution and

2) parts of the project are also conducted under the jurisdiction or auspices of the University of Ottawa.

This letter confirms that the University of Ottawa has authorized the REB named above to serve as Board of Record for the review and oversight of this research project. This is not an REB approval.

In order to help us keep your file up to date, please submit a copy of all amendment requests, project renewals or any other changes submitted to and approved by the BoR, as they become available.

Administrative approval is valid for the period indicated above and is subject to the conditions listed in the section entitled «Special conditions or comments».

Catherine PAQUET

Directeur / Director

Pour/For **Daniel LAGAREC** Président(e) du/ Chair of the **Comité d'éthique de la recherche en sciences de la santé et sciences / Health Sciences and Sciences Research Ethics Board**

550, rue Cumberland, pièce 154 550 Cumberland Street, Room 154
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Study 3 (article 4)



**Ottawa Health Science Network Research Ethics Board (OHSN-REB) / Conseil
d'éthique de la recherche du réseau de science de la santé d'Ottawa (CÉR-RSSO)**

Date: July 27, 2021
Principal Investigator: Dr. Cheryl Harris, TOH/OHRI
Protocol ID: 20210474-01H
Study Title: Developing and evaluating a yoga program for gynecologic cancer survivors
Submission Type: Initial Application
Review Type: Delegated
Date of Approval: July 27, 2021
Approval Expiry Date: July 27, 2022

Dear Dr. Harris,

An **Institutional approval (OHRI) letter is required prior to the conduct of the study** at this site. The institutional approval letter is an indication that you have satisfied ethics, contracts, departmental notifications, as applicable.

Thank you for submitting the above referenced study. The Ottawa Health Science Network Research Ethics Board (OHSN-REB) has reviewed the application and granted approval for your study. This approval is granted until the expiration date noted above. This research study is to be conducted by the investigator noted above.

The **OHSN-REB ethics approval** is applicable only for The Ottawa Hospital.

Documents Approved:

Document Name	Document Version Date
English Verbal Consent_R1	July 12, 2021
English_Admin Email for Cancer Survivors _To Administrators	May 25, 2021
English_Admin Email for Yoga Instructors _To Administrators	May 25, 2021
English_Advertisement text for Cancer Survivors	May 25, 2021
English_Advertisement text for Yoga Instructors	May 25, 2021
English_CS Focus Group Guide	May 25, 2021
English_Information Sheet_R1	July 12, 2021
English_Instructor Focus Group Guide	May 25, 2021
English_Poster for Cancer Survivors_R1	July 14, 2021
English_Poster for Yoga Instructors_R1	July 14, 2021
English_Recruitment Letter for Cancer Survivors	May 25, 2021
English_Researcher Recruitment Email	May 25, 2021
English_Script for Cancer Survivors _Eligibility Questions	May 25, 2021
English_Script for Yoga Instructors _Eligibility Questions	May 25, 2021
Protocol	May 31, 2021

No deviations from, or changes to, the protocol should be initiated without prior written approval of an appropriate amendment from the OHSN-REB, except when necessary to eliminate immediate hazard(s) to study participants.

REB members involved in the research project do not participate in the review, discussion or decision.

If the study is to continue beyond the expiry date noted above, a Continuing Review Form must be received by the OHSN-REB on or prior to the full board submission deadline date of the meeting scheduled to occur a minimum of 30 days prior to the study expiry date. If the study has been completed by the expiry noted above, a Study Closure Report must be received by the OHSN-REB.

The OHSN-REB operates in compliance with, and is constituted in accordance with, the requirements of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2); International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use; Integrated Addendum to ICH E6 (R1): Guideline for Good Clinical Practice E6 (R2); Part C, Division 5 of the Food and Drug Regulations; or with the definition in the Interim Order Respecting Clinical Trials for Medical Devices and Drugs Relating to COVID-19; Part 4 of the Natural Health Products Regulations; Part 3 of the Medical Devices Regulations; and the provisions of the Ontario Personal Health Information Protection Act (PHIPA 2004) and its applicable regulations. OHSN-REB is qualified through the CTO REB Qualification Program and is registered with the U.S. Department of Health and Human Services (DHHS) Office for Human Research Protection (OHRP).

Please do not hesitate to contact us if you have any questions.

Sincerely,

Raphael Saginur, M.D.
Chairperson
Ottawa Health Science Network Research Ethics Board

/hl



July 20, 2022

Dr. Cheryl Harris

Ottawa Hospital Cancer Centre - General Campus
 Psychosocial Oncology Program
 501 Smyth Rd, Box 918
 Ottawa, ON
 K1H 8L6

Re: OHRI Institutional Approval for Ottawa Health Science Network Research Ethics Board (OHSN-REB) Submission

Protocol ID#: 20210474-01H;

Developing and evaluating a yoga program for gynecologic cancer survivors

Dear Dr. Cheryl Harris,

This letter serves as **Ottawa Hospital Research Institute (OHRI)** Institutional Approval for the above-referenced study. Please maintain this documentation in your investigator study file.

Based on the information you provided about this study through the Clinical Research Registration Form, you have satisfied the requirements for institutional (OHRI) approval. This includes initial research ethics approval by OHSN-REB, appropriate departmental/service area notifications and execution (fully signed versions) of all agreement(s) required to begin the study locally. Please note there may be additional agreement(s) pending execution that are required to send funds, samples, or data to external sites, but are not required for you to begin your study locally.

Changes and/or additions to your study that may require additional agreement(s) or revisions to existing agreement(s) must be communicated to the OHRI Contracts Office. This should be undertaken simultaneously with any related OHSN-REB amendment submission.

Changes and/or additions to your study that affect various hospital/institution departments (e.g., pharmacy, Department of Medical Imaging, EORLA, EEG, etc.) must be communicated to the relevant departments.

As mentioned in the 'Response' tab of the Ethics application, you have 3 months from the date of initial OHSN-REB approval to submit French documents including the translation certificate to OHSN-REB through the Translated Documents section of the ethics application (if applicable).

Should you have any questions, please contact REBadministration@ohri.ca or 613-798-5555 extension 16719.

Penny Phillips
 Director, Clinical Research Administration
 Ottawa Hospital Research Institute | Institut de recherche de l'Hôpital d'Ottawa

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Université d'Ottawa

Bureau d'éthique et d'intégrité de la recherche

University of Ottawa

Office of Research Ethics and Integrity

H-08-21-7280 - OTH-7280 - Lettre d'approbation administrative / Letter of Administrative Approval

(English message follows)

Cher/Chère Jenson Price,

Veuillez trouver la lettre d'approbation administrative pour le projet intitulé «Developing and evaluating a yoga program for gynecologic cancer survivors».

L'approbation est valide jusqu'au 27-07-2022 (correspond à la date du CÉR primaire). Afin de garder votre dossier à jour, veuillez nous soumettre une copie de toutes demandes de modification, certificats de renouvellement, et/ou autres documents pertinents soumis à et approuvés par le CÉR primaire, dès qu'ils sont disponibles.

Recherche financée : Veuillez faire suivre une copie de cette lettre au [Service de gestion de la recherche](#).

Si vous avez des questions, n'hésitez pas à communiquer avec le Bureau d'éthique à ethique@uottawa.ca ou en composant le 613-562-5387.

Vous pouvez voir votre demande en vous connectant à votre compte [eReviews](#).

Cordialement,

Catherine Paquet
Directeur

Ceci est une réponse automatisée, merci de ne pas répondre à ce courriel.

Dear Jenson Price,

Please find attached the letter of administrative approval for your research project titled "Developing and evaluating a yoga program for gynecologic cancer survivors".

This approval is valid until 27-07-2022 (corresponds to the date of the Primary REB). In order to keep your file up to date, please submit a copy of all modification requests, project renewals, and/or other relevant documents submitted to and approved by the Primary REB, as they become available.

Funded research: A reminder that you must provide a copy of this letter to [Research Management Services](#).

If you have any questions, please contact the Ethics Office at ethics@uottawa.ca or by telephone at 613-562-5387.

You can view your project at any time by logging into [eReviews](#).

Best regards,

Catherine Paquet
Director

This is an automated message. Please do not reply directly to this email.

Attachement(s) / Attachment(s)

[approvalLetter1628104603511.pdf](#)

550, rue Cumberland, pièce 154 550 Cumberland Street, Room 154
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Study 4 (article 6 and 6)



**Ottawa Health Science Network Research Ethics Board (OHSN-REB) / Conseil
d'éthique de la recherche du réseau de science de la santé d'Ottawa (CÉR-RSSO)**

Date: September 27, 2022
Principal Investigator: Dr. Cheryl Harris, TOH/OHRI
Protocol ID: 20220544-01H
Study Title: A yoga program for adults diagnosed with gynecologic cancer
Submission Type: Initial Application
Review Type: Delegated
Date of Approval: September 27, 2022
Study Approval Expiry Date: September 27, 2023

Dear Dr. Harris,

An **Institutional approval (OHRI) letter is required prior to the conduct of the study** at this site. The institutional approval letter is an indication that you have satisfied ethics, contracts, departmental notifications, as applicable.

Thank you for submitting the above referenced study. The Ottawa Health Science Network Research Ethics Board (OHSN-REB) has reviewed the application and granted approval for your study. This approval is granted until the expiration date noted above. This research study is to be conducted by the investigator noted above.

The **OHSN-REB ethics approval** is applicable only for The Ottawa Hospital.

Documents Approved:

Document Name	Document Version Date
English, Appendix B - Recruitment Poster	September 5, 2022
English, Appendix C - Brochure	September 5, 2022
English, Gynecologic Cancer Interview Guide v1	July 5, 2022
English, Information Sheet	September 9, 2022
English, Questionnaire - Sociodemographic Measure	July 26, 2022
English, Recruitment Letter	July 5, 2022
English, Recruitment script - with eligibility questions	June 9, 2022
English, Survey Questions v1	June 16, 2022
English, Verbal Consent Script	September 9, 2022
English, Yoga Instructor Interview Guide v1	July 5, 2022
Protocol	September 9, 2022

No deviations from, or changes to, the protocol should be initiated without prior written approval of an appropriate amendment from the OHSN-REB, except when necessary to eliminate immediate hazard(s) to study participants.

REB members involved in the research project do not participate in the review, discussion or decision.

If the study is to continue beyond the expiry date noted above, a Continuing Review Form must be received by the OHSN-REB on or prior to the full board submission deadline date of the meeting scheduled to occur a minimum of 30 days prior to the study expiry date. If the study has been completed by the expiry noted above, a Study Closure Report must be received by the OHSN-REB.

The OHSN-REB operates in compliance with, and is constituted in accordance with, the requirements of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2); International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use; Integrated Addendum to ICH E6 (R1): Guideline for Good Clinical Practice E6 (R2); Part C, Division 5 of the Food and Drug Regulations; or with the definition in the Interim Order Respecting Clinical Trials for Medical Devices and Drugs Relating to COVID-19; Part 4 of the Natural Health Products Regulations; Part 3 of the Medical Devices Regulations; and the provisions of the Ontario Personal Health Information Protection Act (PHIPA 2004) and its applicable regulations. OHSN-REB is qualified through the CTO REB Qualification Program and is registered with the U.S. Department of Health and Human Services (DHHS) Office for Human Research Protection (OHRP).

Please do not hesitate to contact us if you have any questions.

Sincerely,

Raphael Saginur, M.D.
Chairperson
Ottawa Health Science Network Research Ethics Board

/hl



November 09, 2022

Dr. Cheryl Harris

Ottawa Hospital Cancer Centre - General Campus
 Psychosocial Oncology Program
 501 Smyth Rd, Box 918
 Ottawa, ON
 K1H 8L6

Re: OHRI Institutional Approval for Ottawa Health Science Network Research Ethics Board (OHSN-REB) Submission

Protocol ID#: 20220544-01H;

A yoga program for adults diagnosed with gynecologic cancer

Dear Dr. Cheryl Harris,

This letter serves as **Ottawa Hospital Research Institute (OHRI)** Institutional Approval for the above-referenced study. Please maintain this documentation in your investigator study file.

Based on the information you provided about this study through the Clinical Research Registration Form, you have satisfied the requirements for institutional (OHRI) approval. This includes initial research ethics approval by OHSN-REB, appropriate departmental/service area notifications and execution (fully signed versions) of all agreement(s) required to begin the study locally. Please note there may be additional agreement(s) pending execution that are required to send funds, samples, or data to external sites, but are not required for you to begin your study locally.

Changes and/or additions to your study that may require additional agreement(s) or revisions to existing agreement(s) must be communicated to the OHRI Contracts Office. This should be undertaken simultaneously with any related OHSN-REB amendment submission.

Changes and/or additions to your study that affect various hospital/institution departments (e.g., pharmacy, Department of Medical Imaging, EORLA, EEG, etc.) must be communicated to the relevant departments.

As mentioned in the 'Response' tab of the Ethics application, you have 3 months from the date of initial OHSN-REB approval to submit French documents including the translation certificate to OHSN-REB through the Translated Documents section of the ethics application (if applicable).

Should you have any questions, please contact REBadministration@ohri.ca or 613-798-5555 extension 16719.

Penny Phillips
 Director, Clinical Research Administration
 Ottawa Hospital Research Institute | Institut de recherche de l'Hôpital d'Ottawa

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11/11/2022

Université d'Ottawa

Bureau d'éthique et d'intégrité de la recherche

University of Ottawa

Office of Research Ethics and Integrity

Lettre d'approbation administrative | Letter of administrative approval

Numéro de dossier / Ethics File Number	H-10-22-8671
Titre du projet / Project Title	A yoga program for adults diagnosed with gynecologic cancer
Type de projet / Project Type	Thèse de doctorat / Doctoral thesis
CÉR primaire / Primary REB	Réseau de science de la santé d'Ottawa (RSSO) / Ottawa Health Science Network (OHSN)
Statut du projet / Project Status	Approuvé / Approved
Date d'approbation (jj/mm/aaaa) / Approval Date (dd/mm/yyyy)	11/11/2022
Date d'expiration (jj/mm/aaaa) / Expiry Date (dd/mm/yyyy)	27/09/2023

Équipe de recherche / Research Team

Chercheur / Researcher	Affiliation	Role
Jenson PRICE	École des sciences de l'activité physique / School of Human Kinetics	Chercheur Principal / Principal Investigator
Jennifer BRUNET	École des sciences de l'activité physique / School of Human Kinetics	Superviseur / Supervisor

Conditions spéciales ou commentaires / Special conditions or comments:

OHSN-REB Number: 20220544-01H

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11/11/2022

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L'Université d'Ottawa a signé une Entente, conforme aux exigences de la plus récente version de l'EPTC et tout autre règlement ou législation applicable, permettant au CÉR ci-haut nommé d'être désigné comme CÉR primaire pour les projets de recherche où

1) les activités principales de recherche sont menées sous l'autorité ou sous les auspices de l'établissement lié au CÉR primaire et

2) Une partie du projet est également réalisé sous l'autorité ou sous les auspices de l'Université d'Ottawa.

Cette lettre confirme que l'Université d'Ottawa a autorisé que le CÉR primaire soit le CÉR officiel pour l'évaluation et la supervision de ce projet de recherche. Ceci n'est pas une approbation éthique.

Afin de nous aider à garder votre dossier à jour, veuillez soumettre une copie de toutes demandes de modification, renouvellement d'approbation éthique etc. soumis à et approuvé par le CÉR primaire dès qu'elles sont disponibles.

Cette approbation administrative est valide pour la durée indiquée ci-haut et est sujette aux conditions énumérées dans la section intitulée « Conditions spéciales ou commentaires ».

The University of Ottawa has signed an Agreement, compliant with current TCPS guidelines and any other applicable guidelines or legislation regarding multisite review, allowing the REB named above to serve as Board of Record (BoR) for research projects where

1) the main research activities are conducted within the auspices or jurisdiction of the BoR's institution and

2) parts of the project are also conducted under the jurisdiction or auspices of the University of Ottawa.

This letter confirms that the University of Ottawa has authorized the REB named above to serve as Board of Record for the review and oversight of this research project. This is not an REB approval.

In order to help us keep your file up to date, please submit a copy of all amendment requests, project renewals or any other changes submitted to and approved by the BoR, as they become available.

Administrative approval is valid for the period indicated above and is subject to the conditions listed in the section entitled «Special conditions or comments».

Catherine PAQUET

Directeur / Director

Pour/For **Daniel LAGAREC** Président(e) du/ Chair of the **Comité d'éthique de la recherche en sciences de la santé et sciences / Health Sciences and Sciences Research Ethics Board**

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Appendix D – Measurements and Assessments

Study 1 (article 1)

Sociodemographic and Medical Characteristics

This part of the questionnaire is needed to help understand the characteristics of the people participating in our study. For this reason, it is very important information. All information is held in strict confidence.

1. Date of birth (month/year): _____

☐ I prefer not to answer

2. Select the option you identify with:

☐ Woman

☐ Man

☐ Gender-fluid, non-binary, and/or Two-Spirit

☐ I prefer not to answer

3. Civil status (i.e., relationship status):

☐ Never married

☐ Married

☐ Common law

☐ Single/dating

☐ Widowed

☐ Divorced

☐ Separated

☐ In a relationship

☐ I prefer not to answer

4. Education (please check highest level attained):

☐ Some high school

☐ Completed high school

☐ Some university/college

☐ Completed university/college

☐ Some graduate school (e.g., master's degree, PhD)

☐ Completed graduate school (e.g., master's degree, PhD)

☐ I prefer not to answer

5. Annual household income in Canadian dollars:

☐ Less than \$5,000

☐ \$5,000 - \$9,999

☐ \$10,000 - \$14,999

☐ \$15,000 - \$19,999

☐ \$20,000 - \$24,999

☐ \$25,000 - \$29,999

☐ \$30,000 - \$34,999

☐ \$35,000 - \$49,000

☐ \$50,000 - \$74,999

☐ \$75,000 - \$99,999

☐ \$100,000 - \$149,999

☐ \$150,000 - \$199,999

☐ \$200,000 - \$249,999

☐ \$250,000 or more

☐ Do not know

☐ I prefer not to answer

6. Employment status (please select all those that apply):

☐ Full-time student

☐ Part-time student

☐ Other (please specify):

☐ Full-time work

☐ Homemaker

☐ On disability

☐ Part-time work

☐ Unemployed

☐ I prefer not to answer

☐ Retired

7. Do you have children?

- ☐ Yes
☐ No
☐ I prefer not answer

8. If yes, please specify the age(s) and whether they live with you:

Child 1: Age _____	Lives with you ☐
Child 2: Age _____	Lives with you ☐
Child 3: Age _____	Lives with you ☐
Child 4: Age _____	Lives with you ☐
Child 5: Age _____	Lives with you ☐
Child 6: Age _____	Lives with you ☐

9. Has a doctor or nurse ever told you that you have the following?

1. Angina	☐ Yes	☐ No
2. Heart attack	☐ Yes	☐ No
3. Stroke	☐ Yes	☐ No
4. Diabetes	☐ Yes	☐ No
5. High blood pressure	☐ Yes	☐ No
6. High blood cholesterol	☐ Yes	☐ No

10. Has a doctor or nurse ever told you that you have any other health condition(s) (including a mental health diagnosis) that were not listed above?

- ☐ Yes, I have been told I have (please specify): _____
☐ No

11. Do you identify as Indigenous; that is First Nations (North American Indian), Métis, or Inuit?

- ☐ Yes
☐ No
☐ I prefer not answer

If yes, select the options that you identify with:

- ☐ First nations ☐ Inuit ☐ Métis ☐ I prefer not to answer

12. Do you identify as a member of a visible minority in Canada?

Note: Visible minority refers to whether a person belongs to a visible minority group as defined by the Employment Equity Act and, if so, the visible minority group to which the person belongs. The Employment Equity Act defines visible minorities as “persons, other than Aboriginal peoples, who are non-Caucasian in race or non-white in colour.”

- ☐ Yes
☐ No
☐ I prefer not answer

If yes, Select the options that you identify with:

☐ Korean	☐ Japanese	
☐ Chinese	☐ South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.)	☐ Southeast Asian (including Vietnamese, Cambodian, Laotian, Thai; etc.)
☐ West Asian (e.g., Iranian, Afghan, etc.)	☐ Arab	☐ Black
☐ Latin American	☐ Filipino	☐ White
☐ Another visible minority group (please specify):	☐ Multiple visible minorities (please specify):	☐ Prefer not to answer

13. What was the date of your cancer diagnosis (month/year)? _____

14. What type of gynecologic cancer were you diagnosed with (please select those that apply)?

☐ Ovarian	☐ Endometrial/uterine
☐ Cervical	☐ Vulvar
☐ Vaginal	

15. What stage of cancer were you diagnosed with?

- ☐ Stage 0
☐ Stage I
☐ Stage II
☐ Stage III
☐ Stage IV
☐ Do not know
☐ Not applicable, staging does not apply to my cancer

16. Did you undergo surgery for your cancer?

- ☐ Yes, I underwent surgery for my cancer: _____ (month/year).
☐ No, I did not undergo surgery for my cancer.
☐ No, I am scheduled to undergo surgery for my cancer.

17. Did you complete radiation therapy for your cancer?

- ☐ Yes, I completed radiation therapy for my cancer: _____ (month/year)
☐ Do not remember.
☐ No, I did not receive radiation therapy.
☐ No, I am still receiving radiation therapy.

18. Did you complete chemotherapy for your cancer?

- ☐ Yes, I completed chemotherapy for my cancer: _____ (month/year).
☐ Do not remember.
☐ No, I did not receive chemotherapy.
☐ No, I am still receiving chemotherapy.

19. Are you currently receiving hormonal therapy for your cancer?

- ☐ Yes
☐ No

20. Are you currently taking any medications (do not include vitamins and minerals)?

- ☐ Yes, I am taking (please specify): _____
☐ No

21. Since being diagnosed with cancer, have you experienced any changes in your weight?

- ☐ Yes, I have gained more than 11 pounds.
☐ Yes, I have lost more than 11 pounds.
☐ No, my weight has not changed.

22. In general, how would you rate your physical health?

Poor	Okay	Good	Very good	Excellent
1	2	3	4	5

23. In general, how would you rate your mental health?

Poor	Okay	Good	Very good	Excellent
1	2	3	4	5

Physical measures

- Please list your height: _____ (feet) _____ (inches)
- Please list your most recent weight: _____ (pounds)

Interview 1 Guide

- 1) How much importance do you place on the appearance of your body and its functionality?
How much importance do you place on others' (such as your friends, family members, strangers, coworkers) opinions of your body and its functionality?
- 2) How would you describe your attitude toward your body in terms of its appearance (i.e., how you look)? How would you describe your attitude toward your body in terms of its functionality (i.e., what your body is capable of)?
 - a. Do you feel your attitude now is different from before your diagnosis?
- 3) Tell me how you feel when you look in the mirror or when you picture yourself in your mind. This includes how you feel about your appearance, what you think about your body itself, such as your strength and physical abilities, and how you feel in your own skin.
 - a. What do you think other people (such as your friends, family members, strangers, coworkers) think when they look at your body?
- 4) Can you describe any situations/scenarios in which you have had positive thoughts, feelings and attitudes about your body?
 - a. What or who, in your opinion, gives rise to these positive thoughts, feelings and attitudes about your body?
- 5) Can you describe any situations/scenarios in which you have had negative thoughts, feelings and attitudes about your body?
 - a. What or who, in your opinion, triggers these negative thoughts, feelings and attitudes about your body?
- 6) Body-related concerns have been implicated as a trigger for relationship problems by women in past studies. Can you tell me about any concerns and/or changes in sexual feelings or sexual relationships you may have experienced after your cancer diagnosis?
 - a. What impact have these concerns/changes had on you and/or your relationship(s)?
How, in turn has this affected your thoughts, feelings, and attitudes towards your body?
- 7) Women are often bombarded with messages and images of the "ideal body". These images can lead women to internalize this ideal and prompt women to engage in certain behaviours to move closer towards this ideal. What sort of behaviours (e.g., dieting, exercising, dying their hair) have you engaged in with the purpose of altering your body's appearance and/or functionality, and/or to present a desirable image (i.e., make a good impression)?
- 8) Self-care reflects the decisions and actions that people take to cope with a health problem, to improve their health, or take care of themselves. How do you care for your body?
 - a. Do you engage in any mind-body practices, such as mindfulness or meditation? Why or why not?
- 9) Can you tell me about your experience practicing yoga?

- a. How long have you been practicing yoga? Did you practice before your cancer diagnosis? How, if at all, has it changed since your cancer diagnosis?
- b. Where, when and with who do you practice yoga?
- c. Can you tell me your reasons for practicing yoga *now*? Which of these is the most important reason? Are these different from before your cancer diagnosis? How so?
- d. Have you ever stopped your yoga practice? What prompted you to stop? What prompted you to start up again?

10) How do you see your practicing yoga relating to what you think of your body, and how you feel about it?

- a. Are there any particular aspects of your yoga practice that facilitate positive thoughts, feelings and attitudes about your body? Please explain.
- b. Are there any instances when yoga triggered negative thoughts, feelings and attitudes about your body? Please explain.

11) How do you see your practicing yoga relating to your self-care and lifestyle behaviours and relationship with others?

- a. Were there any particular aspects of your yoga practice that facilitate positive behaviours and relationships with others? Please explain.
- b. Are there any instances when yoga triggered maladaptive behaviours and relationships issues with others? Please explain.

Is there anything else you would like to share with me today?

30-Day Journal

Page 1

Please use the following questions to prompt your reflections about your yoga practices, your thoughts and feelings about your body, behaviours, and relationships with others.

Please answer the questions within 24 hours of each session of yoga that you complete over the next 30 days, including practices completed at home.

Date (YYYY/MM/DD): _____

Please use the following prompts to record the characteristics of each yoga class/session you participated in.

1. What type of style of yoga did you participate in?

Hatha	Iyengar	Kundalini	Vinyasa	Ashtanga
Yin	Bikram	Power/exercise	Restorative	Aerial/acro
Sivananda	Other:	I don't know		

2. How long was your session? _____ minutes

3. Where did you practice?

Studio	Gym	Recreation centre	Spa	Home
Outdoors	Other:			

4. Who or what did you use to guide your practice?

An instructor	A DVD	A book	A mobile app	A website
A Youtube video	I did not use a guide	Other:		

5. What time of day did you practice?

Early morning (before 9am)	Morning (9am-12pm)	Afternoon (12-4pm)	Evening (4-7pm)	Night (after 7)

6. Why did you choose to participate in this yoga session?

General wellness	Physical exercise	Stress management	To gain/increase flexibility	To manage weight
To gain clarity and/or focus	Illness prevention	A spiritual activity	To manage or treat a health condition	Other:

Page 2

Please use the following prompts to reflect on your general thoughts and feelings before and after **this session of yoga**. Please discuss both positive and negative feelings (if any). Feel free to use as much or as little space as you need to express yourself.

7. Before yoga, how did you feel or what were you thinking:

8. Did anything happen to make you have these feelings or thoughts? Please explain.

9. After yoga, how did you feel or what were you thinking:

10. Did anything happen to make you have these feelings or thoughts? Please explain.

Page 3

Please use the following prompts to reflect on your thoughts and feelings towards your body before and after **this session of yoga**. Please discuss both positive and negative thoughts and feelings (if any). Feel free to use as much or as little space as you need to express yourself.

11. Before yoga, what did you think about your body:

12. Did anything happen to make you have these thoughts? Please explain.

13. After your session of yoga, what did you think about your body:

14. Did anything happen to make you have these thoughts? Please explain.

15. Before your session of yoga, how did you feel in your body:

16. Did anything happen to make you have these feelings? Please explain.

17. After your session of yoga, how did you feel about your body:

18. Did anything happen to make you have these feelings? Please explain.

Page 4

Please use the next questions to reflect on your relationships with others, **since your last entry**. Please discuss both positive and negative thoughts and feelings (if any). Feel free to use as much or as little space as you need to express yourself.

19. Did anything happen with your partner that related to how you think or feel about your body?

20. Did anything happen with anyone else that was related to how you think or feel about your body?

Page 5

Often times, people participate in different behaviours because they are feeling and/or thinking positively or negatively towards their bodies. Please use the following prompts to reflect on behaviours that you participated in **since your last entry** that you think are because of your yoga session to address your thoughts and feelings towards your body (e.g., meditation, restrictive eating, exercise). Please discuss behaviours that you think may be positive or negative (if any). Feel free to use as much or as little space as you need to express yourself.

21. I participated in (one behaviour):

22. I chose to participate in this behaviour because:

23. This behaviour made me feel:

24. This behaviour made me think:

25. Did you participate in another behaviour to address your thoughts or feelings about your body?

Yes No

If yes, questions 21-25 would populate again. Participants were able to fill out these questions for each behaviour they participated in.

If no, the following message would populate:

Thank you for filling out your journal! Feel free to exit out of your browser. When you are ready to record another session, please use your personal link to start your next entry.

Interview 2 Guide

- 1) Over the last 4 weeks what sort of things did you do to alter your views, thoughts, and attitudes toward your body's appearance and/or functionality (e.g., dieting, exercising, dying your hair)? What about for making a good impression or presenting a more desirable image?
 - a. How are these behaviours different from other self-care behaviours you engage in to care for your body (for instance in the first interview you shared ...)?
- 2) Can you tell me about your experiences practicing yoga in the past month?
 - a. Has this been your experience since your cancer diagnosis or have there been changes?
 - b. Can you tell me about a situation/scenario that stands out as being particularly positive?
 - i. Did this have any impact on how you think of your body, how you feel about it, your behaviors and relationship with others? Please explain.
 - c. Can you tell me about a situation/scenario that stands out as particularly negative?
 - i. Did this have any impact on how you think of your body, how you feel about it, your behaviors and relationship with others? Please explain.
- 3) How do you generally feel before your yoga sessions?
 - a. Do you feel any of these feelings are related to how you think and feel about your body, your behaviours, and relationship with others? How so?
- 4) How do you generally feel about your body, behaviours, and relationships with others after your yoga sessions?
 - a. What do you typically do after you have practiced yoga (i.e., immediately after, the next day)?
- 5) Often, yoga instructors use phrases and prompts that are focused on the body to transition participants through different poses. What kind of phrases and prompts do the instructors use throughout the classes you attend (if applicable; i.e., not self-guided yoga)?
 - a. How do these phrases make you feel in general?
 - b. How do they impact how you think and feel about your body, your behaviours, and relationship with others?
- 6) Do the instructors offer modifications to poses? What do you think about that?
- 7) When the instructors ask you to focus on your breathing, what are you thinking about?
- 8) During yoga, when you are trying to be mindful or focus on your breathing, what kind of thoughts come to you?
 - a. Do you ever have repetitive, prolonged, or recurrent thinking about your body? Please explain.
- 9) When you think about the environment where you most often practice yoga, do you feel it is focused on appearance or functionality? How so?

- 10) Can you tell me what yoga means to you? Has this meaning changed at all throughout your time practicing yoga or since being diagnosed with cancer?
- 11) Can you rate how important yoga is to your day-to-day life *now*? Please explain. What about before your cancer diagnosis?
- 12) Do you feel that having to write in a journal for 4 weeks has had an impact on your perceptions of yoga? Why or why not?
 - a. Do you feel the journal has had an impact on your thoughts and feelings towards your body, your behaviours, or your relationships with others? Please explain.

Is there anything else you would like to tell me?

Study 2 (article 2 and 3)

MEDLINE Search Strategy

1	(wom?n or female*).ti,ab.
2	Women/
3	Female/
4	1 or 2 or 3
5	exp breathing exercises/
6	exp yoga/
7	exp relaxation/ or relaxation therapy
8	exp meditation/
9	exp mindfulness/
10	(yog* or asana or pranayama or dhyana or meditation or relaxation or mindful*).ti,ab.
11	(breath* adj3 exercise?).ti,ab.
12	(body adj3 posture?).ti,ab.
13	(deep* adj3 breath*).ti,ab.
14	(breath* adj3 technique?).ti,ab.
15	5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14
16	exp Neoplasms/
17	exp Medical Oncology/ or exp Psycho-Oncology/
18	(neoplas* or oncolog* or cancer* or tumo?r or leuk?emia* or carcinoma* or adeno-carcinoma* or lymphoma* or malignan* or melanoma* or metasta* or sarcoma* or adenoma* or adenocarcinoma* or blastoma* or mesothelioma*).ti,ab.
19	16 or 17 or 18
20	4 and 15 and 19
21	Limit 20 to (English language and humans)

Study 3 (article 4)

Instructor sociodemographic characteristics

This part of the questionnaire is needed to help understand the characteristics of the people participating in our study. For this reason, it is very important information. All information is held in strict confidence.

1. Date of birth (month/year):

☐ I prefer not to answer

2. Select the option you identify with:

☐ Woman

☐ Man

☐ Gender-fluid, non-binary, and/or Two-Spirit

☐ I prefer not to answer

3. Civil status (i.e., relationship status):

☐ Never married

☐ Married

☐ Common law

☐ Single/dating

☐ Widowed

☐ Divorced

☐ Separated

☐ In a relationship

☐ I prefer not to answer

4. Education (please check highest level attained):

☐ Some high school

☐ Completed high school

☐ Some university/college

☐ Completed university/college

☐ Some graduate school (e.g., master's degree, PhD)

☐ Completed graduate school (e.g., master's degree, PhD)

☐ I prefer not to answer

5. Annual household income in Canadian dollars:

☐ Less than \$5,000

☐ \$5,000 - \$9,999

☐ \$10,000 - \$14,999

☐ \$15,000 - \$19,999

☐ \$20,000 - \$24,999

☐ \$25,000 - \$29,999

☐ \$30,000 - \$34,999

☐ \$35,000 - \$49,000

☐ \$50,000 - \$74,999

☐ \$75,000 - \$99,999

☐ \$100,000 - \$149,999

☐ \$150,000 - \$199,999

☐ \$200,000 - \$249,999

☐ \$250,000 or more

☐ Do not know

☐ I prefer not to answer

6. Employment status (please select all those that apply):

☐ Full-time student

☐ Part-time student

☐ Other (please specify):

☐ Full-time work

☐ Homemaker

☐ On disability

☐ Part-time work

☐ Unemployed

☐ I prefer not to answer

☐ Retired

7. Do you identify as Indigenous; that is First Nations (North American Indian), Métis, or Inuit?

- ☐ Yes
☐ No
☐ I prefer not answer

If yes, select the options that you identify with:

- ☐ First nations ☐ Inuit ☐ Métis ☐ I prefer not to answer

8. Do you identify as a member of a visible minority in Canada?

Note: Visible minority refers to whether a person belongs to a visible minority group as defined by the Employment Equity Act and, if so, the visible minority group to which the person belongs. The Employment Equity Act defines visible minorities as “persons, other than Aboriginal peoples, who are non-Caucasian in race or non-white in colour.”

- ☐ Yes
☐ No
☐ I prefer not answer

If yes, Select the options that you identify with:

☐ Korean	☐ Japanese	
☐ Chinese	☐ South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.)	☐ Southeast Asian (including Vietnamese, Cambodian, Laotian, Thai; etc.)
☐ West Asian (e.g., Iranian, Afghan, etc.)	☐ Arab	☐ Black
☐ Latin American	☐ Filipino	☐ White
☐ Another visible minority group (please specify):	☐ Multiple visible minorities (please specify):	☐ Prefer not to answer

9. How many years have you practiced yoga for? _____

10. How many years have you taught yoga for? _____

11. What is highest level of training (e.g., 200-hour training)? _____

12. What style(s) of yoga are you trained in (select all that apply)?

- ☐ Hatha ☐ Iyengar ☐ Kundalini ☐ Vinyasa ☐ Ashtanga

- ☐ Yin ☐ Bikram ☐ Power/exercise ☐ Restorative ☐ Aerial/acro
☐ Sivananda ☐ Other: ☐ I don't know

13. What style(s) of yoga do you currently teach? When answering, please only report the style(s) that you have taught at least 3 times in the last 12 months.

- ☐ Hatha ☐ Iyengar ☐ Kundalini ☐ Vinyasa ☐ Ashtanga
☐ Yin ☐ Bikram ☐ Power/exercise ☐ Restorative ☐ Aerial/acro
☐ Sivananda ☐ Other: ☐ I don't know

14. How often do you teach? ____/week OR ____/month

a. What is the average session length of your classes? ____ minutes

15. How often do you yourself participate in yoga? ____/week OR ____/month

Sociodemographic and medical characteristics

This part of the questionnaire is needed to help understand the characteristics of the people participating in our study. For this reason, it is very important information. All information is held in strict confidence.

10. Date of birth (month/year): _____

☐ I prefer not to answer

11. Select the option you identify with:

☐ Woman

☐ Man

☐ Gender-fluid, non-binary, and/or Two-Spirit

☐ I prefer not to answer

12. Civil status (i.e., relationship status):

☐ Never married

☐ Married

☐ Common law

☐ Single/dating

☐ Widowed

☐ Divorced

☐ Separated

☐ In a relationship

☐ I prefer not to answer

13. Education (please check highest level attained):

☐ Some high school

☐ Completed high school

☐ Some university/college

☐ Completed university/college

☐ Some graduate school (e.g., master's degree, PhD)

☐ Completed graduate school (e.g., master's degree, PhD)

☐ I prefer not to answer

14. Annual household income in Canadian dollars:

☐ Less than \$5,000

☐ \$5,000 - \$9,999

☐ \$10,000 - \$14,999

☐ \$15,000 - \$19,999

☐ \$20,000 - \$24,999

☐ \$25,000 - \$29,999

☐ \$30,000 - \$34,999

☐ \$35,000 - \$49,000

☐ \$50,000 - \$74,999

☐ \$75,000 - \$99,999

☐ \$100,000 - \$149,999

☐ \$150,000 - \$199,999

☐ \$200,000 - \$249,999

☐ \$250,000 or more

☐ Do not know

☐ I prefer not to answer

15. Employment status (please select all those that apply):

☐ Full-time student

☐ Part-time student

☐ Other (please specify):

☐ Full-time work

☐ Homemaker

☐ On disability

☐ Part-time work

☐ Unemployed

☐ I prefer not to answer

☐ Retired

16. Do you have children?

- ☐ Yes
☐ No
☐ I prefer not answer

17. If yes, please specify the age(s) and whether they live with you:

Child 1: Age _____	Lives with you ☐
Child 2: Age _____	Lives with you ☐
Child 3: Age _____	Lives with you ☐
Child 4: Age _____	Lives with you ☐
Child 5: Age _____	Lives with you ☐
Child 6: Age _____	Lives with you ☐

18. Has a doctor or nurse ever told you that you have the following?

7. Angina	☐ Yes	☐ No
8. Heart attack	☐ Yes	☐ No
9. Stroke	☐ Yes	☐ No
10. Diabetes	☐ Yes	☐ No
11. High blood pressure	☐ Yes	☐ No
12. High blood cholesterol	☐ Yes	☐ No

10. Has a doctor or nurse ever told you that you have any other health condition(s) (including a mental health diagnosis) that were not listed above?

- ☐ Yes, I have been told I have (please specify): _____
☐ No

24. Do you identify as Indigenous; that is First Nations (North American Indian), Métis, or Inuit?

- ☐ Yes
☐ No
☐ I prefer not answer

If yes, select the options that you identify with:

- ☐ First nations ☐ Inuit ☐ Métis ☐ I prefer not to answer

25. Do you identify as a member of a visible minority in Canada?

Note: Visible minority refers to whether a person belongs to a visible minority group as defined by the Employment Equity Act and, if so, the visible minority group to which the person belongs. The Employment Equity Act defines visible minorities as “persons, other than Aboriginal peoples, who are non-Caucasian in race or non-white in colour.”

- ☐ Yes
☐ No
☐ I prefer not answer

If yes, Select the options that you identify with:

- ☐ Korean
 ☐ Japanese
- ☐ Chinese
 ☐ South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.)
 ☐ Southeast Asian (including Vietnamese, Cambodian, Laotian, Thai; etc.)
- ☐ West Asian (e.g., Iranian, Afghan, etc.)
 ☐ Arab
 ☐ Black
- ☐ Latin American
 ☐ Filipino
 ☐ White
- ☐ Another visible minority group (please specify):
 ☐ Multiple visible minorities (please specify):
 ☐ Prefer not to answer

26. What was the date of your cancer diagnosis (month/year)? _____

27. What type of gynecologic cancer were you diagnosed with (please select those that apply)?

- ☐ Ovarian
 ☐ Endometrial/uterine
- ☐ Cervical
 ☐ Vulvar
- ☐ Vaginal

28. What stage of cancer were you diagnosed with?

- ☐ Stage 0
☐ Stage I
☐ Stage II
☐ Stage III
☐ Stage IV
☐ Do not know
☐ Not applicable, staging does not apply to my cancer

29. Did you undergo surgery for your cancer?

- ☐ Yes, I underwent surgery for my cancer: _____ (month/year).
☐ No, I did not undergo surgery for my cancer.
☐ No, I am scheduled to undergo surgery for my cancer.

30. Did you complete radiation therapy for your cancer?

- ☐ Yes, I completed radiation therapy for my cancer: _____ (month/year)
☐ Do not remember.
☐ No, I did not receive radiation therapy.
☐ No, I am still receiving radiation therapy.

31. Did you complete chemotherapy for your cancer?

- ☐ Yes, I completed chemotherapy for my cancer: _____ (month/year).
☐ Do not remember.
☐ No, I did not receive chemotherapy.
☐ No, I am still receiving chemotherapy.

32. Are you currently receiving hormonal therapy for your cancer?

- ☐ Yes
☐ No

33. Are you currently taking any medications (do not include vitamins and minerals)?

- ☐ Yes, I am taking (please specify): _____
☐ No

34. Since being diagnosed with cancer, have you experienced any changes in your weight?

- ☐ Yes, I have gained more than 11 pounds.
☐ Yes, I have lost more than 11 pounds.
☐ No, my weight has not changed.

35. In general, how would you rate your physical health?

Poor	Okay	Good	Very good	Excellent
1	2	3	4	5

36. In general, how would you rate your mental health?

Poor	Okay	Good	Very good	Excellent
1	2	3	4	5

Physical measures

1. Please list your height: _____ (feet) _____ (inches)

2. Please list your most recent weight: _____ (pounds)

Focus group guide for Instructors

Purpose: explore yoga instructors (1) opinions on length, duration, dosage, location, poses, and delivery-style of yoga sessions, and (2) support, training, and resources required to facilitate a yoga program for cancer survivors.

Introduction:

- The purpose of this focus group is to explore your opinions and thoughts about the protocol for the yoga program, including the length of the program, the duration of the sessions, the number of sessions per week (i.e., dosage), the location of the sessions, the poses and prompts used, delivery-style of instructor, and type of yoga (i.e., hatha, Iyengar).
- We would also like to hear about your impressions on the support, training, and resources you think you would need to facilitate this program
- Before we start, we just want to remind you that if we start talking about something on this topic that is strongly important to you, please feel free to talk openly and honestly about it. Also, if you do not want to talk about a certain topic, that is okay as well. Remember, there are no right or wrong answers for any of the questions we ask during this focus group. We are not here to judge you but learn from you.
- This discussion will also be audio-taped and video-taped, in that way, we will be able to better listen to you without have to write notes, although we may take some notes if there is a topic we would like to follow-up about. All identifying information, including your name, used during this interview will be removed when the focus group dialogue is transcribed.
- Finally, we want to take this opportunity to ask that you do not share information discussed within the focus group with individuals outside the group.
- Do you have any questions or concerns before we begin?
- Could everyone please take 2 minutes to introduce yourselves. Please share your name, your experience teaching yoga, including years of experience, types of yoga, and whether you have taught yoga for individual's diagnosed with cancer.

Evaluating the program

1. What do you think of the length of the program, the duration of the sessions, and number of weekly sessions? Please explain.
2. What do you think of the outline of the prototypical session, including:
 - a. The poses and their sequence?

- b. The timing of the sequences?
 - c. The style of yoga?
- 3. As we created the prototypical sessions, we thought about the transitions, that is, what instructors could say to get participants to move from one pose to the next. What did you think about the prompts we provided?
- 4. A good yoga class has a logical flow to it. We want the poses to weave together intuitively. Think about the sequence of the poses. Do you feel they flow in a coherent manner? Why or why not? What changes, if any, would you make.
 - a. We want to ensure participants' safety during the sessions. Do you feel the poses are safe and that the sequences allow for adequate preparation for each pose? If you think something needs to be added, altered, or removed, please let us know.

Support, training, and resources

- 5. Beyond providing instructors with a protocol and prototypical session, we want them to feel confident in their ability to deliver it. Without having received any training on how to deliver this yoga program to women after gynecologic cancer, what is your confidence level to deliver this program? What would you need to increase your confidence?
- 6. Do you see yourself able and willing to deliver a program like this one? Why or why not?
- 7. Some people may not feel comfortable delivering a yoga program to women with gynecologic cancer. As such, we are looking to deliver a training. How do you think it would be most beneficial to receive training on a program like this?
 - a. What kind of support or resources do you think you need to deliver a program like this? Why or why not?
 - b. What information would be helpful or necessary to include in a training session?
 - c. What are your unanswered questions about using yoga to support women's body image and perceptions of sexual health after gynecologic cancer?
- 8. Is there any additional information you would need to be able to deliver this type of program?
- 9. Is there anything else you would like to share about the protocol or training required to deliver the program?

Focus group guide for Cancer Survivors

Purpose: explore adults diagnosed with cancer (1) opinions on length, duration, dosage, location, poses, and delivery-style of yoga sessions, and (2) impressions of the usefulness and utility of a yoga program to address body image and their perceptions of their sexual health to ensure the proposed program and preliminary delivery manual are in line with discussions from the virtual consensus meeting.

Introduction:

- The purpose of this focus group is to explore your opinions and thoughts about the design of the yoga program, including the length of the program, the duration of the sessions, the number of sessions per week (i.e., dosage), the location of the sessions, the poses and prompts used, delivery-style of instructor, and type of yoga (i.e., hatha, Iyengar).
- We would also like to hear about your impressions on the usefulness and utility of the program.
- Before we start, we just want to remind you that if we start talking about something on this topic that is strongly important to you, please feel free to talk openly and honestly about it. Also, if you do not want to talk about a certain topic, that is okay as well. Remember, there are no right or wrong answers for any of the questions we ask during this focus group. We are not here to judge you but learn from you.
- This discussion will also be audio-taped and video-taped, in that way, we will be able to better listen to you without have to write notes, although we may take some notes if there is a topic we would like to follow-up about. All identifying information, including your name, used during this interview will be removed when the focus group dialogue is transcribed.
- Finally, we want to take this opportunity to ask that you do not share information discussed within the focus group with individuals outside the group.
- Do you have any questions or concerns before we begin?

Focus Group Questions

10. What do you think of the length of the program, the duration of the sessions, and number of weekly sessions? Please explain.
 - a. How do you see the program, if at all, impacting the way you see yourself? What about your relationships with others?
11. What do you think of the outline of the prototypical session, including:
 - a. The poses and their sequence?
 - b. The timing of the sequences?
 - c. The style of yoga?
12. As we created the prototypical sessions, we thought about the transitions, that is, what instructors could say to get participants to move from one pose to the next. What did you think about the prompts we provided?

- a. When you think about participating in a yoga session, how and in what ways do you like the yoga instructor to use prompts to guide you through poses and meditations?
13. How do think participating in this prototypical session would impact the way you feel and think about your body? What about your relationships with others?
- a. What do you think is more impactful, poses or prompts? Please explain.
14. A good yoga class has a logical flow to it. We want the poses to weave together intuitively. Think about the sequence of the poses. Do you feel they flow in a coherent manner? Why or why not? What changes, if any, would you make.
- a. We want to ensure participants safety during the sessions. Do you feel the poses and the sequence allow for adequate preparation for each pose? If you think something needs to be added, altered, or removed, please let us know.
15. How would you like to learn about the existence of a program like this?
16. Is the program appealing to you and do you think it would be useful to you? Please explain.
17. When do you think it would be most beneficial to participate in a program like this? Please explain.
18. Can you think of anything or anyone that would stop you from participating in a program like this? Please explain.
19. Is there any additional information or support you would like to receive in a program like this?
20. Is there anything else you would like to share about the program or the usefulness and utility of the program?

Study 4 (article 5 and 6)

Baseline/Program/Follow-up Survey

Sociodemographic and Medical Characteristics - only for the first baseline survey

This part of the questionnaire is needed to help understand the characteristics of the people participating in our study. For this reason, it is very important information. All information is held in strict confidence.

1. What is your age in years: _____

a) Prefer not to answer.

2. What is your self-identified gender: _____

a) Prefer not to answer.

3. Civil status (i.e., relationship status):

Never married	Married	Common law	Single/dating
Widowed	Divorced	Separated	In a relationship
Prefer not to answer			

4. Education (please check highest level attained):

Some high school	Completed high school
Some university/college	Completed university/college
Some graduate school (e.g., master's degree, PhD)	Completed graduate school (e.g., master's degree, PhD)
Prefer not to answer	

5. Annual household income: _____ CAD

a) Do not know.

b) Prefer not to answer.

6. Employment status (please select all those that apply):

Student	Disability	Retired
Full-time work	Homemaker	Other (please specify):
Part-time work	Unemployed	Prefer not to answer

7. Do you have any children?

a) Yes

b) No (Continue to question 9)

8. Please give their ages below and indicate if they live with you.

Child 1: _____ years

☐ Currently lives with me

Child 2: _____ years

☐ Currently lives with me

Child 3: _____ years

☐ Currently lives with me

Child 4: _____ years ☐ Currently lives with me
 Child 5: _____ years ☐ Currently lives with me
 Child 6: _____ years ☐ Currently lives with me

9. Has a doctor or nurse ever told you that you have the following?

a) Angina	☐ Yes	☐ No
b) Heart attack	☐ Yes	☐ No
c) Stroke	☐ Yes	☐ No
d) Diabetes	☐ Yes	☐ No
e) High blood pressure	☐ Yes	☐ No
f) High blood cholesterol	☐ Yes	☐ No

10. Has a doctor or nurse ever told you that you have any other health condition(s) (including mental health) that were not listed above?

- a) Yes, I have been told I have (please specify): _____
 b) No

11. What is your ethnic background: _____

12. What was the date of your cancer diagnosis (month/year)? _____

13. What type of gynecologic cancer were you diagnosed with (please select those that apply)?

☐ Ovarian	☐ Endometrial/uterine
☐ Cervical	☐ Vulvar
☐ Vaginal	☐ Do not know

14. What stage of cancer were you diagnosed with?

- a) Stage 0
 b) Stage I
 c) Stage II
 d) Stage III
 f) Do not know
 g) Not applicable, staging does not apply to my cancer

15. Did you undergo surgery for your cancer?

- ☐ Yes, I underwent surgery for my cancer: _____ (month/year).
☐ No, I did not undergo surgery for my cancer.
☐ No, I am scheduled to undergo surgery for my cancer.

16. Did you complete radiation therapy for your cancer?

- ☐ Yes, I completed radiation therapy for my cancer: _____ (month/year)
☐ Do not remember.
☐ No, I did not receive radiation therapy.
☐ No, I am still receiving radiation therapy.

17. Did you complete chemotherapy for your cancer?

- ☐ Yes, I completed chemotherapy for my cancer: _____ (month/year).
☐ Do not remember.
☐ No, I did not receive chemotherapy.
☐ No, I am still receiving chemotherapy.

18. Are you currently receiving hormonal therapy for your cancer?

- ☐ Yes
☐ No

19. Are you currently on any medications (do not include vitamins and minerals)?

- a) Yes, I am taking (please specify): _____
b) No

20. Since being diagnosed, have you experienced any changes in your weight?

- a) Yes, I have gained more than 11lbs.
b) Yes, I have lost more than 11lbs.
c) No, my weight has not changed.

21. In general, how would you rate your **physical** health?

Poor	Okay	Good	Very good	Excellent
1	2	3	4	5

22. In general, how would you rate your **mental** health?

Poor	Okay	Good	Very good	Excellent
1	2	3	4	5

Physical measures

1. Please list your height: _____ (feet) _____ (inches)
2. Please list your most recent weight: _____ (pounds)

Functional Assessment of Cancer Therapy-General

Below is a list of statements that other people with your illness have said are important. Please circle or mark one number per line to indicate your response as it applies to the **past 7 days**.

	Physical Well-being	Not at all	A little bit	Some-what	Quite a bit	Very much
1	I have a lack of energy	0	1	2	3	4
2	I have nausea	0	1	2	3	4
3	Because of my physical condition, I have trouble meeting the needs of my family	0	1	2	3	4
4	I have pain	0	1	2	3	4
5	I am bothered by side effects of treatment	0	1	2	3	4
6	I feel ill	0	1	2	3	4

	Social/Family Well-being	Not at all	A little bit	Some-what	Quite a bit	Very much
1	I feel close to my friends	0	1	2	3	4
2	I get emotional support from my family	0	1	2	3	4
3	I get support from my friends	0	1	2	3	4
4	My family has accepted my illness	0	1	2	3	4
5	I am satisfied with family communication about my illness	0	1	2	3	4
6	I feel close to my partner (or the person who is my main support)	0	1	2	3	4
	<i>Regardless of your current level of sexual activity, please answer the following question. If you prefer not to answer it, please mark this box ☐ and go to the next section.</i>					
7	I am satisfied with my sex life	0	1	2	3	4

	Emotional Well-being	Not at all	A little bit	Some-what	Quite a bit	Very much
1	I feel sad	0	1	2	3	4
2	I am satisfied with how I am coping with my illness	0	1	2	3	4
3	I am losing hope in the fight against my illness	0	1	2	3	4
4	I feel nervous	0	1	2	3	4
5	I worry about dying	0	1	2	3	4
6	I worry that my condition will get worse	0	1	2	3	4

	Functional Well-being	Not at all	A little bit	Some-what	Quite a bit	Very much
1	I am able to work (include work at home)	0	1	2	3	4
2	My work (include work at home) is fulfilling	0	1	2	3	4
3	I am able to enjoy life	0	1	2	3	4
4	I have accepted my illness	0	1	2	3	4
5	I am sleeping well	0	1	2	3	4
6	I am enjoying the things I usually do for fun	0	1	2	3	4
7	I am content with the quality of my life right now	0	1	2	3	4

Functional Assessment of Cancer Therapy-Cognitive Function Perceived Cognitive Abilities

Below is a list of statements that other people with your illness have said are important. Please circle or mark one number per line to indicate your response as it applies to the **past 7 days**.

		Not at all	A little bit	Some- what	Quite a bit	Very much
1	I have been able to concentrate	0	1	2	3	4
2	I have been able to bring to mind words that I wanted to use while talking to someone	0	1	2	3	4
3	I have been able to remember things, like where I left my keys or wallet	0	1	2	3	4
4	I have been able to remember to do things, like take medicine or buy something I needed	0	1	2	3	4
5	I am able to pay attention and keep track of what I am doing without extra effort	0	1	2	3	4
6	My mind is as sharp as it has always been	0	1	2	3	4
7	My memory is as good as it has always been	0	1	2	3	4
8	I am able to shift back and forth between two activities that require thinking	0	1	2	3	4
9	I am able to keep track of what I am doing, even if I am interrupted	0	1	2	3	4

Functional Assessment of Chronic Illness Therapy – Fatigue Scale

Below is a list of statements that other people with your illness have said are important. Please circle or mark one number per line to indicate your response as it applies to the **past 7 days**.

		Not at all	A little bit	Some- what	Quite a bit	Very much
1	I feel fatigued	0	1	2	3	4
2	I feel weak all over	0	1	2	3	4
3	I feel listless (“washed out”)	0	1	2	3	4
4	I feel tired	0	1	2	3	4
5	I have trouble <u>starting</u> things because I am tired	0	1	2	3	4
6	I have trouble <u>finishing</u> things because I am tired	0	1	2	3	4
7	I have energy	0	1	2	3	4
8	I am able to do my usual activities	0	1	2	3	4
9	I need to sleep during the day	0	1	2	3	4
10	I am too tired to eat	0	1	2	3	4
11	I need help doing my usual activities	0	1	2	3	4
12	I am frustrated by being too tired to do the things I want to do	0	1	2	3	4
13	I have to limit my social activity because I am tired	0	1	2	3	4

Female Sexual Distress Scale – Revised

Below is a list of feelings and problems that women sometimes have concerning their sexuality. Please read each item carefully and select the number that best describes how often that problem has bothered you or caused you distress during the **past 7 days**. Select only one number for each item, and take care not to skip any items.

		Never	Rarely	Occasionally	Frequently	Always
How often did you feel:						
1	Distressed about your sex life	0	1	2	3	4
2	Unhappy about your sexual relationships	0	1	2	3	4
3	Guilty about sexual difficulties	0	1	2	3	4
4	Frustrated by your sexual problems	0	1	2	3	4
5	Stressed about sex	0	1	2	3	4
6	Inferior because of sexual problems	0	1	2	3	4
7	Worried about sex	0	1	2	3	4
8	Sexually inadequate	0	1	2	3	4
9	Regrets about your sexuality	0	1	2	3	4
10	Embarrassed about sexual problems	0	1	2	3	4
11	Dissatisfied with your sex life	0	1	2	3	4
12	Angry about your sex life	0	1	2	3	4
13	Bothered by low sexual desire	0	1	2	3	4

Body Image Scale

In this questionnaire you will be asked how you feel about your appearance, and about any changes that may have resulted from your disease or treatment. Please read each item carefully and select the reply which comes closest to the way you have been feeling about yourself, during the **past 7 days**.

	Not at all	A little	Quite a bit	Very much
1. Have you been feeling self-conscious about your appearance?	1	2	3	4
2. Have you felt less physically attractive as a result of your disease or treatment?	1	2	3	4
3. Have you been dissatisfied with your appearance when dressed?	1	2	3	4
4. Have you been feeling less feminine/masculine as a result of your disease or treatment?	1	2	3	4
5. Did you find it difficult to look at yourself naked?	1	2	3	4
6. Have you been feeling less sexually attractive as a result of your disease or treatment?	1	2	3	4
7. Did you avoid people because of the way you felt about your appearance?	1	2	3	4
8. Have you been feeling the treatment has left your body less whole?	1	2	3	4
9. Have you felt dissatisfied with your body?	1	2	3	4
10. Have you been dissatisfied with the appearance of your scars?	1	2	3	4
Not applicable ☐				

Perceived Stress Scale

The questions in this scale ask you about your feelings and thoughts during the **past 7 days**. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

		Never	Almost never	Some times	Fairly often	Very often
1	In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2	In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3	In the last month, how often have you felt nervous and “stressed”?	0	1	2	3	4
4	In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
5	In the last month, how often have you felt that things were going your way?	0	1	2	3	4
6	In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
7	In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
8	In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
9	In the last month, how often have you been angered because of things that were outside of your control?	0	1	2	3	4
10	In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

Acceptance and Action Questionnaire II

Below you will find a list of statements. Please rate how true each statement is for you for the **past 7 days** by selecting a number next to it using the scale below.

		Never true	Very seldom true	Seldom true	Some- times true	Frequ- ently true	Almost always true	Always true
1	My painful experiences and memories make it difficult for me to live a life that I would value	1	2	3	4	5	6	7
2	I'm afraid of my feelings	1	2	3	4	5	6	7
3	I worry about not being able to control my worries and feelings	1	2	3	4	5	6	7
4	My painful memories prevent me from having a fulfilling life	1	2	3	4	5	6	7
5	Emotions cause problems in my life	1	2	3	4	5	6	7
6	It seems like most people are handling their lives better than I am	1	2	3	4	5	6	7
7	Worries get in the way of my success	1	2	3	4	5	6	7

Experiences of Embodiment Scale

Please choose the number from the following that best describes how you feel about each of the statements listed below. Indicate your response by selecting a number beside each statement:

Please provide responses for how you felt the **past 7 days**.

		Strongly Disagree	Somewha t Disagree	Neither Agree nor Disagree	Somewha t Agree	Strongl y Agree
1	I feel in tune with my body	1	2	3	4	5
2	I feel at one with my body	1	2	3	4	5
3	I feel “detached” and separate from my body	1	2	3	4	5
4	I feel depressed/anxious/scare d in/about my body	1	2	3	4	5
5	I care more about how my body feels than about how it looks	1	2	3	4	5
6	I focus more on what my body can do than on its appearance	1	2	3	4	5
7	My eating habits are a way for me to manage my emotions or how I have felt about myself	1	2	3	4	5
8	Generally I feel good/comfortable in my body	1	2	3	4	5
9	I am proud of what my body can do	1	2	3	4	5
10	I feel dissatisfied, envious and frustrated when I compare my body to others	1	2	3	4	5
11	I feel joy in my body	1	2	3	4	5
12	My body reduces my sense of self worth in the world	1	2	3	4	5

13	I sometimes tend to blame my body for difficulties I am having	1	2	3	4	5
14	I am comfortable with my sexual feelings/desires	1	2	3	4	5
15	I engage in potentially harmful or painful behaviours (e.g., disordered eating, bingeing, purging, denying physical needs, skin cutting, burning, drug use, excessive alcohol consumption)	1	2	3	4	5
16	I have an eating disorder	1	2	3	4	5
17	I take good care of, and am respectful of, my body	1	2	3	4	5
		Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
18	I ignore the signs my body sends me (e.g., of hunger, stress, fatigue, illness/injury)	1	2	3	4	5
19	I spend a lot of time/energy/money engaging in activities that I hope make me fit with cultural ideals of beauty (e.g., exercise, clothing, make-up, hair, plastic surgery, skin bleaching)	1	2	3	4	5
20	I am comfortable voicing my views, opinions and beliefs	1	2	3	4	5
21	I find it difficult to express my emotions	1	2	3	4	5
22	I am aware of my needs	1	2	3	4	5
23	It is hard for me to read/identify my feelings	1	2	3	4	5

24	I am comfortable with, and proud of, who I am	1	2	3	4	5
25	I consider myself to be a powerful person	1	2	3	4	5
26	I am aware of, and confident in, my strengths and abilities	1	2	3	4	5
27	My dissatisfaction with my body/appearance has a negative effect on my social life	1	2	3	4	5
28	I feel disconnected from my own sense of sexual desire	1	2	3	4	5
29	I express what I want and need sexually	1	2	3	4	5
30	I feel that I cannot express what I want or need in a dating/partnership relationship	1	2	3	4	5
31	I have difficulty asserting myself with others in the world	1	2	3	4	5
32	I believe in my ability to accomplish what I desire in the world	1	2	3	4	5
33	I put a priority on listening to my body and its needs (e.g., stress, fatigue, hunger)	1	2	3	4	5
34	I constantly think about the way my body fits with cultural standards of appearance	1	2	3	4	5

Integrated Self-Discrepancy Index

On the following page, you will be asked to list qualities that you might apply to yourself. You will be asked to list these for FOUR different types self:

- Your "**ACTUAL** self:" The type of person you are right now; the traits you **actually do have**.
- Your "**SHOULD** self:" Traits that you think you ought to possess; the type of person you have a **duty, obligation, or responsibility** to be; the traits you are **morally obligated** to possess
- Your "**IDEAL** self:" Traits that you would **IDEALLY** like to possess; the type of person you **wish, desire, or hope** to be
- Your "**UNDESIRED** self:" Traits that, in general, you do **NOT** want to possess, traits that are **UNDESIRED**

How are the should and ideal self different?

Here is an example of how the ideal and should selves are different: I may hope to be rich someday, being rich may be a goal I have for myself, but I do not think I have a duty or a moral obligation to be rich. So, rich would be a word that describes the type of person I ideally want to be, but it is not a word that describes the type of person I think I should be.

Is the should self just more realistic than the ideal self?

No, not necessarily. Everyone differs in how realistic the traits of the ideal and should selves are, as well as how much they actually possess those traits. For you, just think about who you ideally want to be and who you think you should be, not about which one is more realistic.

For each list, think carefully about the type of qualities you are being asked to list. You may use any words you want to describe these different types of self.

Please list the attributes of the type of person you would IDEALLY like to be; the type of person you wish, desire, or hope to be.

- 1.
- 2.
- 3.
- 4.
- 5.

Please list the attributes of the type of person you believe you SHOULD or OUGHT to be; the traits you believe you are morally obligated to possess.

- 1.
- 2.
- 3.
- 4.
- 5.

Please list the attributes of the type of person you do NOT want to be; the traits that are UNDESIRED.

- 1.
- 2.
- 3.
- 4.
- 5.

To what extent does each of the qualities listed below actually describe who you are now?

The qualities will be generated based on participants' responses to the above questions.

		Does not describe me at all	Describes me slightly	Describes me somewhat	Describes me well	Completely describes me
1						
2						
3						

4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

Interview Guide for Adults Diagnosed with Gynecologic Cancer

- The purpose of this interview is to explore your opinions and thoughts about the yoga program that you just completed.
 - I would also like to hear about what you liked and disliked, including things you think we must keep for the next participants and things you think should be removed.
 - Before we start, I just want to remind you that if we start talking about something on this topic that is strongly important to you, please feel free to talk openly and honestly about it. Also, if you do not want to talk about a certain topic, that is okay as well, and keep in mind that there are no right or wrong answers for any of the questions I ask during this interview.
 - This interview will be audio- and video-recorded, in that way, I will be able to better listen to you without having to write down what you say, although I may take notes if there is a topic I would like to follow-up about. All identifying information, such as your name as well as other names, used during this interview will be removed when the interview dialogue is transcribed.
 - I want to emphasize that this will probably feel like a one-way conversation with a lot of pauses and few silences and that is okay. The pauses and silences are my way of ensuring I'm not interrupting your thoughts or stories.
 - Do you have any questions or concerns before we begin?
1. What did you enjoy or like about the yoga program overall?
[Probes: Can you give me some examples?]
 2. What did you dislike about the yoga program overall?
[Probes: Can you give me some examples?]
 3. What did you think of the overall structure of the program, like its length and number of classes? Is there anything you would change? *[Probes: The number of classes in total (24)? , The length of the classes (60 minutes)? The content (i.e., asanas, meditations, breath work)? The number of classes per week (2)? The length of time in-between classes? The size of the classes?*
 4. What did you think of the location, specifically the Ottawa Regional Cancer Foundation, and time of the classes?
 5. How did you attend class most often – online or in-person? Why?
 - a. What did you think about having to attend in-person with others for the first 2 weeks?
 - b. Did you like having the option to attend online?
 - c. *If they practiced online*, what did you think about the environment of the location for when you practiced online? What did you like/dislike about the environment?
 - d. What difficulties or challenges, if any, did you encounter attending classes in-person and/or online? What would have helped minimize these difficulties/challenges?

6. What did you think of content of the program – the poses, breathwork, and meditation?
7. If you had to rate your satisfaction with the *yoga program* overall on a scale of 0-10, with 0 being poor and 10 being excellent, how would you rate it? What about the *instructor*?

My next few questions are about the supplemental program features that you had the option to use or participate in during the program.

8. When you think about the pre-recorded videos to support at-home practices, How many did you end up watching? Why did you choose to watch these videos? [Probes: What did you think about: The number of videos available (10)? The length of the videos (15mins)? The content (i.e., asanas, meditations, breath work)? Did you find the videos to be helpful or useful? What would have helped to make the videos more helpful or useful?
9. If you had to rate your satisfaction with the *pre-recorded videos* overall on a scale of 0-10, with 0 being poor and 10 being excellent, how would you rate it?
 - i. Would you continue to use the videos if you had access to them? Why or why not?
10. When you think about the group discussions that took place after the classes, how often would you stay to participate in the group discussions?
 - a. What were your motives to stay? What did these group discussions offer you? Did you find them helpful or useful?
 - b. Did you find you were able to form a connection with the other participants? Why or why not? Was this important to you?
11. When you think about the journaling option:
 - a. How often did you complete a journal?
 - i. What prompted you to complete the journal?
 - ii. Did you find the journal beneficial? Why/why not?
12. Would you recommend the yoga program to others?
 - a. Why or why not?

My next few questions are to explore your thoughts on whether the program had any impact on your thoughts, feelings, and behaviours towards yourself and others.

13. What did participating in this yoga program mean to you?
14. Did you experience a change in how you view your body during the program? [Probes: *did you experience greater connection and comfort with your body? Did you experience a sense of agency and functionality? Did you experience a change in your experience and expression of desire? Did you place more emphasis on your self-care?*]
 - a. If you did, when do you feel this happened and what do you think lead to this change?

15. Did you experience a feeling of being within and ‘at one’ with your body during the program?
16. To what extent do you think participating in the yoga program had an impact on you think or feel about your body?
17. How, if at all, do you think participating in the yoga program had an impact on the relationships you have with others, which includes close family, friends, co-workers, and strangers.
18. When you think about the ideal version of yourself (ideal self), what comes to mind? Do you feel this is the same or similar to who you should be (ought self) or who you are right now (actual self)?
 - a. Over the course of the program, did you experience any changes in how you think/feel/view about yourself and who you think you should be?

My last few questions are about the study itself and how we can potentially improve it for the next participants.

19. What did you think about the yoga instructor you had?
 - a. Did you find the intake form and meeting to be useful or worthwhile? Why or why not?
20. When thinking of the questionnaires that you have been completing and will continue to complete:
 - a. Was there anything you think we should be measuring that we are not?
 - b. What do you think about having to complete them online and receiving links by email?
 - c. What do you think about the frequency and length?
 - d. Are there any questionnaires/topics that bother you or that you like?
21. What were your expectations for this yoga program and study when you first signed up?
 - a. Do you feel your expectations have been met so far (or will be met by the time you complete your final survey)? [*Probes: Why or why not?*]
22. What could make your experience better in this study? [*Probes: communication (written/verbal), number of study assessments, screening/consent process*]
23. Do you have any additional comments or experiences you would like to share before we conclude this interview?

Interview Guide for Yoga Instructor

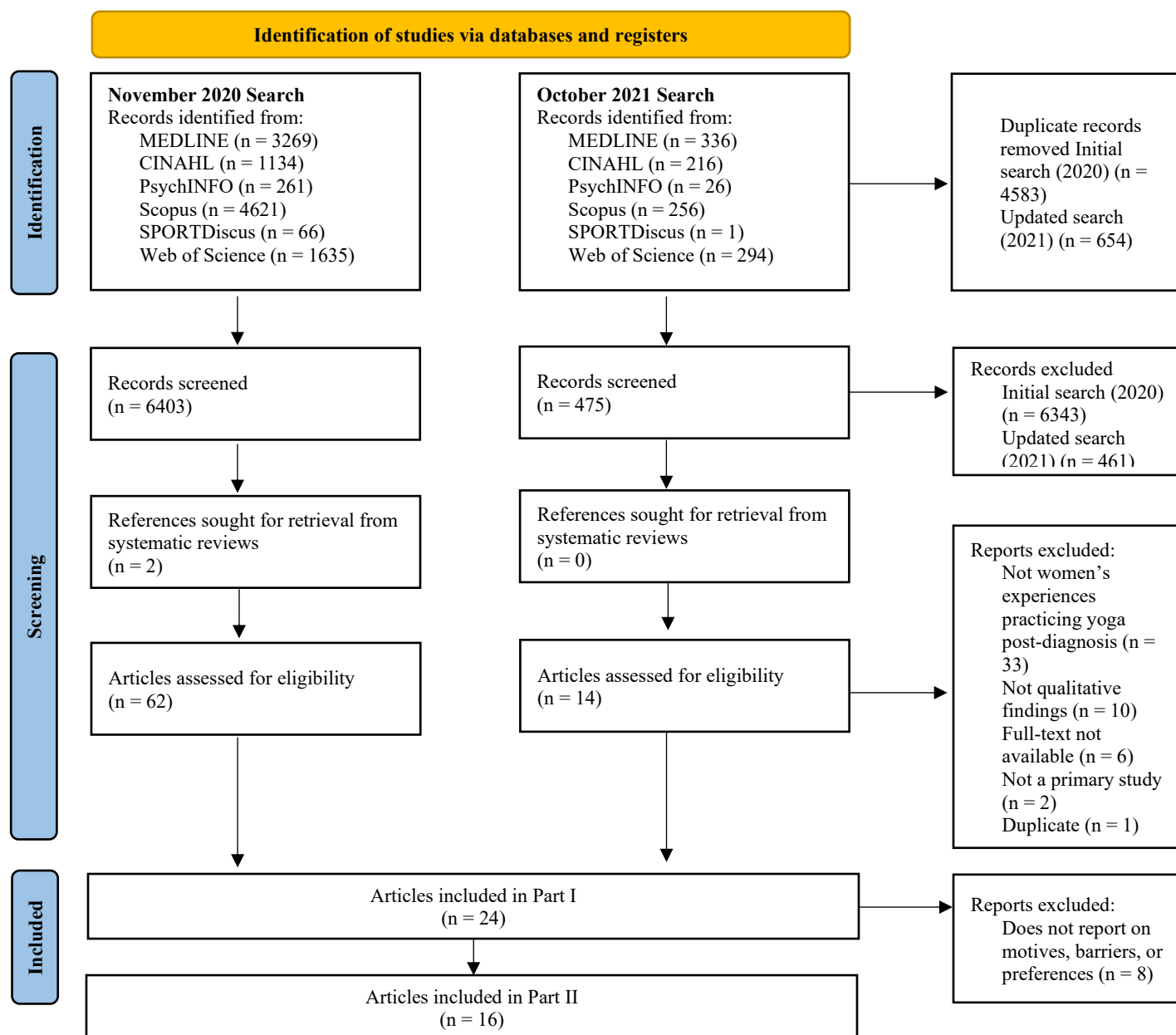
1. What do you think about the training you received to offer the 12-week yoga program [*Probes: how relevant was it, was the length and content sufficient, how useful was it to you, did your knowledge of the yoga program and confidence to deliver it increase as a result of the training?*]?
 - a. What about it was helpful? Least helpful?
 - b. Following the training, how would you rate your confidence to deliver the yoga program as intended, that is your belief in your ability to deliver it, on a scale of 0 (not able at all) to 10 (very able)?
 - c. What aspects of the training, if any, could be improved [*Probes: content, structure, instructor, design*]??
2. What do you think about the yoga program manual and readings you received?
 - a. What about them was helpful? Least helpful?
 - b. What aspects of the yoga program manual and/or readings, if any, could be improved [*Probes: content, design and presentation*]??
3. Overall, how well, on a scale of 0 (inadequately) to 10 (very adequately), do you feel the 3-hour training, the yoga program manual, and the readings you received collectively prepared you to deliver the yoga program? Please explain your response.
4. With regards to the yoga program, what do you think about:
 - a. The number of classes in total (24)?
 - b. The length of the classes (60 minutes)?
 - c. The content (i.e., asanas, meditations, breath work)?
 - d. The number of classes per week (2)?
 - e. The length of time in-between classes?
 - f. The size of the classes?
 - g. The location, at the Ottawa Regional Cancer Foundation, and time of the classes?
 - h. The supplemental program features? How effective do you think they were?
 - i. The way the yoga program was delivered (i.e., 2 weeks in-person and then hybrid online/in-person)?
 - j. The intake form and meeting?
5. How convenient, on a scale of 0 (not at all convenient) to 10 (very convenient), was it for you to deliver the yoga program? Please explain your response.
6. Explain any challenges *you* faced personally while delivering the yoga program?
 - a. What can be done to mitigate these challenges?
7. Explain any challenges *participants* in your program shared with you that affected your ability to deliver the yoga program [*Probe: yoga program mode (i.e., hybrid)*]?
 - a. If any occurred, how did you handle them? Did you feel prepared to do so? Why or why not?

8. What do you think was the most effective/impactful part(s) of the yoga program (e.g., asanas, meditation, breath work, group bonding/discussion/social support, journaling, at-home practice)? Explain your response.
9. Was there content not covered (or not sufficiently covered), either in the in-person classes or in the pre-recorded videos, that you think would have been helpful to cover? Was there content covered that you think could be removed (or minimized)?
10. What aspects of the yoga program could be improved?
11. Do you have any additional comments or experiences you would like to share before we conclude this interview?

Appendix E – Supplemental Findings

Study 2 (article 3)

Figure 1. PRISMA Flow Diagram for meta-synthesis of women's experiences participating in yoga after a cancer diagnosis.



Study 3 (article 4)

Table 1. Adults diagnosed with gynecologic cancer characteristics who participated in the focus groups.

Participant ID	Focus Group 1			Focus Group 2		
	G1	G2	G3*	G4	G5	G6
Age	51	67		33	39	33
Marital status	Married	Divorced		Common Law	Never married	Common Law
Education	Completed graduate school	Some university/college		Completed university/college	Completed graduate school	Completed university/college
Income	\$100,000 - \$149,999	I prefer not to answer		\$75,000 - \$99,999	\$35,000 - \$49,999	\$100,000 - \$149,999
Employment status	On disability	Retired		Full-time	Part-time	Full-time
Children	Yes	No		No	No	No
Time since diagnosis (months)	11	139		29	10	37
Cancer type	Ovarian	Endometrial/uterine		Cervical	Ovarian	Cervical
Stage	Stage III	Stage I		Stage I	Stage III	Stage I
Surgery	Yes	Yes		Yes	Yes	Yes
Radiotherapy	No	No		Yes	No	No
Chemotherapy	Yes	No		Yes	Yes	No
Hormonal treatments	No	No		Yes	No	No
Weight changes	Lost > 11 pounds	Lost > 11 pounds		Lost > 11 pounds	Lost > 11 pounds	No change
Physical**	3	3		3	3	4
Mental**	3	3		4	2	3

Notes. * = Did not complete sociodemographic and medical characteristics survey. ** = on a 5 point scale, with 1 being the lowest and 5 the highest.

Table 2. Yoga Instructor characteristics

	Focus Group 1			Focus Group 2			Focus Group 3		Focus Group 4		
Participant ID	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11
Age	47	68	41	55	49	58	57	52	53	48	29
Marital status	Married	Divorced	Married	Married	Married	Married	Married	Prefer not to answer	Married	Common Law	Married
Education	Completed university/college	Some graduate school	Completed graduate school	Completed university/college	Completed university/college	Completed high school	Completed university/college	Completed graduate school	Completed graduate school	Completed university/college	Completed graduate school
Household income	\$100,000 - \$149,999	\$50,000 - \$74,999	\$100,000 - \$149,999	I prefer not to answer	\$200,000 - \$249,999	\$100,000 - \$149,999	\$50,000 - \$74,999	\$100,000 - \$149,999	\$75,000 - \$99,999	\$100,000 - \$149,999	\$50,000 - \$74,999
Employment status	Part-time	Part-time	Student/homemaker	Prefer not to answer	Part-time	Full-time	Full-time	Full-time	Part-time	Full-time	Student/Full-time
Ethnicity	White	White	White	I prefer not to answer	White	White	White	White	White	White	Black
Number of years teaching	14	12	3	3	5	10	24	7	21	15	3
Styles trained in	Hatha	Hatha Vinyasa Yin Restorative	Hatha Vinyasa Yin YogaFit	Hatha Vinyasa Restorative	Hatha Vinyasa Yin Restorative	Vinyasa Yin Restorative	Hatha Vinyasa Restorative	Hatha Vinyasa Yin Trauma Sensitive Yoga	Iyengar	Hatha Yin Restorative Sivananda Mantra	Hatha Yin

Number of classes in a typical week										Kirta, Meditati on Nada Yoga		
	28	6	2	2	11	4	4	2	3	7	2	

Study 4 (article 5)

Table 1. Qualitative responses pertaining to acceptability of study methods and program features for 12-week bi-modal hatha yoga program for adults diagnosed with gynecologic cancer (n=19)

Sub-theme and description	Example quote with participant ID
Reasons for reaching out and enrolling in program (qualitative responses related to recruitment)	
<i>In-person programming</i> Due to the pandemic, participants were interested in opportunities that were in-person because they were tired of online programming.	“I think it's useful, particularly I'd say coming out of the pandemic, to have the group [...] I've had enough online stuff, and also, I mean when the pandemic first started I used to try and carry on some fitness classes online and I just get bored. So, I much prefer the in-person” (Mary, morning program)
<i>Group-based programming with similar others</i> Similarly, participants wanted to alleviate some of the isolation that they felt as a result of the pandemic and considered the program appealing because it was a group of similar others.	“to get out and to meet other women in the same sort of bracket, who you know just recovered or have recovered over the years from chemo and radiation and whatnot, and of a similar age” (Linda, morning program)
<i>Timing of classes</i> From a practical standpoint, the timing of the classes fit into their schedules (either in the morning for those retired or after work for those still employed).	“It was, for me, saving my mental health as well. Yeah, because we were just coming out of the pandemic and my body was terrible for sitting for three years and not doing anything. So, for me this whole program gave me hope. I was extremely excited.” (Carol, evening program) “Personally, I prefer doing it in the morning because then your body is more apt to wake up as towards the end of the day you tend to be a little bit more tired. For me, I always prefer doing my running or yoga in the first thing in the morning when it's cooler and then you have the energy for the rest of the day.” (Deborah, morning program)
<i>Convenient location</i> In addition, some participants commented on the added benefit of the location of the building (although this was not a motivating factor for everyone, as several participants noted distance to the building was far).	“It fit well. Yes, it worked well in my schedule two nights a week because I can go home after work to have supper and relax before I headed to class.” (Brenda, evening program) “The location was perfect because it's a 10-minute drive for me.” (Susan, morning program)
<i>Giving back</i>	“I thought it was like super convenient having at the Cancer Center as well too, like it was pretty close to my house, which was great, maybe like a 15-minute drive and free parking, which was great.” (Diane, evening program) “It gave me a sense of feeling of giving back, through research. A way of saying thank you maybe and

Participants were motivated to participate because they wanted to give back to “science” that had helped them and to also create better supports for future cancer patients.

Coping with side-effects

For some, they were interested in how yoga could help them cope with side-effects from treatment (e.g., sleep, urinary inconsistency).

Start or get back into yoga

Others had been interested in starting (or getting back into) yoga for a while and jumped at the opportunity.

New lifestyle

Finally, participants also viewed the program as an opportunity to test out changes they wanted to make in their lifestyle, such as cutting down on the number days they worked.

contributing to the experience of future women who are going to have to go through this. So that was definitely that sense of fulfillment that I was doing something bigger than me.” (Cynthia, morning program)

“I realized for me, the reason I participated in the first place, I felt that I wanted to contribute. I said, “Hey, this is a great opportunity contribute, talk about my experiences, especially if they can help other women going through the same kind of treatment and cancer.” (Elizabeth, evening program)

“I thought it would help more in centralizing some physical issues, like the core strength, I thought that would be more, that in helping bladder and helping more some of the stuff that was damaged through radiation.” (Deborah, morning program)

“for me, you know, my purpose was really I want to get back to doing yoga myself, I want to go through some real guided healing” (Cynthia, morning program)

“I liked that it really introduced me to yoga because pre-pandemic I did yoga and then nothing since the pandemic. So it motivated me to go back.” (Sharon, evening program)

“I think it for me it went even beyond that, you know, to the extent of testing whether I can do four days a week with work” (Cynthia, morning program)

“For me, it meant like a good opportunity to get into like a healthy routine.” (Diane, evening program)

Components that may have impacted the completion of data collection measures (qualitative responses related to retention)

Sense of obligation

Participants acknowledged that they felt they should complete the measures because they were aware of what was asked of them when they signed up for the study.

“If we participated, if we can't fill in forms, do surveys, then we shouldn't bother burdening you with our presence - if we can't cooperate and help in any way we can.” (Linda, morning program)

Altruism

Participating in research, and thus completing the data

“My daughter had depended on individuals for her research to get her PhD and I thought how can I know that and not agree to participate for you and I was a bit frankly hostile in

collection measures, was considered a necessity to ensure good programming for future cancer survivors or supporting research.

Completing questionnaires online

Of the potential options (i.e., online, via phone, pen and paper), online was considered the best option as it allowed for flexibility of when and where to complete the survey package and time to reflect on answers.

Struggled with topic area

Out of the 9 outcomes explored in the survey package, participants predominately raised concerns with the FACT-G, the FSDS, and the SDQ. For the FACT-G and FSDS, participants struggled with the applicability of the questions. While there was the option to answer “never” if the question did not have a bearing on their life, they still found the presence of the question unnecessary. In addition, for the FSDS, participants who were not sexually active did not believe the questions applied to them, even though the focus of the questions were intrapersonal and not interpersonal. Finally, for the SDQ, participants struggled with understanding “why” of the questions as well as with identifying descriptors for themselves.

the beginning in the sense of I don't have time for this.” (Barbara, morning program)

“I enjoy, to me, research is very important and I like to participate in research to help others.” (Brenda, evening program)

“I liked it on the computer. Yeah. Because then I can go at my own pace, or I could just, you know, go back and forth between questions if I wasn't sure where I was feeling in one particular question, I'd go forward or back, so or just leave it.” (Deborah, morning program)

“Online, totally online, don't give me the pen and paper and don't call me, because then like if I want to take a break and come back. No, no, no online. Easy peasy. Do it on my tablet. I can do it like you know, while I'm, like listening to music or, you know, like petting my cat online. 100%.” (Sandra, evening program)

“I often find the you know none of the above or not applicable is something that is just hugely helpful because I know it's a bit of a scapegoat, but I'm a widow and I really find it hard to talk about sexuality. And you didn't allow me an opt out except in the very first question I prefer not to say and it I just I found that so I was very whimsical about it.” (Barabara, morning program)

“Maybe you know as an older person, I hate to say it, but I thought some of the questions were kind of geared to somebody younger than myself, you know? As one gets older, I feel there's a lot more of self-acceptance. [...] The questions with regards to the sex. Well, yeah, it's important, but maybe it's, you know, not the biggest issue at my age.” (Pamela, evening program)

Struggled with timeframe of questions

The questions asked participants to reflect on the past 7 days. For some participants, this was difficult when they interpreted the questions as being “truths” (or traits) of who they are and not necessarily changeable (states).

“I did think that it was hard to say in the past week how has this felt, and I think sometimes I would forget that we're only talking about the last week as, you know, how have you felt about this. So, that was a tricky one, and I wouldn't be surprised if I didn't, if I wasn't always consistent on that.” (Mary, morning program)

“Sometimes I found it hard because umm, sometimes like for me, I always have stomach issues or sudden back problems. So when we talk to physical part, I was like, ‘OK, is it how I feel now?’ So sometimes I had to say no, no, it's true within this last seven days.” (Elizabeth, evening program)

Struggled with repetition in individual questionnaires

Participants were discouraged by the presence of repetitive questions (i.e., stems that were similar but had slight variation in wording) as they wanted to be consistent in their answering and/or they felt they had already answered the question.

“I think from my experience doing the surveys was not the highlight of my day, but you know, and the fact that they were somewhat repetitive if they had been, you know, different questions, more varied, it would have been more interesting.” (Linda, morning program)

“The surveys were always the same questions, so I kind of repeated myself a lot.” (Elizabeth, evening program)

Why people choose to attend the classes (qualitative responses related to adherence rate)

Fit and congruence with lifestyle

Convenient and hospitable location

Attending in-person (the preferred method) was facilitated by the location of the building and the general welcoming environment that was created by the staff.

“Everybody's so incredibly welcoming, like when you come in, how are you today? How are you feeling today? What are you here for? You know, the yoga program, “ohh yeah, that's great” sign in and then when you go to leave, “how did that work for you? Do you feel well?” I mean, there's just such an aura of support, and it is an outstandingly beautiful building, but the staff. They've just hired the right people to be there.” (Barbara, morning program)

“That was fabulous, you know? I would drive by there all the time and I never realized, you know what a welcoming place it was and that they offer all these different programs. And so, I liked it and, and the fact that it was smallish, you know, and easy parking and everything was wonderful.” (Pamela, evening program)

I love the ladies that I greet you as you come in. They are the best, very, very welcoming, full of information and just

Flexibility of bi-modal delivery

The bi-modal delivery of the program provided participants with the chance to still participate if they had other commitments or were not feeling well enough to attend in-person.

Make up of class

The timing of the classes (either morning or evening) allowed participants to choose the time that most met their needs, whether that was accommodating for a higher energy in the morning or working during the day. As a result, the sociodemographic characteristics of participants in the groups were more closely aligned (e.g., employment status, age).

Connection to peers

As the program advanced, attending in-person allowed participants to foster and benefit from interacting with similar others through the provision of informal and instrumental support.

lovely. It's almost like when you walk in there, I feel like I'm Hoo. Like you know, like it's just somewhere to tell you just walk in and it's like the rest of the shit that you carry with you is kind of gone.” (Carol, evening program)

“It was quite a long way from my house, but I didn't mind, you know, getting there, as I said, you were flexible with the zoom for the days where I really couldn't get there or the weather couldn't get me there. So that was not an issue for me.” (Cynthia, morning program)

“I did do the beginning couple weeks in person. I did the last class in person but due to the fact that I couldn't fully participate [due to health concerns], I didn't want to kind of you know disrupt the class by me not being able to do it. And then there was a few weeks there where I had to take on more responsibilities at work so it was really difficult for me to get there in time. So the bulk of the bulk of the classes I did remotely.” (Janet, evening program)

“Personally, I prefer doing it in the morning because then your body is more apt to wake up as towards the end of the day you tend to be a little bit more tired. For me, I always prefer doing my running or yoga in the first thing in the morning when it's cooler and then you have the energy for the rest of the day.” (Deborah, morning program)

“I think like there was a nice mix of people. Like I was one of the younger ones, so like there was me and another girl that were probably closer to 50. And then I know that there was some that was that were probably like late 50s. And then there was probably a few in our class that were probably a little bit older. And I know the morning class was like people that were significantly older than us. So I'm glad that's the way that they grouped out, I think it would have been a little bit different if I was in a class with like, you know the 80-year-olds.” (Sandra, evening program)

“I think I saw us as a group. We had one thing in common to start with, that was gynecological cancer, but we've arranged next Friday, we're all going to go for tea and you know it's sort of we don't want to let it go that we don't want to lose one another. [...] To collect another group of friends when you're in your 60s and 70s and maybe some in their 80s, it's not that easy. It's kind of precious and you don't want to throw that away because we all need friends. We all need to have a social life to sort of keep us active and enjoying life, so I think it created a little unit.” (Linda, morning program)

First 2 weeks of program in-person

The first 2 weeks of the program being mandatory in-person set the foundation for connecting with their peers and creating a sense of trust with the instructor.

“I like the support of the other ladies around me and they motivate me to actually get it done and do it instead of just saying, “Ohh well, maybe I’ll go, maybe I won’t”. No, I should go get off my ass and go because it is the best thing for my mind, body and soul. So, I loved going in-person and plus you got to see these lovely ladies, and everybody usually had a story or somebody would ask you a question or an opinion or give you some advice.” (Carol, evening program)

“You requested we come in person, brilliant, we needed to meet in person because otherwise, I’ve had to do the zoom connections at times when it just couldn’t be avoided for me because I also have a commitment at noon on Thursday so, to get all the way to the general and back wasn’t always not the general, but the Cancer Foundation was not always possible and meet that other commitment. But that was crucial that we got together the first two weeks. Huge part of this success, so we could see each other face to face.” (Barbara, morning program)

“I think that it’s a good thing in a way because it encourages people to come out right, make it a little bit more of a routine than staying at home.” (Sharon, evening program)

Knowledgeable and supportive instructor

Doing (and struggling) with what she asks them

The instructors age and gender were noted as benefits for the participants because they saw themselves in her when she would do the physical postures with the participants and would admit when she was struggling with the postures. This created a sense of safety and comfort.

“Maybe, the fact I think that she was also maybe in a similar age group and maybe you know her own body experiencing certain things she could connect better maybe I don’t know you know because obviously I can’t compare to another instructor but I felt that as compared to classes that, you know these were private sector classes or, you know, in gyms and things that I try to connect to where you didn’t feel the real communication with the instructor. They were just delivering a class and it’s probably my own inhibitions, you know nothing to do with that instructor, but that’s what I meant by Jody coming to your level. She gave you time. She was patient and you know, I guess the fact that she works with people in pain. Even though none of us were in our group, were in, you know, in excessive pain, she was used maybe to accommodating people’s needs.” (Cynthia, morning program)

“She was very kind and welcoming and gentle. And also like funny and like realistic as well too. She was like a real

*Flexible and incorporated
their wants/needs*

The instructor requested input from the participants and then incorporated their suggestions into topics areas, postures, breath practices, or meditations.

person, she was like, 'yeah, I don't like doing sun salutations on the ground. I use a chair. This is modification I do.' And I think that kind of gives people some permission, like even if the yoga instructor is doing modifications, I think it's OK for me to do it." (Diane, evening program)

"You know, I'd asked her something about, I mean, other people from other classes asked about some pelvic floor issues and stuff, and she brought it, you know, sent out links and things and those were helpful. You always knew that if you asked a question and if she didn't have the answer, she'd be getting you one or a list of a book or something, and you could tell she had a ton of experience herself. So, I can't point to any, you know, one thing, but there were a lot of little things that she, that added up." (Donna, morning program)

Gentle, compassionate, non-judgemental

The instructor's interacting style fit the needs of the participants, with many drawing parallels with the types of classes that they had quit previously. The instructor created an environment wherein the participants felt they were allowed to be themselves, to do what they were capable of with encourage to challenge themselves if they wanted to that day.

"I liked the breathwork and bringing in different things to try and she was open, like 'you don't have to like this and if you don't, that's OK.' [...] I like the fact that she gave you options, like you used the chair, don't use the chair, use blocks, don't use blocks, use a band, don't use a band, like she gave you so many different options." (Sandra, evening program)

"The instructor. Jody, I mean, she's outstanding, she has a personality and a professionalism that encourages involvement and interaction. She's incredibly supportive, gentle." (Barbara, morning program)

"She really certainly made an effort to make it comfortable. And you know the way she was just very empathetic, understanding. Sympathetic, I guess is a good way to put it. It was more a comforting atmosphere rather than, let's say you know competitive or anything. I described the whole thing actually as a healing journey to me." (Pamela, morning program)

*Content that supports them to
connect with their body*

The dose of the program was identified as ideal because it provided enough instruction

"I really loved her approach of listening to your own body. She didn't go around the room correcting positioning of our arms and legs like to what end right. It was all about us feeling, I think it was about us feeling more confident and if you're not able to, you know, do a forward bend the way

weekly to develop a connection with the self and long enough to form a connection with their peers and the instructor. In addition, the content and the manner in which the instructor taught the content emphasised listening to and respecting the needs of the body, forming a connection with the body.

she wanted it, that was not the goal necessarily. And I thought that was really great.” (Nancy, morning program)

“I did find that it helped me be more in tuned to my body and listened to more signals and it helped lower my blood pressure. I did end up in the hospital, I had a cardiac event, but it did help bring my blood pressure down some days after work, when I would do it. So. Before I had my [cardiac] event, I was having what I thought were anxiety attacks and different symptoms, so it did help me kind of be more attuned and paid more attention to what I was feeling so I went to the emergency room when I needed to and did not just put it all down to being stressed out.” (Janet, evening program)

Value and use of optional program features (qualitative responses related to program engagement rates)

At-home videos

No added value

Participants did not feel they had the time or a need to add more yoga to their schedule.

“I probably wasn't that interested because if I'm going twice a week, I don't really feel the need to access it on top of twice a week. I'm busy enough, so it was just more than I was willing to consider, I guess.” (Donna, morning program)

“I did look at a couple in the beginning, but then life kind of got in the way and I just did the classes and other things like I was walking and things like that.” (Janet, evening program)

Offering recordings of full classes

Participants suggested that offering recordings of the classes would be beneficial for when they were unable to attend. These recordings were preferable because they were comfortable and used to the instructor's style of teaching while also allowing them to continue on with the progressive nature of the program. In addition, participants noted that they did not want the videos during the program but believed it would be beneficial to have access to

“I think you got into the flow of it [structure of class]. So you know, the [pre-recorded] videos concentrated on a certain thing and I could choose that, but I liked the flow of the classes, you knew more or less what kind of things you were going to do there.” (Mary, morning program)

“Because it was a different person and I find it was a little bit more challenging and it was at when I first started I didn't like it because I found it too challenging at first and Jody I found her class is more she starts you from the bottom right?” (Elizabeth, evening program)

videos after the program to continue their practice.

Journals

Different approaches for different needs

Some participants found value using the journals on a regular basis (i.e., after every class) to remember thoughts and class content. While others did not see a need to journal, as they felt they processed their emotions/thoughts better internally. Finally, for some participants, once the instructor stopped prompting participants to complete a journal entry (after week 3), they either forgot about the journal or preferred to not journal so that they could more fully engage in the group discussions.

“At the beginning Jody would say if you want to take out your journals and then we'd all scurry and get our bags and get our journals out and start writing in them, and then I don't remember her saying that towards the last, maybe four or so classes so I'd go home and think oh there's my journal empty again, I didn't do anything. Sometimes I'd go back to write something. I think it's a good thing to have, just because I didn't use it doesn't mean it's not a good thing to have, but that was just me.” (Susan, morning program)

“I guess I have trouble expressing my emotions and even writing it down on a piece of paper. I just keep it inside or I don't know. It's just, I'm not good at writing. I never know what to write about or what to so I guess I mean maybe a structured journal, I don't know.” (Brenda, evening program)

Group discussions

Motivating

The group discussions were considered an important component of the program that drove connection with the program and facilitated comfort in the classes.

“One of the reasons why I never took up yoga again and also many other classes that I've been to in gyms and things like that, I've dropped out because you go there, you do your thing and you go away. You know, there's absolutely no social interaction and maybe some people like that I am somebody who seems who needs that bonding and social interaction, I've never been able to make it and that was one of the differences with this group, for me. You know, so it's obviously important for me because I've never been able to stick to a group in a gym or anything like that.” (Cynthia, morning program)

““I found that I mostly stayed even though I was like kind of eager to go home to bed for work. I thought that they were really like valuable and I feel like I learned like stuff from the other women.” (Diane, evening program)

Progressive connection

Not an immediate benefit (or connection) but one that

“would have these sessions at the end where we could, you know, we all talked about everything and nothing kind of thing. But it became everything in the end because I guess

grew with continuous discussion and sharing of similar experiences.

we all developed a connection and we felt quite at ease. And you know, you discover that what you're going through, you're not unique and you know it kind of helped me process a lot of my anxieties." (Cynthia, morning program)

Struggled to form connection online

Participants found it difficult to form the same connection with participants who attended primarily online. This was attributed to struggles associated with ease of communicating.

"I just thought it was nice to like connect with people after and to like have that like connection because I think that everyone kind of like comes with from all these like different circumstances and then they come together in this place and like some people are worried about work I know some people worried about their families like some people's parents were sick. So it's kind of like a like a little support and a little check in like community connection... So I do really think that's important." (Diane evening program)

"The zoom is much harder because of the fact that you're not there and there is, she always had this in a circle at the end, which is brilliant, you know none of this boardroom type stuff. We pull together as a circle, but then the people online were sort of had some had their backs to them, we all turned around if someone spoke, but I had to do some of the sessions online and it's not the same. I would really encourage on site as much as possible." (Barbara, morning program)

Sense of community

For the morning program, the group discussions helped to facilitate a sense of emotional safety, cohesion, and connection that lead participants to see themselves as part of a group, which they were committed to trying to maintain post-program.

However, for the evening program, this was less prevalent. Participants felt

"Not so much because again, I was always at home. [...] If it would have been like mandatory 12 weeks, you got to show up, I would have done it and maybe the benefit for me would have been I met a few people, forced me to do it. While doing it online, hey, I don't have to do that, right?" (Elizabeth, evening program)

"Last class I think it was emotional because the girls didn't want to say bye." (Karen, morning program)

"We're going to continue meeting when we had our little tea on the last day, we exchanged emails and actually their meeting I think it's next week." (Deborah, morning program)

"Because of my work, there are times I just didn't linger. I had to go because I had to fit in an hour of work before bed, and so I was conscious of that. Sometimes people were sitting and talking like after the kind of." (Kathy, evening program)

they developed less of a connection because the timing of the classes prompted participants to pack up more quickly to head home instead of connecting post-class.

Notes.

Table 2. Instructor qualitative responses

	Appropriate/Useful	Challenges and Suggestions
Preparation for Program Delivery		
Training Session	Adequate preparation: “I felt quite capable and able after the training. [...] It was excellent. It was beneficial for sure to meet the team, to meet you and the other people on the team, so that was important to make that personal contact, go through the materials and understanding what everybody's role was helpful. It was good to have the opportunity to ask any questions of you that I had come up when I went through the manual itself.”	
Guidebook	Well formatted and helpful content: “I think it was easy to find things, that was handy. It was good to have as a reference and included lots of information. It was well laid out, even the fact that, there was the one page [class structure and timing] that you can just briefly glance like it's just helpful. So each part I think was beneficial. [...] I like to have all the information and I did reference it a lot. It was good to have at the beginning and I went back to it over and over again, various different parts for various different reasons. What have I done? What have I not done?”	Add breath awareness practice: “I would often bring in some other breath awareness practices. I don't particularly like to muck around with people's breath before I get to know them and I want people to get to know their breath and make sure that they have a comfortable starting point before you go into any kind of regulatory regulation type of practice. I would probably do like three sessions, something like that.” Add instructor preparation guidance: “So how do I center and prepare for the class myself? Think about the language I'm going to use to cultivate my own presence. Get grounded, whatever it is that I need to do in order to instruct.” Add class theme/topic suggestions: “Sometimes I would go in with the theme or what I wanted to teach. I would talk about it as part of that check in piece, like ‘today is going to be a little bit softer, more restful practice,’ ‘today is going to be like I got lots of energy and I'm going to really be all about strength and power,’ ‘am I going to give myself kindness?’ Those kind of

things: confidence and power, safe, welcoming, self-permission, compassion, joy. So to have just a list of these are some of the kind of themes that you might want to work with, because I think it's really important piece of the practice - what is your intention today and it could be an instructor's intention or you could put it out towards the class."

Add pelvic floor education:

"Something about pelvic floor stuff. It might be really uncomfortable for people to bring the awareness to that area with a group of people, so it was kind of subtle and I didn't do a lot, but to just get them to know it's OK to go there, you know maybe it's OK to go there again and think about that area of the body or trust in that area in the body or notice that area of the body. [...] At one point, they started talking a little bit more about their own experience and so oh, the this idea of a pelvic floor dilator, so then I of course had to go and research that because, I don't know what they're talking about. That might be something that could be useful to include in the program, and I kind of did that, we got into the diaphragm and the relationship between the diaphragm and the pelvic floor, and we kind of explored that a little bit just in two sessions and they all found it quite useful. So that might be useful.

Intake
meeting
and forms

Useful and necessary: "It was useful. I probably wouldn't want to teach without it, just because that's how I do it now. It was overall a very useful process. And the timing [15 mins] was good."

Adding physical capabilities

questions: "There were some questions that I had that I asked standards: if you had previous yoga experience, if they could get up and down from the floor on their own, if they could do weight bearing on their hands, what their sleep and energy levels were like, and what's their

Delivery of Program

Modifiable protocol **Variation and instructor autonomy:**
 “It was lovely about the program. You had these things that you want included, but it doesn't have to be this [exact flows] because how boring would that be. I think you'd lose people because it just be, like, so boring time after time after time after time.”

biggest concern or challenge that they might have at the moment. So it was just some info because I wanted to get a feel before I went in to teach.”

Dosage **Able to see changes and make connections:** “That [number of weeks] was excellent. It was really starting to kick in probably the last month. It's a bigger commitment, but it's also when they form more as a group. So those extra weeks were important I think.”

A little extra time for shavasana: “I would suggest you know another 15 minutes just to make sure the long shavasana. But that's just me and my teaching, I guess, but an hour, I think an hour is good. An hour and a half might be too long, particularly if you were doing it in the evening and it's, you know, it's hard, people only have so much time in their day, right? An hour is a big commitment.”

“I think 2 at minimum for sure because just the whole time I've been doing this with people you just don't get the same results in once a week. Anecdotal not research wise, but anecdotally that's what I would say.”

Class size

Challenging to tailor for 10 people:
 “I'm not used to teaching that many. It's normally about 6. I mean, it wasn't challenging. I just felt like I couldn't really attend to people as well as I might have if it was a smaller group. Trying to keep my eyes on everyone, I don't know how teachers keep their eyes on 30 people.”

Delivery mode

Adapting teaching style to be more stationary: “I would do certain things and then the assistant would come and change the position of the camera. I didn't really feel like I could get up and walk around because the people that are at home aren't going see what I'm doing. So that was a little bit weird for me.”

Substitute instructor	Reassuring and ensures continuity in delivery: “It was useful to know I had a backup because life happens, right? So I think having that as part of the program, that there is somebody that's familiar with the material and what's going on and the people is important.”	Formally checking on Zoom participants: “I was trying to keep the people on the zoom in my in the back of my head. So it might make sense to do a meeting for the people coming in remotely all the time – ‘is there anything you would like to tell me that is missing for you about my instruction?’ Have some kind of midway conversation, just briefly with them. We could even ask them to stay for a couple of minutes after class and have a brief conversation.”
Location and room features	Convenient: “It was a really great space actually - the fact that they have all the props there is fantastic.”	Better device for monitoring Zoom participants: “One of the notes I made was if I had a bigger screen or had I been closer to the TV, I would have probably had a better feel for what was going on with the people coming in by zoom - I did feel like some of the times I couldn't see them.”
Group discussion		Optional, pre-created music playlist: “I did have a few participants reference music and I think that's a callback to classic studio classes often have music going in the background. Years ago I did but I just find it's too time consuming. So to have a playlist for a more gentle type section of the class. And when you get into more flow or whatever to have something like that is an option would be good.” Self-conscious about facilitating: “I think probably the hardest part for me was the discussion piece, facilitating the discussion. I didn't know if I was doing it right, if they we were getting

enough out of it. I felt like I was kind of continually in there and towards the end was sometimes more just them and all about them. But it was often, I was still in in the discussion piece.”

Using a multidirectional

microphone: “Some more prompts and the technical piece, the microphone because it was awkward trying to facilitate the movement of the microphone around the room and people having to speak into a microphone. So I think that can be off putting for some people because all of a sudden again, they're in the spotlight and I'm speaking on a mic and everybody's going to hear, so it kind of interrupts the flow.”

The necessity of a peer-leader: “So obviously it depends on the people, but there was particularly one person, maybe 2, and I don't think it would have gone in the direction that it went in without her; she kind of led a lot of the discussions and she opened up and she was vulnerable and honest and thoughtful and reflective. So if you don't have someone kind of doing that, it might not have gone the way it went.”

Impact of Program

Connecting with their bodies **Connecting with others and themselves:** “Probably the community social aspect, but I also think the movement piece, the yoga itself, was very impactful for them. Part of it was COVID, people had done yoga before, they were afraid to get back into it or maybe after their treatment. For them, they reiterated over and over towards the end, particularly how safe they felt and how nonjudgmental it was. I don't know that you always find that in studio classes. So for them to have a

place where they can kind of transition and get their confidence was really valuable. So I think the movement piece and learning to trust their bodies and listen to their bodies and what they can do and know that it can change overtime. I think it was really important.”

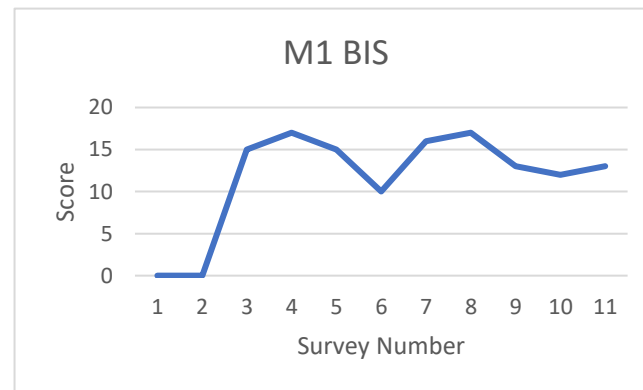
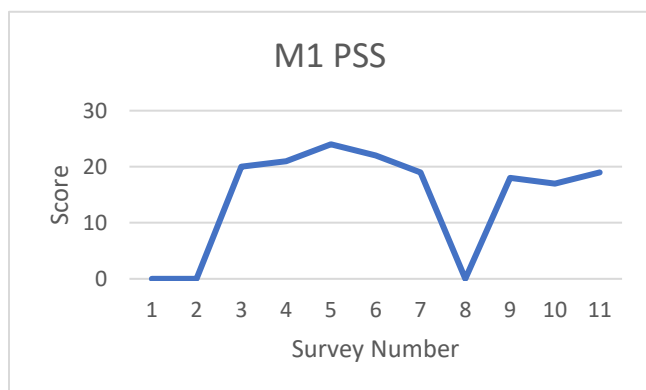
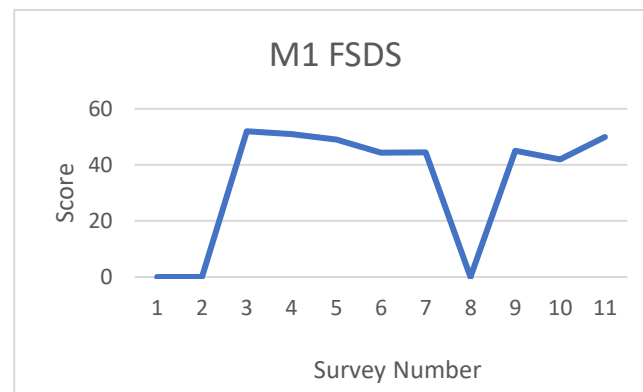
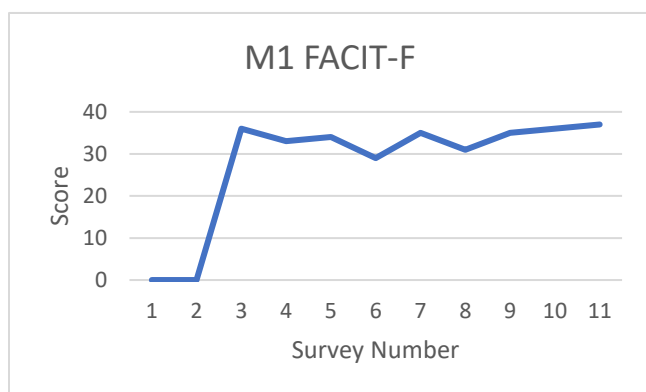
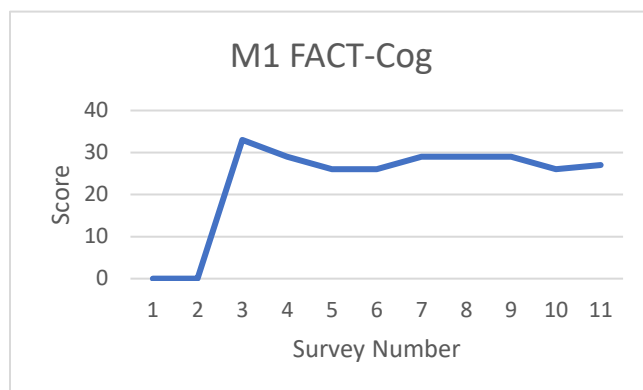
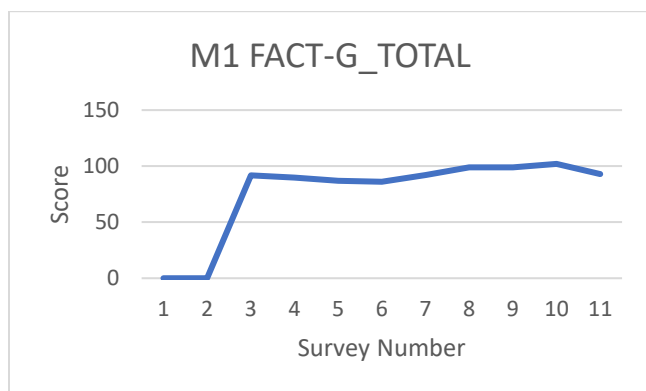
Enriching
experience

An open and understanding

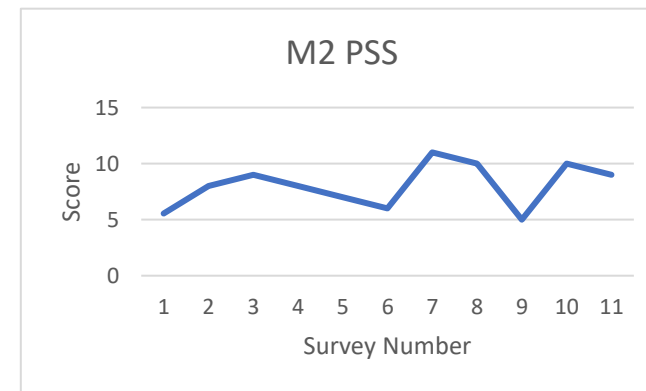
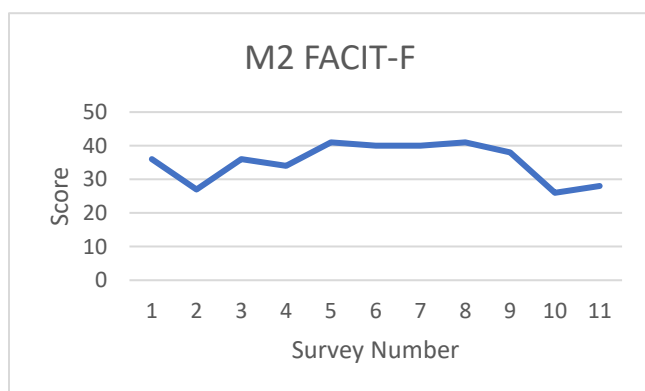
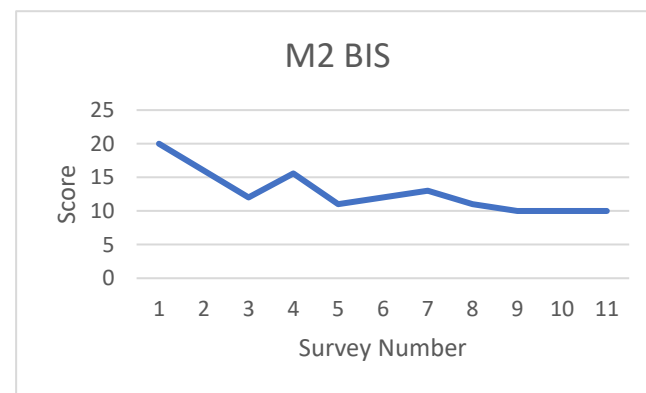
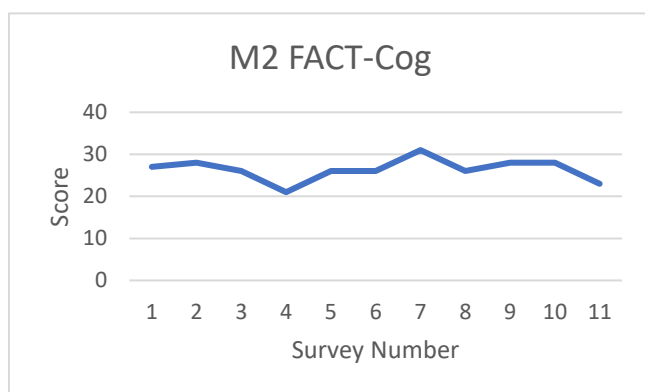
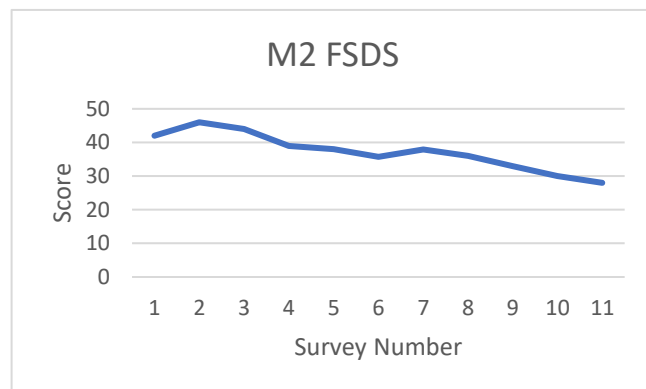
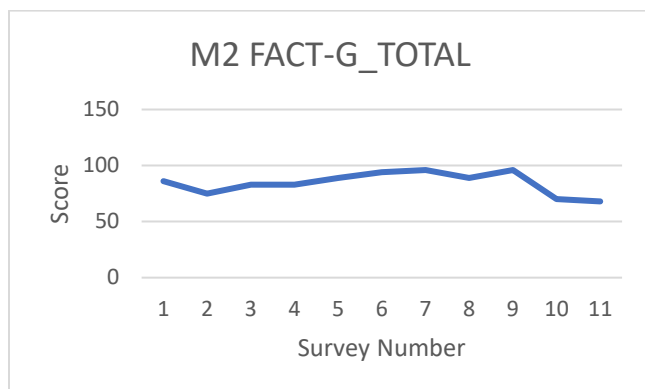
environment: I think it was enriching for them. They had a high level of commitment because perhaps it was enriching but also too I think, it was very meaningful for them to participate in the research because of their own experience. I think that was useful that they could ask me questions and or we could get into experiences and life. Even my age perhaps played a part because I was close to their age. So it might have been different with it 20 year old yoga teacher that for most of these people that was not at that stage in their life, particularly when you're looking at the life aspects and thriving and that sort of thing. I think that was useful.

Study 4 (article 6)

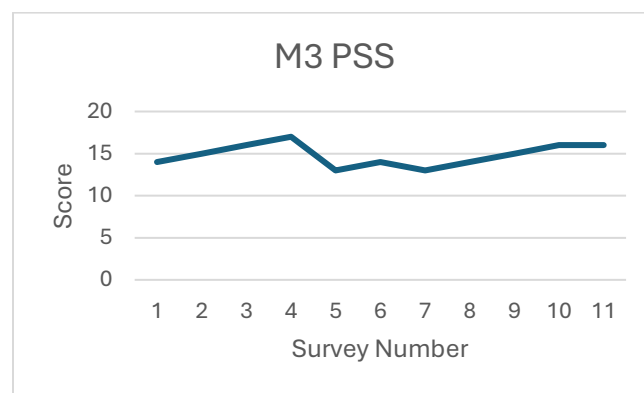
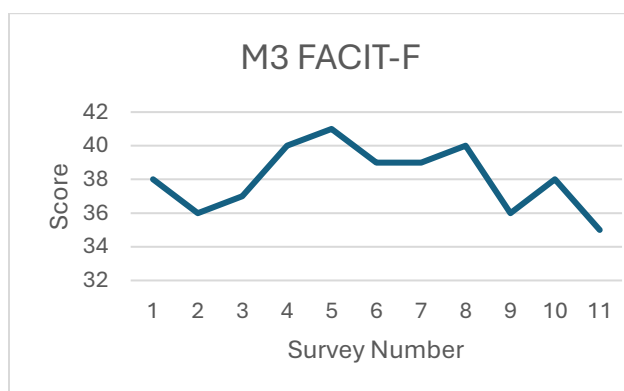
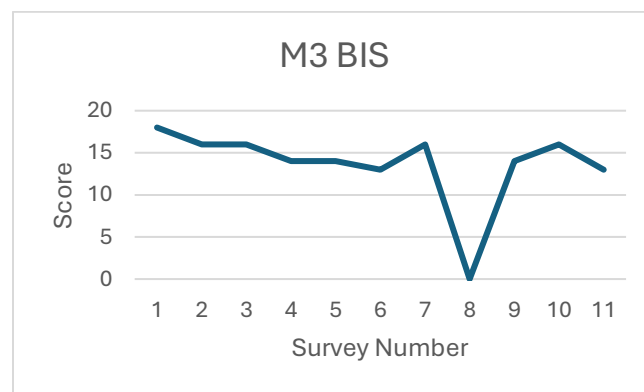
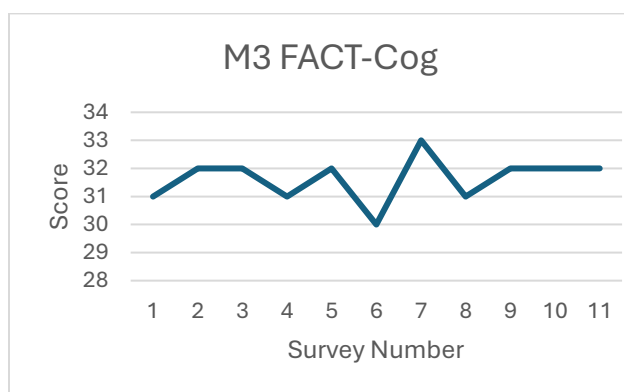
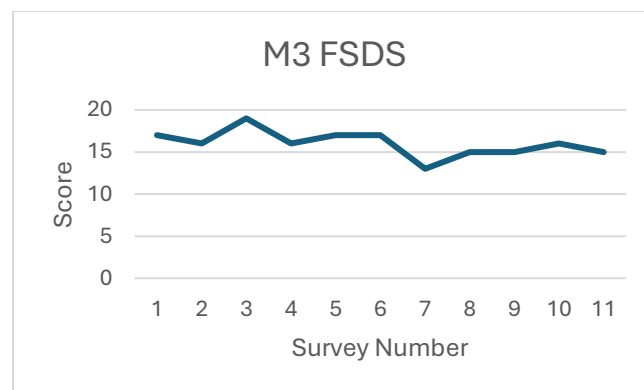
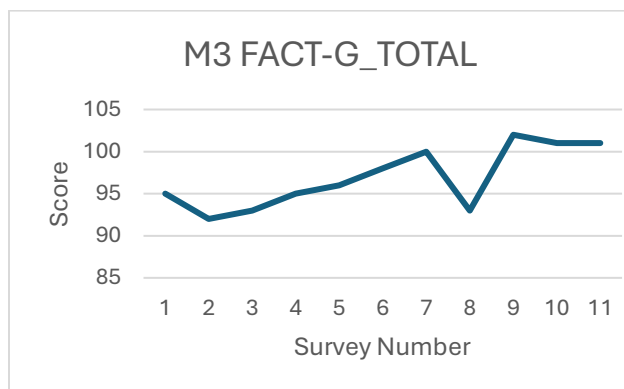
Susan (M1)



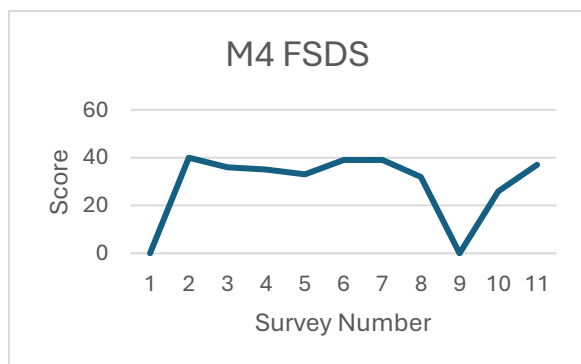
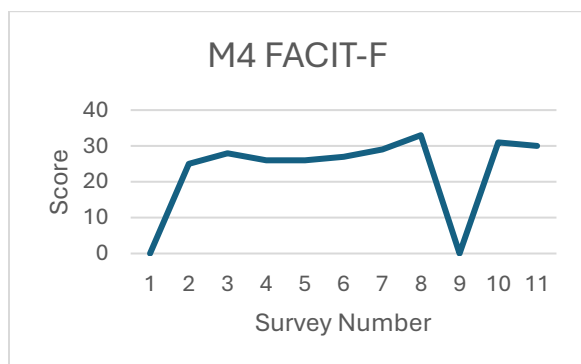
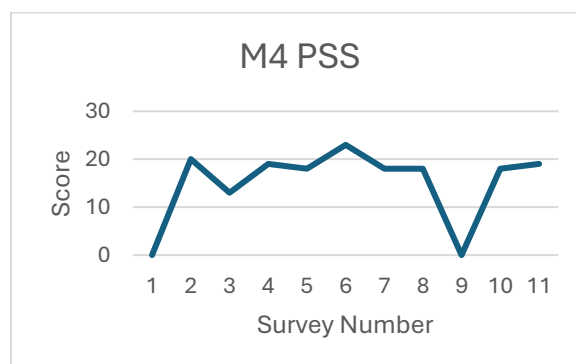
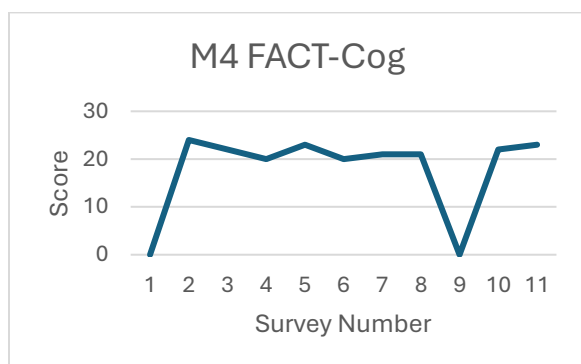
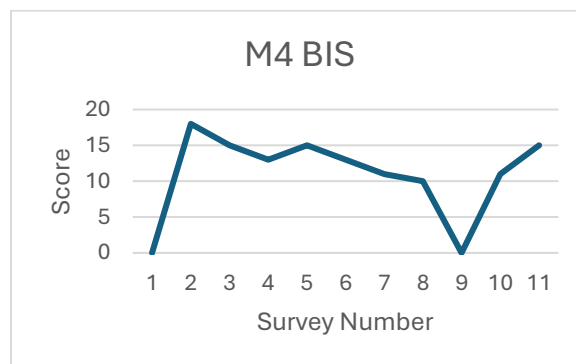
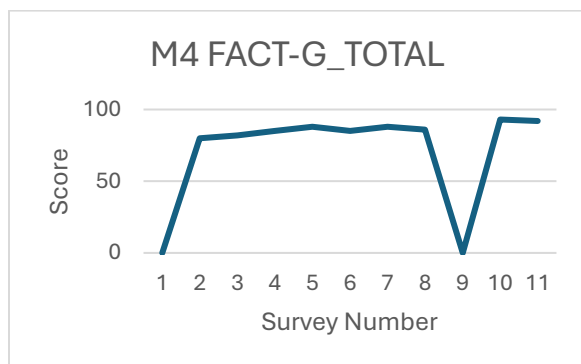
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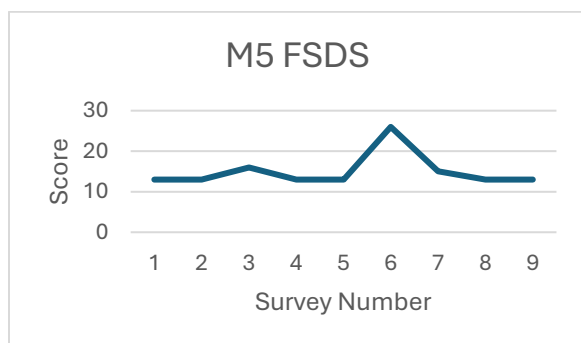
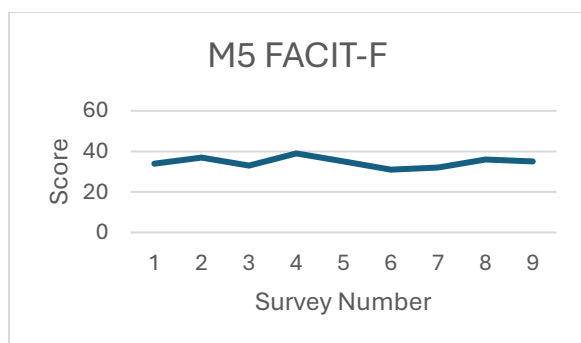
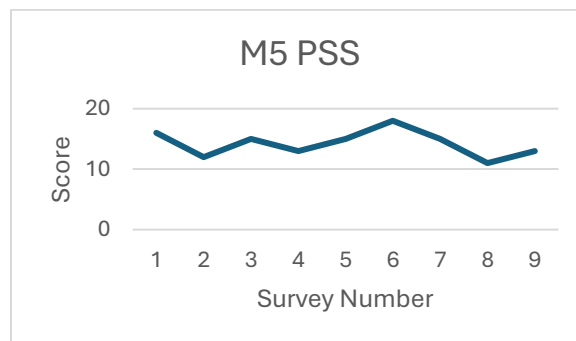
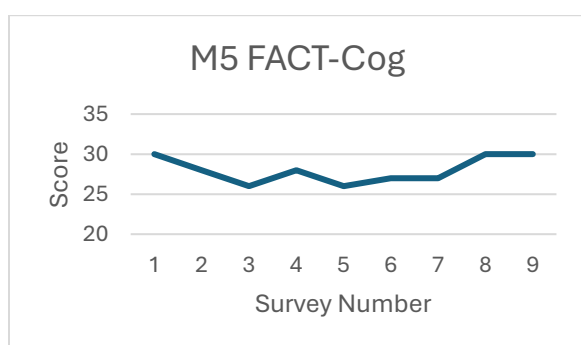
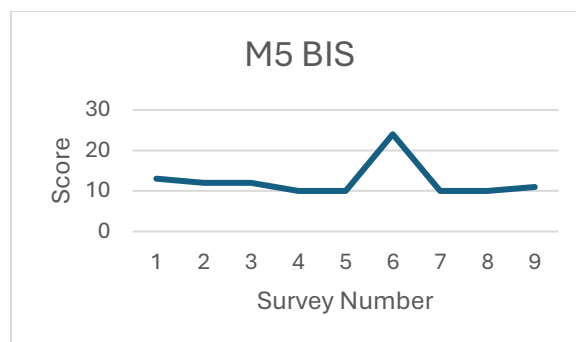
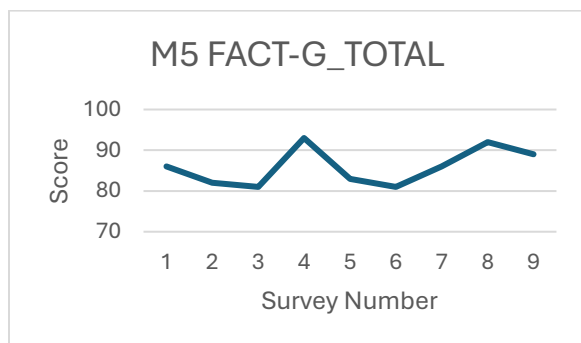
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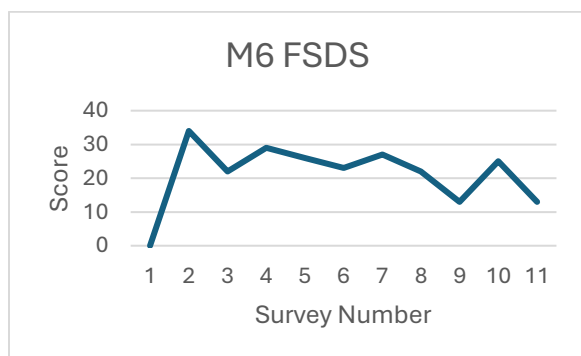
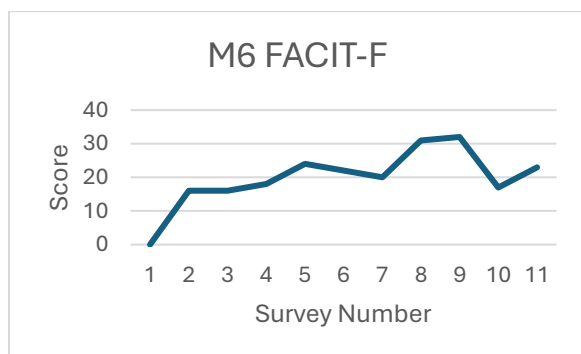
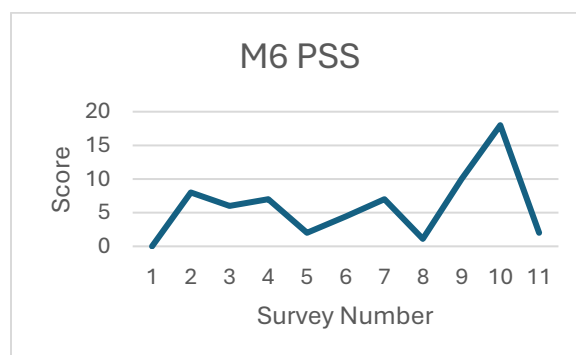
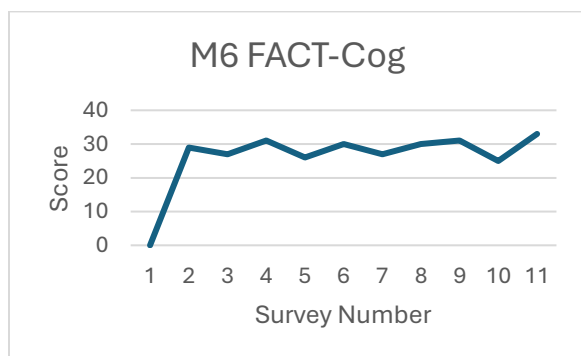
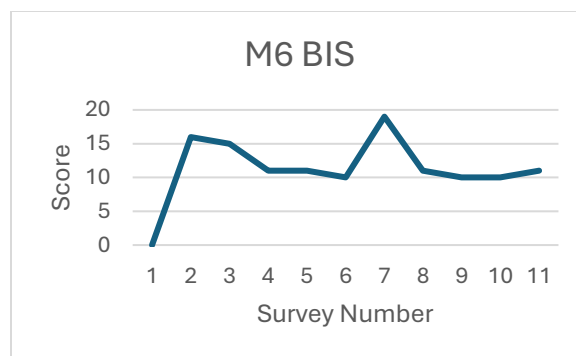
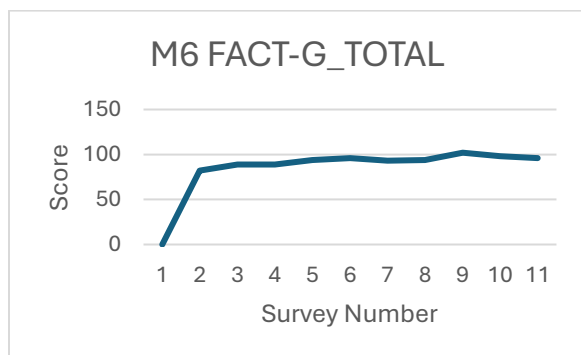
Mary (M4)



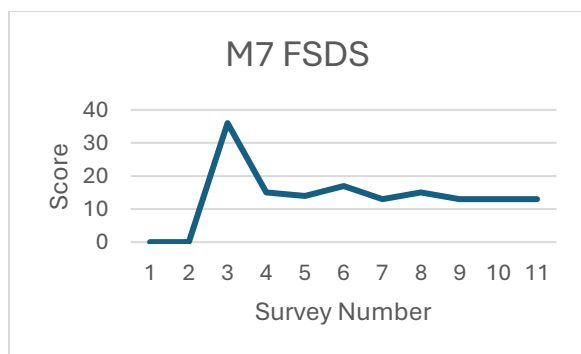
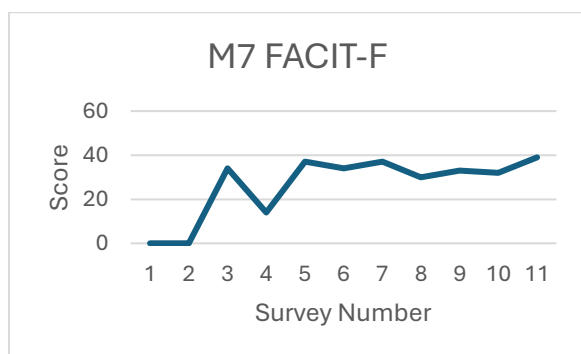
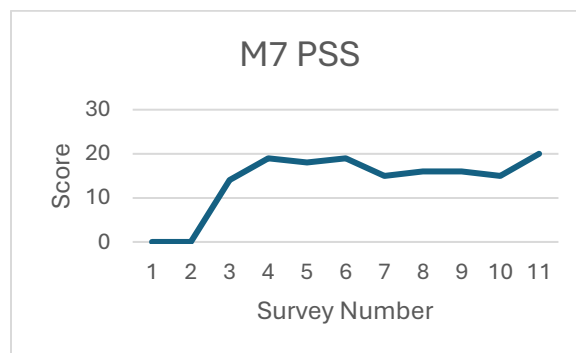
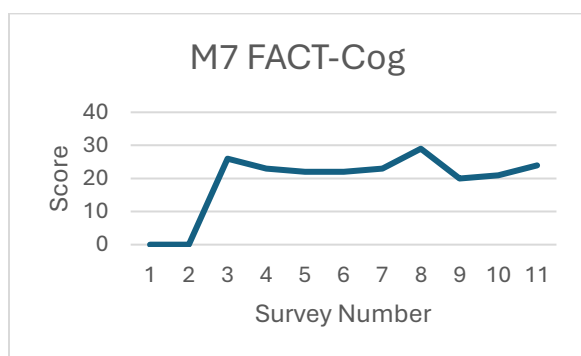
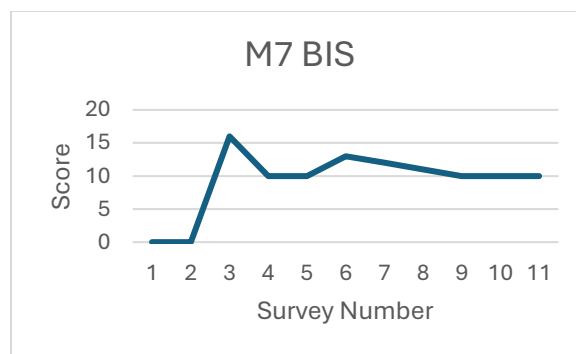
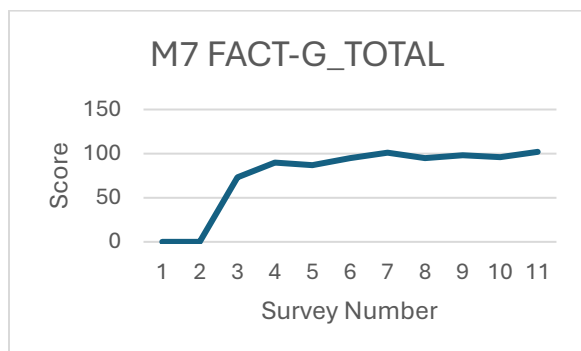
Patricia (M5)



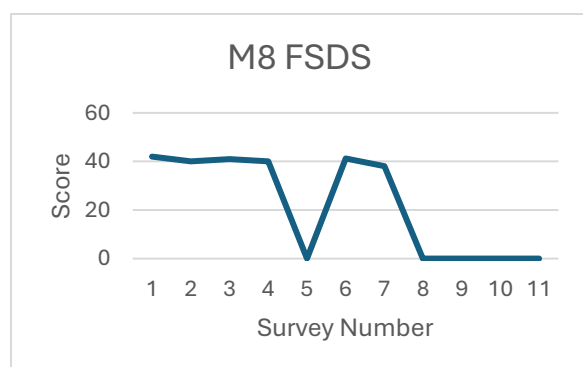
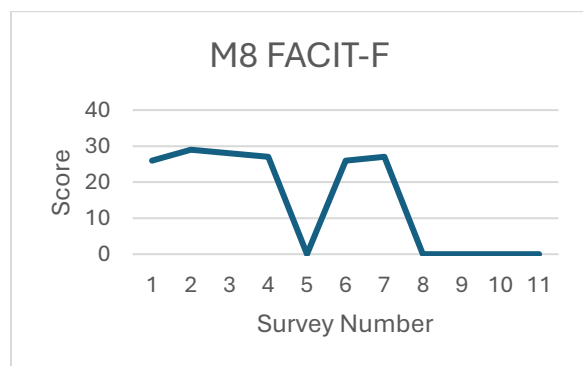
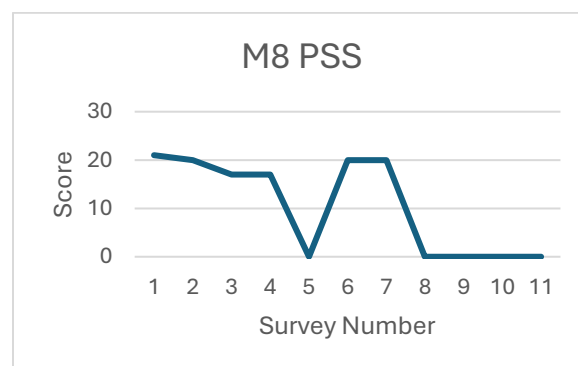
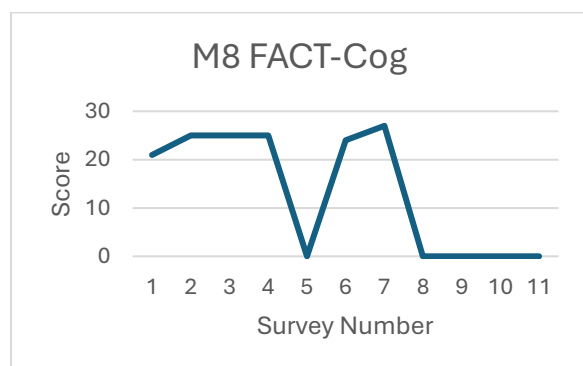
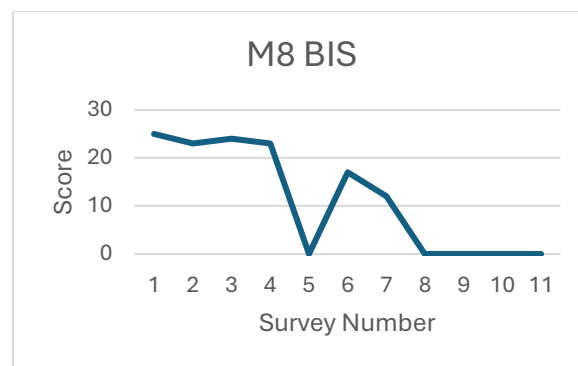
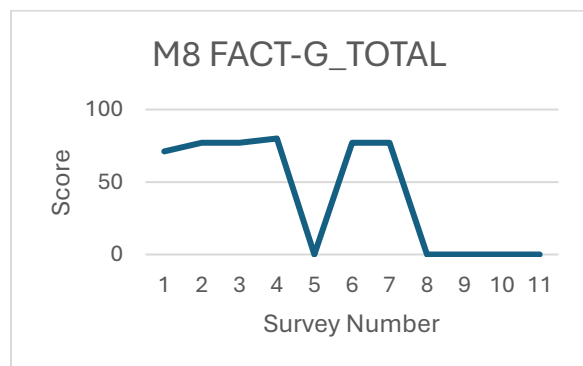
Deborah (M6)



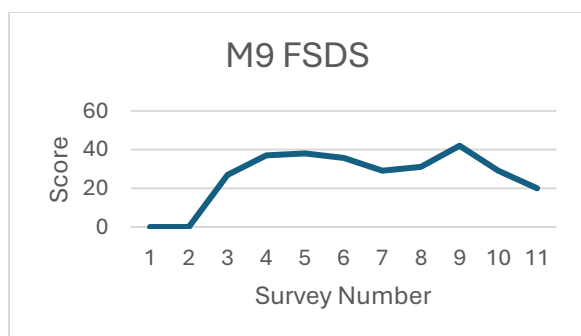
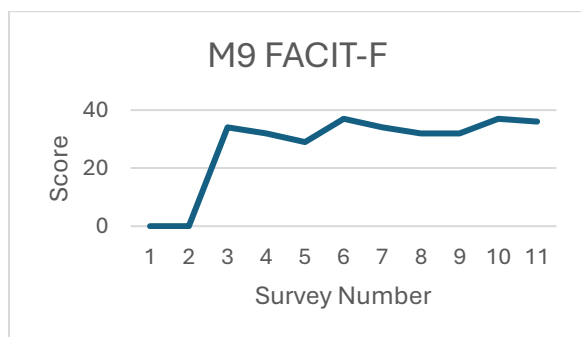
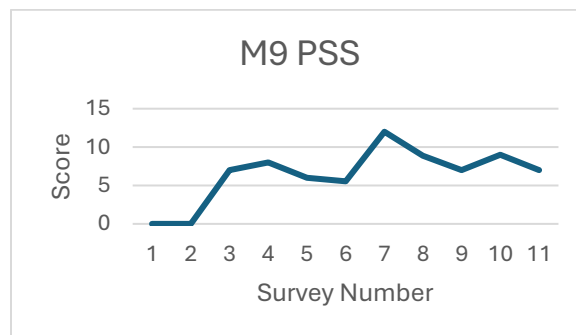
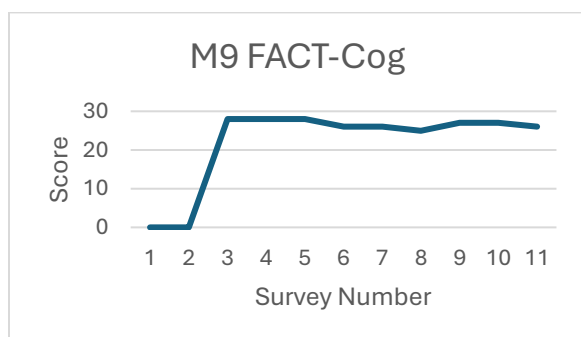
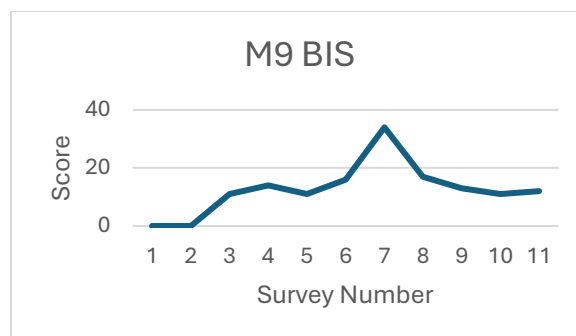
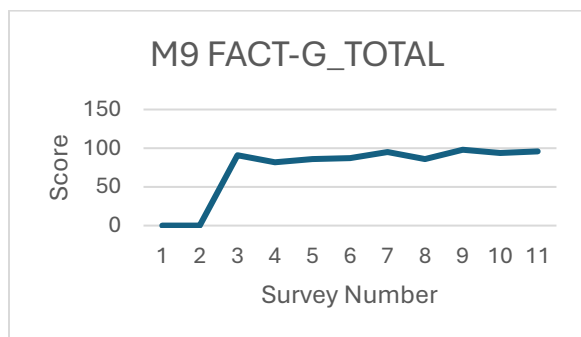
Barbara (M7)



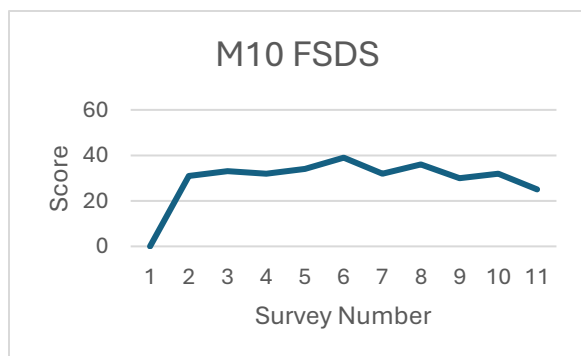
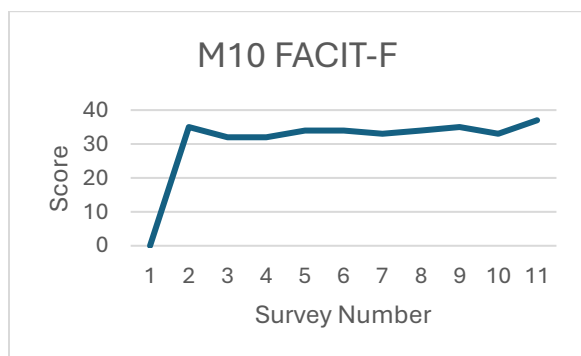
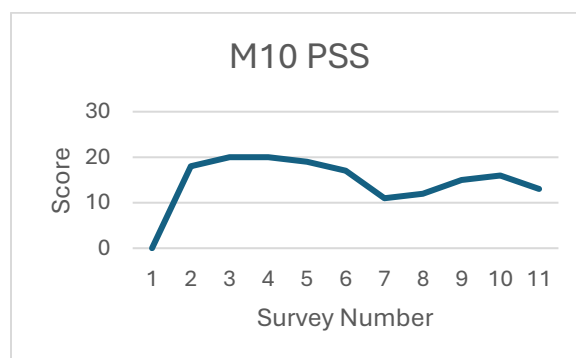
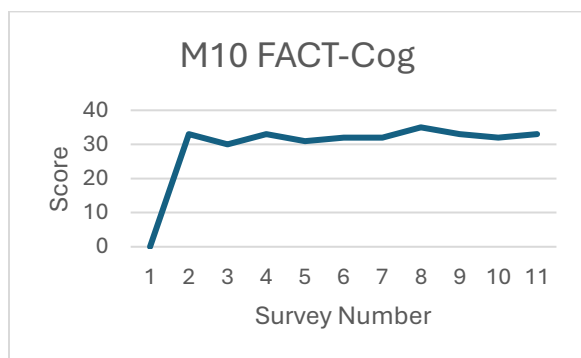
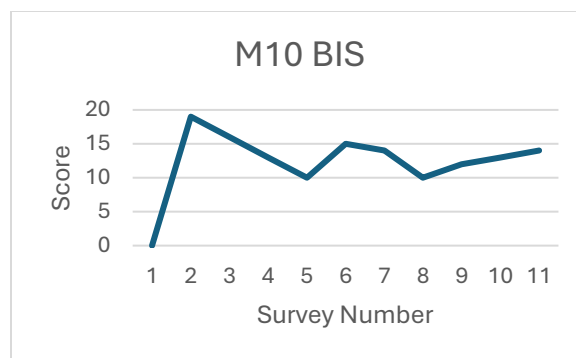
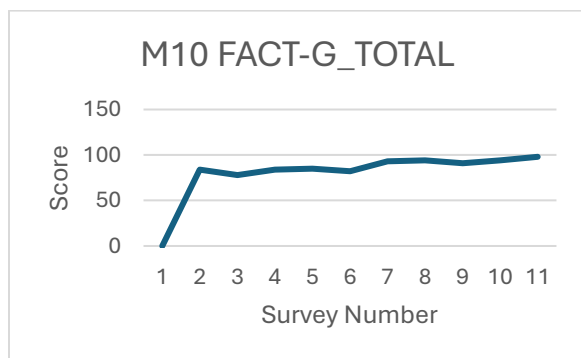
Nancy (M8)



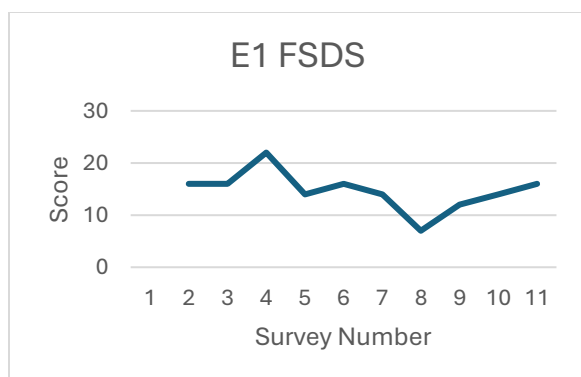
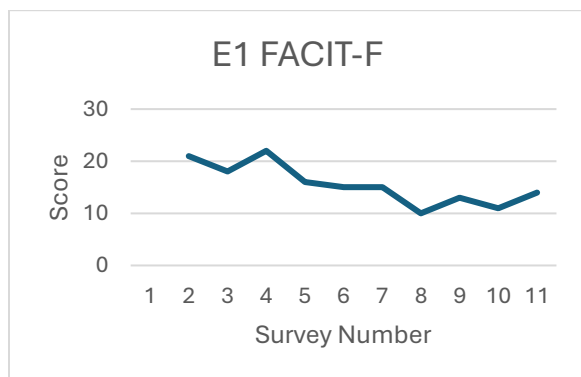
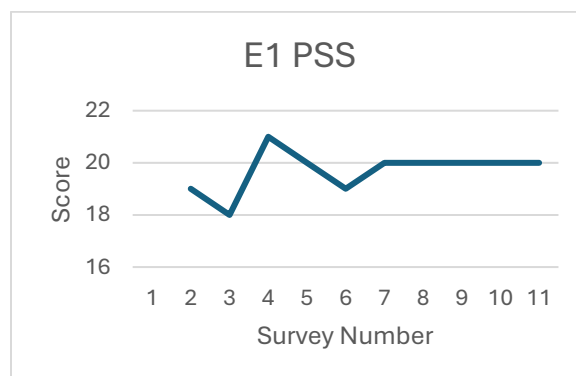
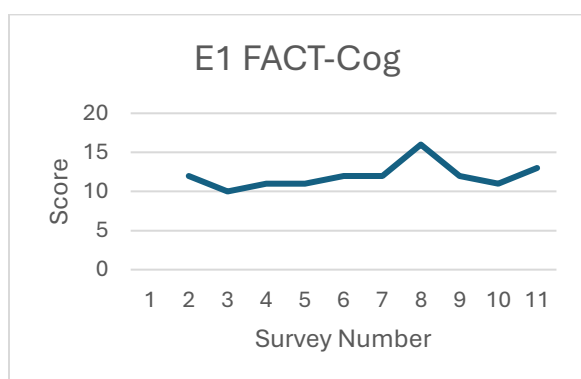
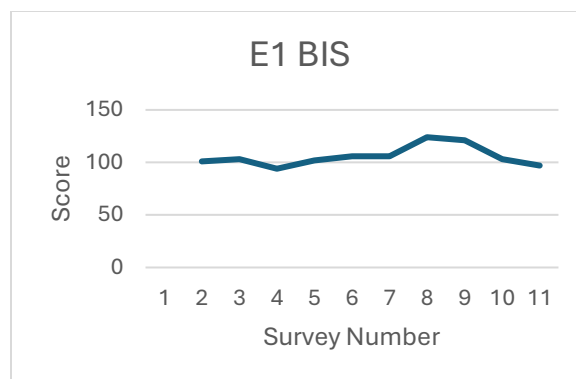
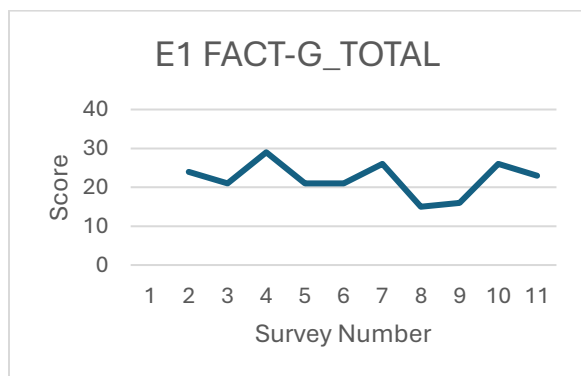
Donna (M9)



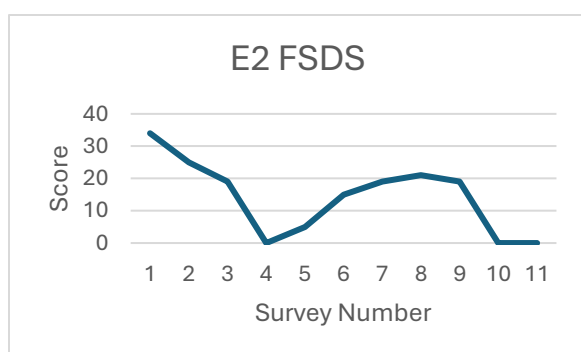
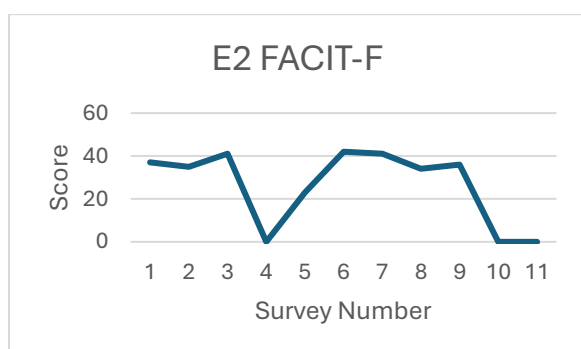
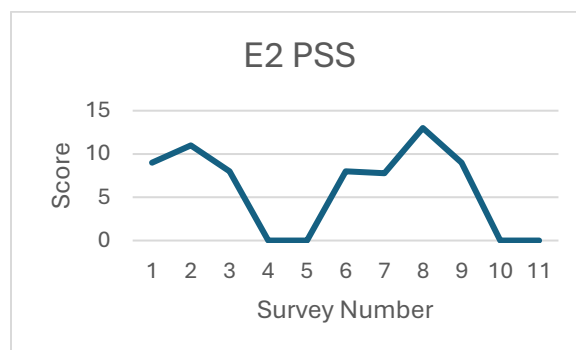
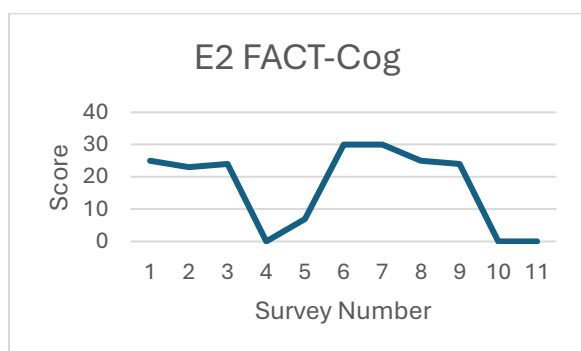
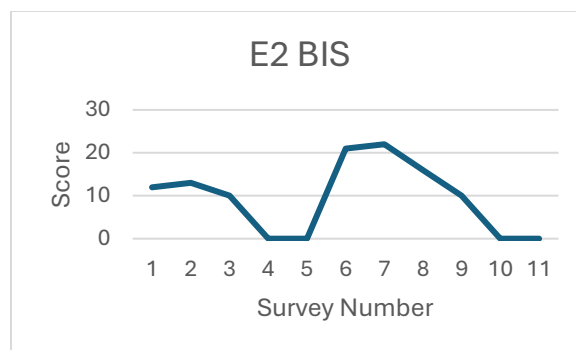
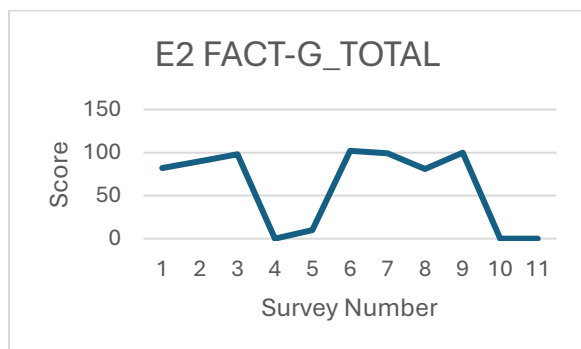
Cynthia (M10)



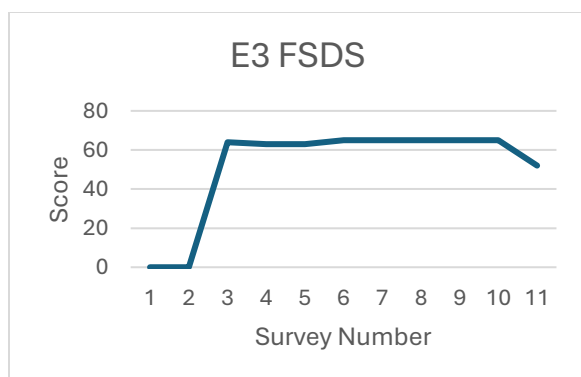
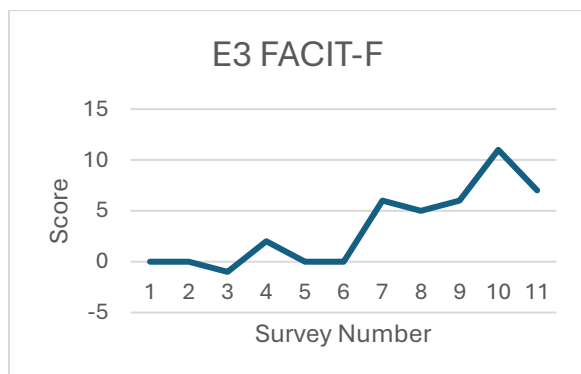
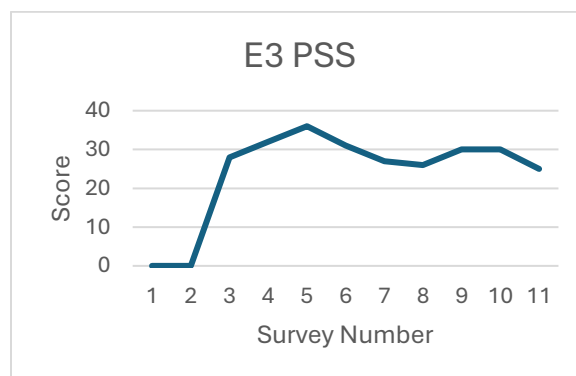
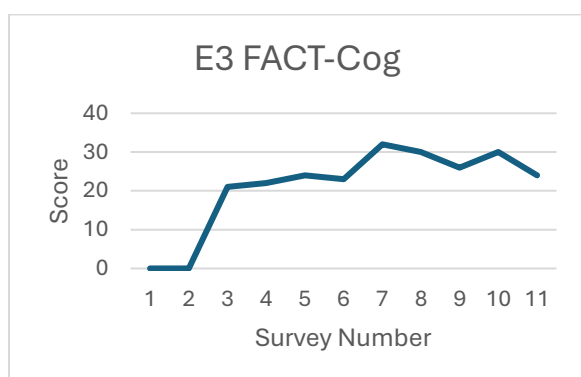
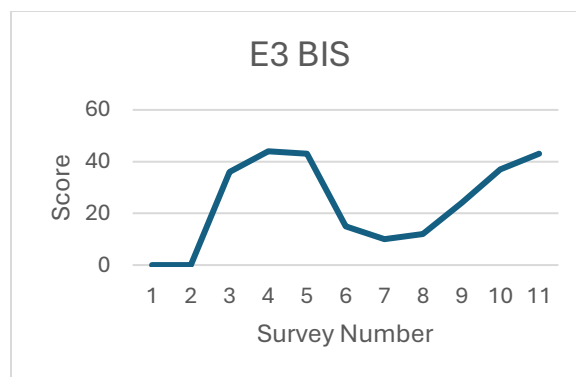
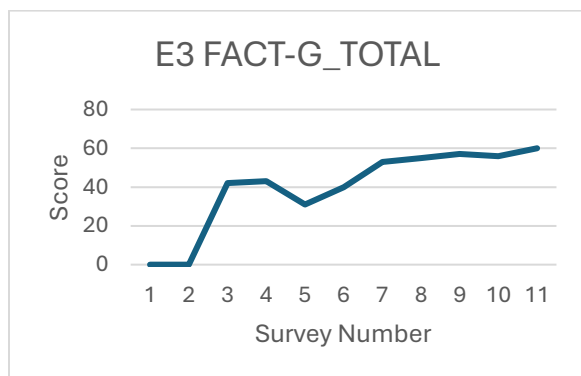
Pamela (E1)



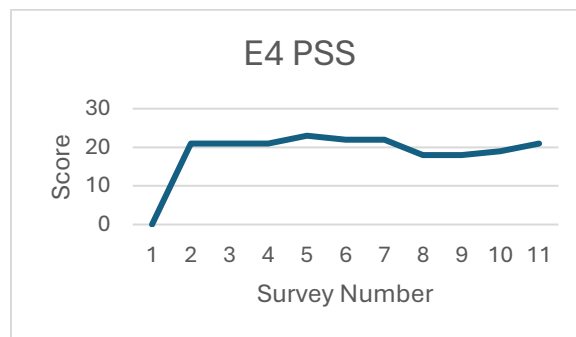
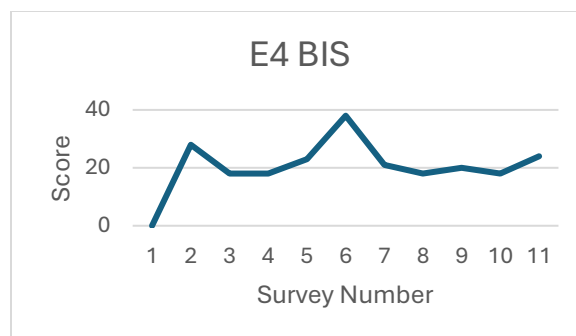
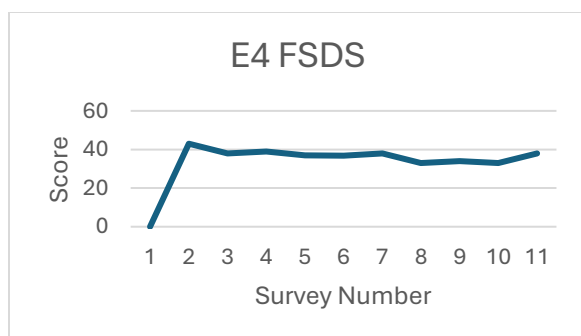
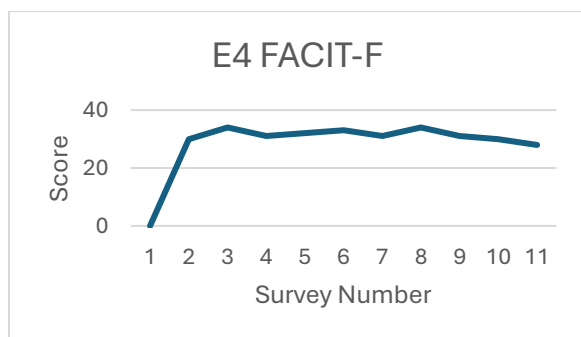
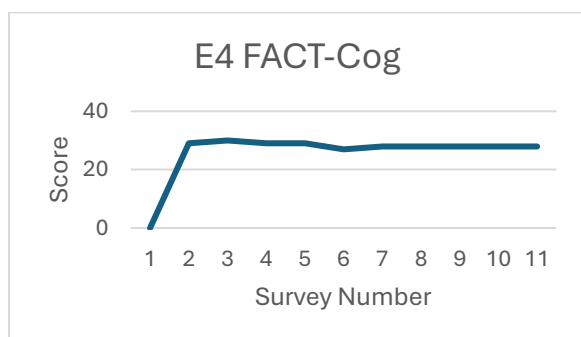
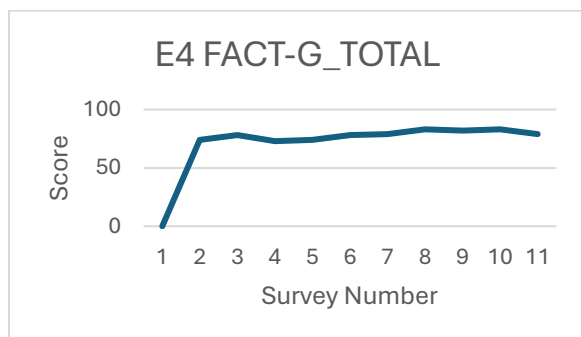
Carol (E2)



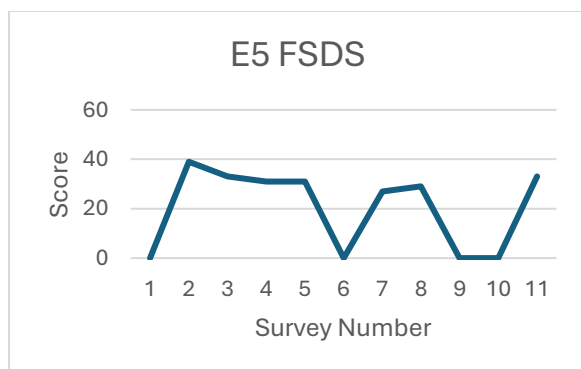
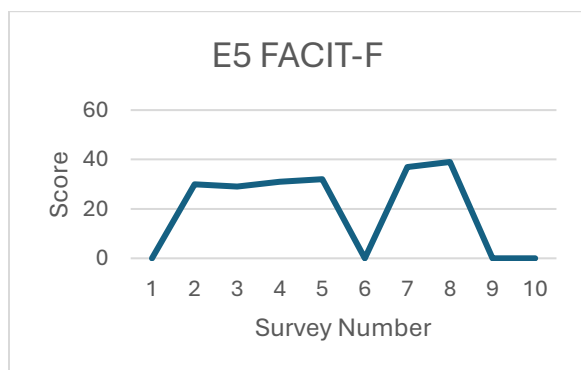
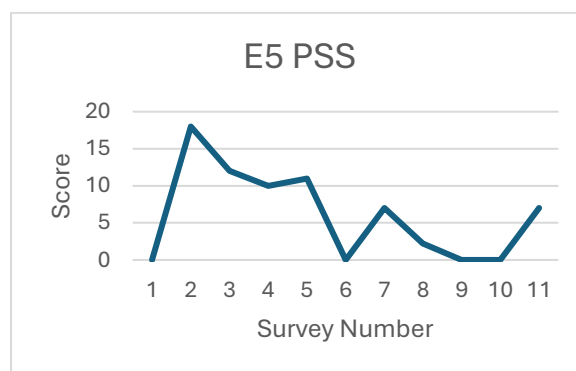
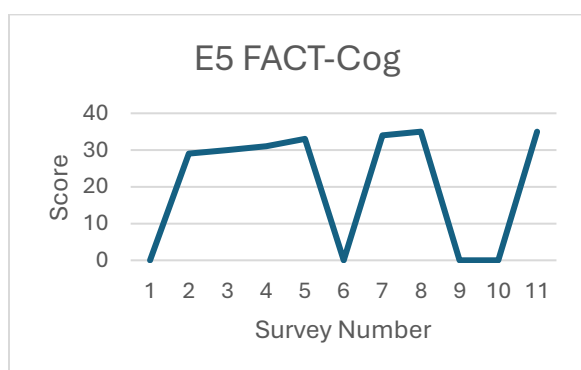
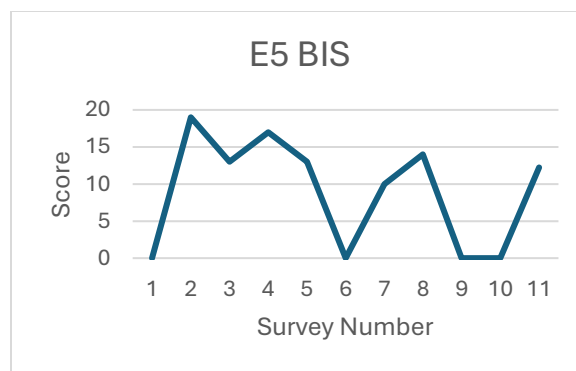
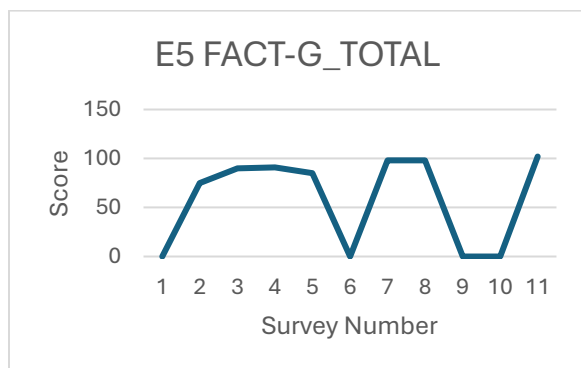
Sandra (E3)



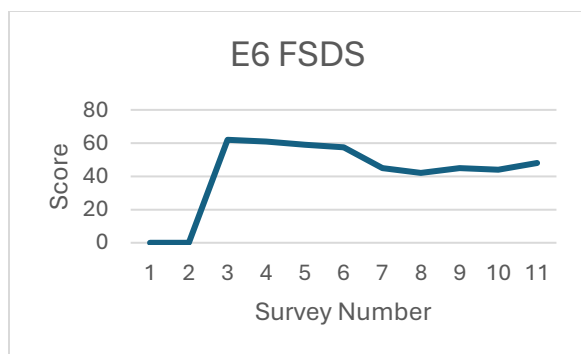
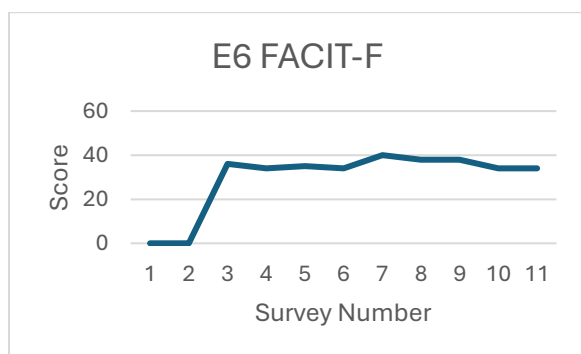
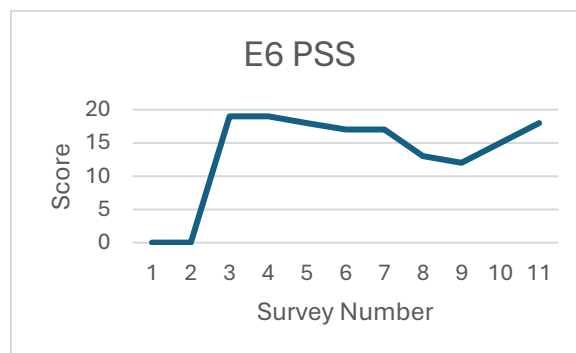
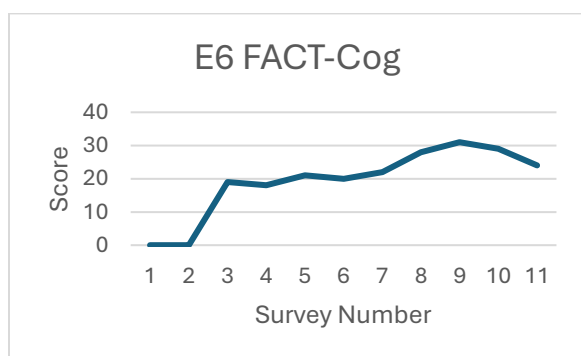
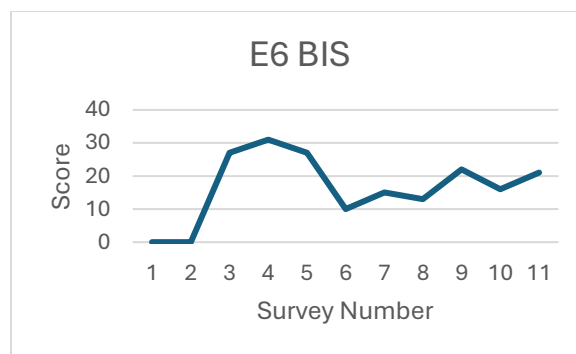
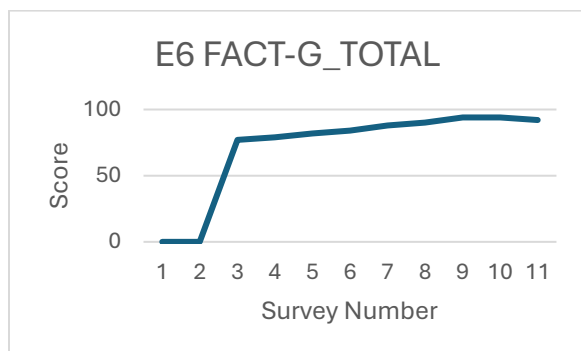
Janet (E4)



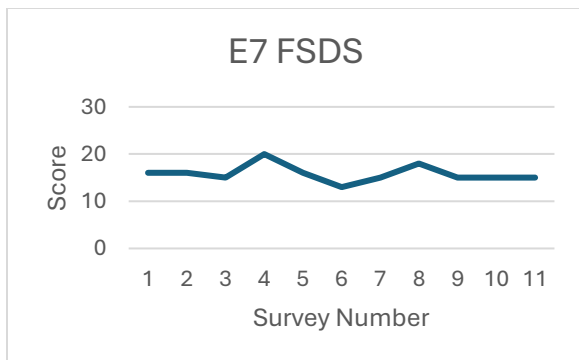
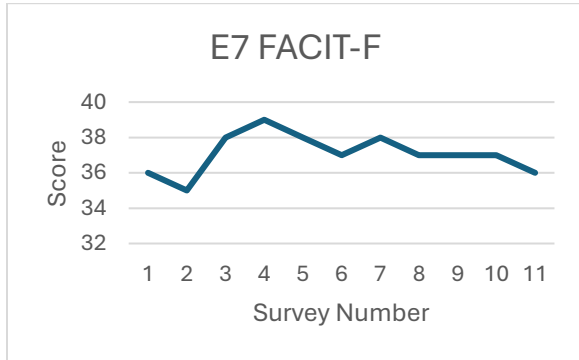
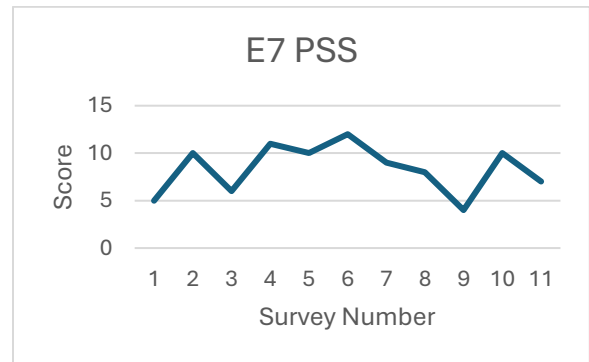
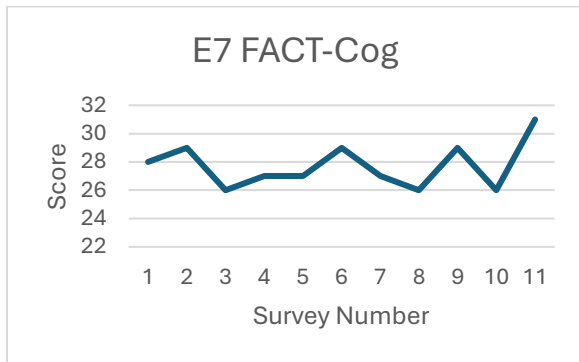
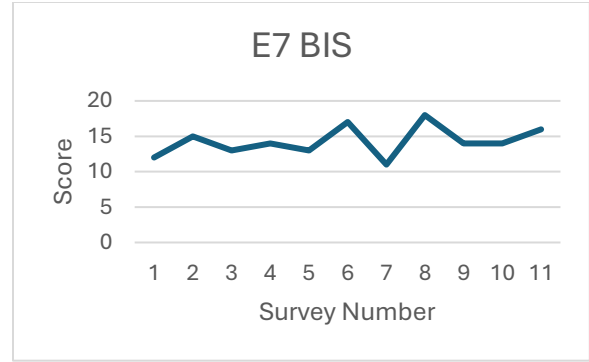
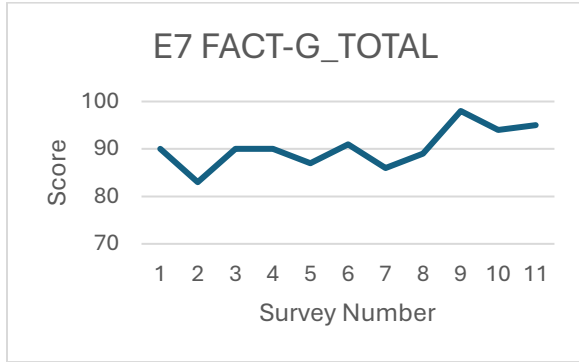
Sharon (E5)



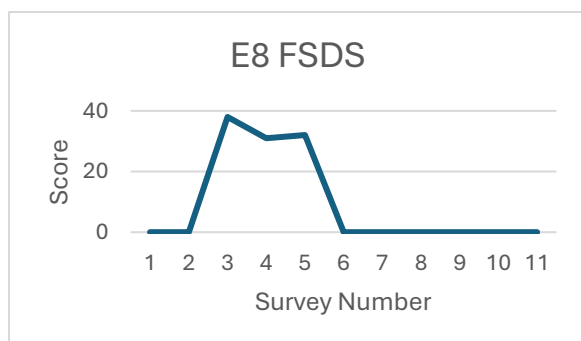
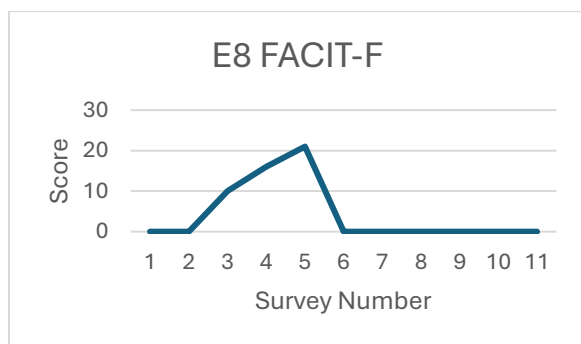
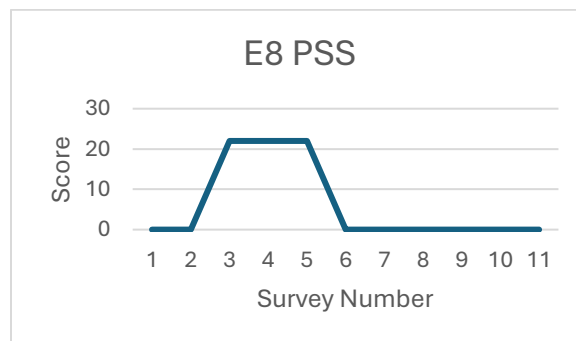
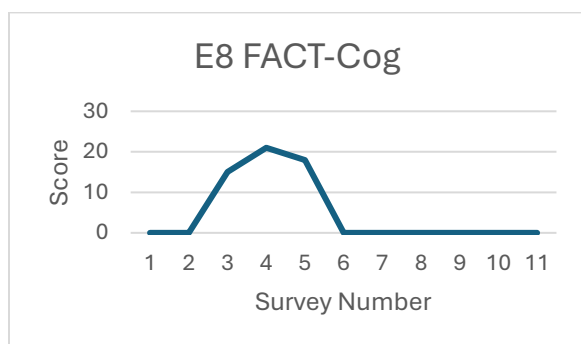
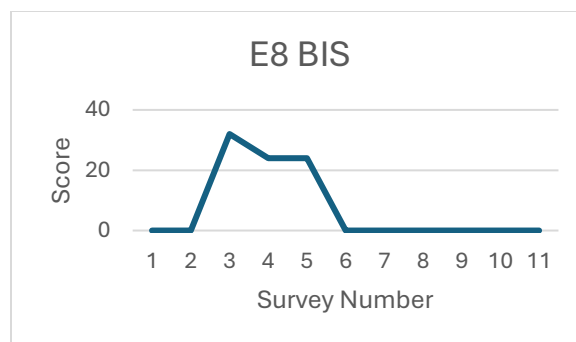
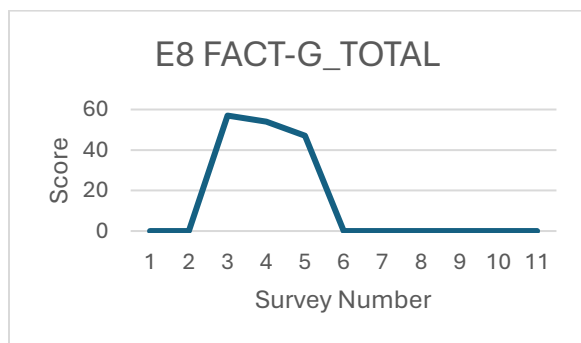
Diane (E6)



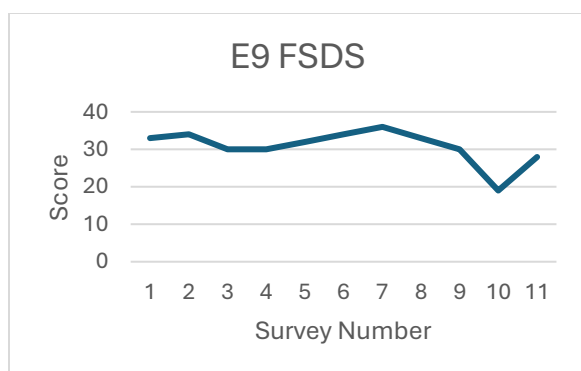
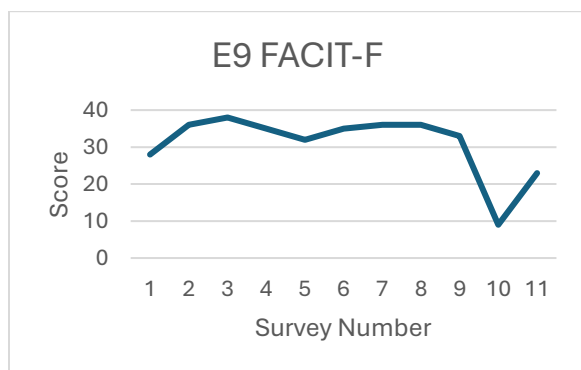
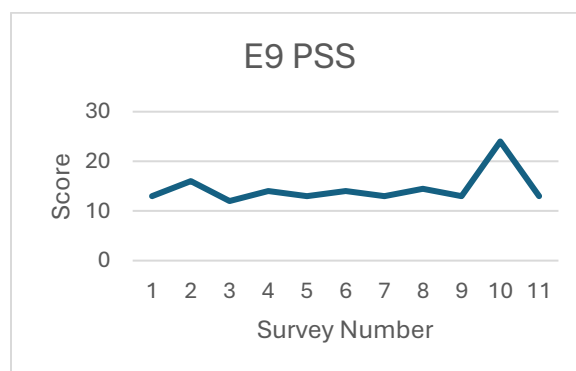
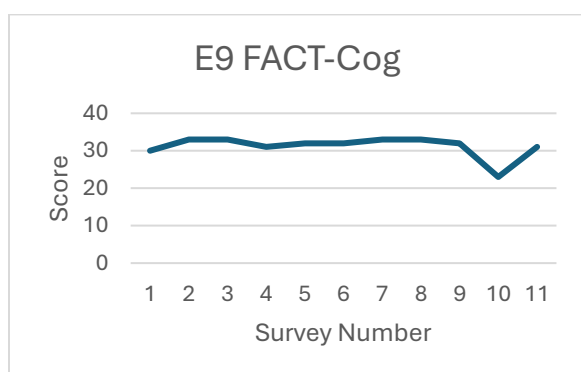
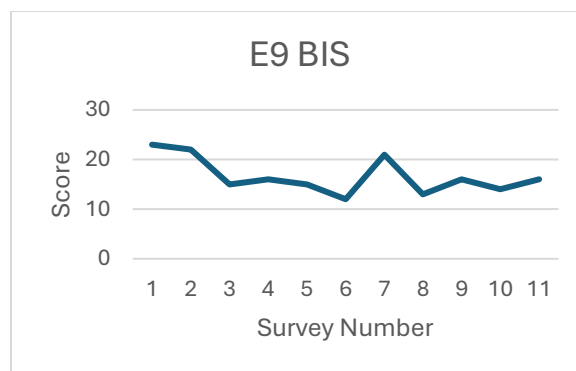
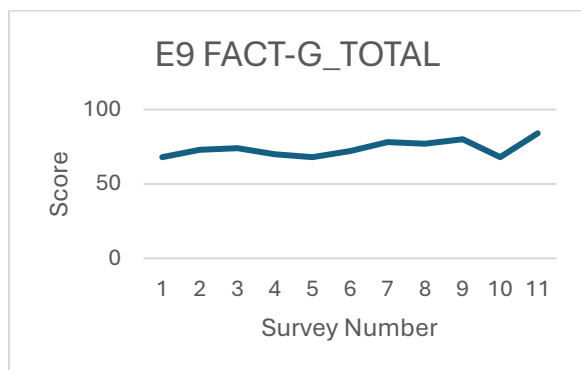
Brenda (E7)



Cheryl (E8)



Elizabeth (E9)



Kathy (E10)

