

**Facilitators and Barriers to Nurses Screening for Frailty in Acute Care in a Provincial
Health Care System: A Survey Study Guided by the Theoretical Domains Framework**

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Abstract

Older adults living with frailty have increased healthcare needs, but require accurate identification for optimal care; nurses' screening practice is unclear. This cross-sectional survey explored nurses' frailty screening practices and barriers/facilitators in acute care. Descriptive statistics were generated from 5-point frequency and 101-point scales of frailty screening methods; practice areas were compared using linear regression. Means for barriers and facilitators were generated from a 43-item 6-point Likert-type Theoretical Domains Framework questionnaire. Respondents ($n = 228$) reported "usually" screening by clinical impression (median = 4, interquartile range = 4-5) and preferring it to formal frailty tools ($M = 67.1$, $SD = 25.7$). Practice area influenced general frailty screening ($B = 0.81$, $r = .31$, $p < .001$). The top barrier was belief conducting frailty screening was routine ($M = 2.68$, $SD = 1.42$, $p > .05$). Frailty screening tools supporting clinical judgement and embedded into routine have greater likelihood for uptake.

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Contribution of Collaborators

Chantal Backman, RN, PhD - Thesis Supervisor

Dr. Backman was fundamental from project inception through to thesis completion. She provided necessary guidance to ensure the project met the University of Ottawa Master of Science in Nursing requirements and especially provided her nursing research expertise.

Michelle Lalonde, RN, PhD - Committee Member

Dr. Lalonde was very helpful during conception of the project and provided expertise in nursing research methods. She also provided support throughout the project and read through multiple drafts of thesis proposals and this thesis.

Daniel McIsaac, MD, MPH, FRCPC - Committee Member

Dr. McIsaac was the expert on frailty and clinical researcher. He helped guide the project structure around current frailty understanding, how to set up the survey for useful interpretation, and supported the process for data analysis. He also read the thesis proposal and this thesis.

Janet Squires, RN, PhD - Contributor

Dr. Squires acted as a content sounding board in particular around the analysis and presentation for the Theoretical Domains Framework data.

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Chapter One

Introduction

1.1 Research Problem

Geriatric care is a burgeoning area of practice; from 2000 to 2016 the global life expectancy increased by 5.5 years (World Health Organization, 2019). In Canada, it is conservatively projected that by 2068 the population of 65 years and older will grow by 17.2% (Statistics Canada, 2019). With an aging population comes greater demand on the health care system, particularly as older adults living with frailty represent the largest primary and tertiary service users (Han et al., 2019). Measured with a frailty index, a conservative Canadian population estimate predicts 47-58% of individuals 65-85 years of age are living with at least a very mild level of frailty (Pérez-Zepeda et al., 2021). During the COVID-19 pandemic, older adults living with frailty have disproportionately been hospitalized and have significantly higher mortality rates (Dumitrascu et al., 2021), especially when they have required intensive care unit (ICU) admission (Turcotte et al., 2021). Providing high quality care for this at-risk population in the acute care setting is important to reduce health inequities, but firstly requires accurate identification of the frailty syndrome.

1.1.1 Defining Frailty

Frailty is generally agreed to be a state of vulnerability especially common to the older adult population developed as a consequence of multidimensional demands over time (Clegg, 2013; Rodríguez-Mañas et al., 2013). There is debate on how best to measure or operationalize frailty assessment (Vermeiren et al., 2016), which creates dissonance in clinical recommendations. In a collaboration project of experts in frailty, four aspects of a frailty definition were agreed upon: physical performance (including gait speed and mobility), nutritional status, mental health, and cognition (Rodríguez-Mañas et al., 2013). The two most accepted models of frailty are the phenotypic (physical) frailty and deficit accumulation (multi-

domain) model for frailty (Walston, 2017). The former, also called the Fried Frailty Phenotype (FP) has an associated screening tool that includes the physical performance domain, with gait speed and mobility (Fried et al., 2001), while the deficit accumulation model includes a Frailty Index (FI) that counts variables across all four domains (Mitnitski et al., 2001). These fundamental differences in frailty definition have led to different frailty screening tools being developed that assess different constructs (Oviedo-Briones et al., 2021). This supports meaningful selection of frailty screening tools to ensure theoretical rigor to inform the interventions within the right domains to be acted upon.

1.1.2 Frailty and Poor Health Outcomes in Acute Care

Older adults living with frailty represent 10-40% of all hospitalized patients (Chen et al., 2019). Admission to acute care is a risk to older adults, especially those living with higher degrees of frailty. Older adults with frailty assessed by an electronic frailty index had a step-wise incidence rate ratio for risk of emergent hospital admission; 1.64 with mild frailty (95% CI [1.60, 1.68], $p < 0.001$), 2.45 with moderate frailty (95% CI [2.37, 2.53], $p < 0.001$), and 3.16 with severe frailty (95% CI [3.00, 3.33], $p < 0.001$) (Han et al., 2019). Hospital length of stay (LOS) significantly ($p < 0.001$) increased for all levels of frailty and for both emergency and elective admissions, with severe frailty and emergency admissions associated with an additional 7.26 days in hospital (95% CI [6.61, 7.97], $p < 0.001$) (Han et al., 2019). Older adults assessed for frailty in the community were followed for their ICU survivability 365 days after admission; living with very severe frailty increased hazard risk of death by 2.00 (95% CI [1.58, 2.53], $p < .01$) and severe frailty 1.22 (95% CI [1.15, 1.30]) compared to mild frailty (Turcotte et al., 2021). The mortality hazards increase stepwise based on severity of frailty in both the FI and Clinical Frail Scale (CFS) ranking, regardless of intubation occurrence (Turcotte et al., 2021). Frailty

measured using both a FI and CFS with a population of older adults admitted to a vascular surgery unit independently predicted delirium occurrence (FI OR = 5.64, 95% CI [1.47, 21.68], CFS OR = 4.21, 95% CI [1.14-15.50] respectively) (Thillainadesan et al., 2021). This research supports older adults living with frailty are vulnerable to become admitted to the hospital, to stay admitted, and suffer complications in their hospital admission.

1.1.3 Frailty Screening in Acute Care

The older adult who is diagnosed as living with frailty may not feel “frail” and could be challenged to recognize the deficits related to this vulnerability (Buhagiar & Smith, 2022), therefore making the self-reported assessment challenging. When older adults present to the acute care environment there is an opportunity to identify the attributes of frailty by the health care professionals that interact with them. One of the best tools for diagnostic and management of frailty is the Comprehensive Geriatric Assessment (CGA), which uses principles of holism to identify and meet patient goals (Theou et al., 2018). It is a heavily resource intensive process that takes at least 90 minutes to complete and is billable for a physician at a minimum of \$ 313.70 CA in Alberta (Alberta Medical Association, 2020). The CGA can also be performed by a nurse practitioner (Duffy, 2018) but requires multiple additional stakeholder inputs. To be complete the CGA should include input from the patient’s caregivers and a multidisciplinary healthcare team which may include: nursing, social work, physiotherapist, occupational therapist, pharmacy, dietician, or speech and language pathologist (Ellis et al., 2017). These factors make the CGA inappropriate for delivery to most hospitalized older adults and likely inappropriate as an initial frailty detection tool.

Screening refers to identifying individuals who will be affected by a condition, which is sometimes used synonymously with case-finding (i.e., determining the prevalence of people

currently affected) (Raïche et al., 2008). Screening for frailty offers an opportunity to identify patients that would benefit most from resource-intensive interventions and to help implement care plans that minimize risk for individuals with frailty (Muscedere et al., 2016). Frailty screening tools have been developed for various settings, with no evidence to support a single best tool for use in research or clinical practice (Apóstolo et al., 2017; Lim et al., 2019). Regardless of which frailty domains are included, there are many frailty screening tools with strong predictive ability for risk of adverse health outcomes, especially when higher degrees of frailty are present (Theou et al., 2018; Vermeiren et al., 2016). One scoping review (Theou et al., 2018) identified the most commonly established frailty screening tools: the CFS, the FI, the FP, and the Edmonton Frail Scale (EFS). A 2020 meta-analysis assessed 35 different frailty screening instruments; the CFS had the strongest association with mortality (OR = 4.89; 95% CI [1.83, 13.05]), non-favourable discharge (OR = 6.31; 95% CI [4.00, 9.94]), and had the highest reported feasibility (Aucoin et al., 2020). The EFS the strongest association with complications (OR = 2.93; 95% CI [1.52, 5.65]) and the FP the strongest association with delirium (OR = 3.79; 95% CI [1.75, 8.22]) (Aucoin et al., 2020).

Indirect ways to assess for frailty include: non-frailty tools (validated risk scales but not specifically for frailty), study-specific measures (such as risk-stratification criteria according to number of chronic diseases and age), and clinical judgement (Theou et al., 2018). Studies published from Canadian populations on acute care screening tools were more likely to use established frailty tools than indirect frailty assessments, especially the CFS (Theou et al., 2018). Some early research has begun exploring development of frailty measurement tools electronically based upon administrative health data, including in a Canadian preoperative context (McIsaac et al., 2019). While there has been some evidence for creation of frailty

screening tools using nursing flowsheet and lab test data that can predict in-hospital mortality (Lekan et al., 2022) the clinical usefulness for these tools and impact upon clinical practice are not clear (Nghiem et al., 2020). There are many different frailty screening tools and methods that measure different constructs of frailty and with few best practice guidelines the decision on best tool is often unclear.

1.1.4 Nurses' Role in Screening for Frailty

Nurses have the professional capacity to use evidence to inform assessments to meet client or patient health goals (Canadian Nurses Association, 2015; College of Registered Psychiatric Nurses of Alberta, 2013; The Canadian Council for Practical Nurse Regulators, 2013) and are the most frequent providers of care to older adults in the acute care setting. A systematic review for frailty screening tools in acute care identified tools nurses use included: Identification Seniors at Risk (ISAR) and ISAR hospitalized patients (ISAR-HP), Score Hospitalier d'Evaluation du Risque de Perte d'Qutonomie (SHERPA), SPICES (Acronym of skin integrity; problems eating; incontinence; confusion; evidence of falls; and sleep disturbance), and Hospital Admission Risk Profile (HARP) (Warnier, Van Rossum, Velthuijsen, et al., 2016). Large reviews on frailty screening tools have not identified the personnel who can administer the tools or the reliability of the personnel who use the tools (Apóstolo et al., 2017; Bessa et al., 2018; Sutton et al., 2019; Theou et al., 2018). One study assessed the inter-rater reliability between professions using the CFS in the ICU context and found the agreement between nurse-nurse was substantial ($\kappa = .63$; 95% CI), nurse-physicians was moderate ($\kappa = .59$; 95% CI), and nurse-physiotherapists near perfect agreement ($\kappa = .88$; 95% CI) (Pugh et al., 2019). This supports nurses can be the appropriate health professional to collect reliable frailty screening assessment data. Given that nurses are well positioned in acute care to have many (if

not the most) opportunities to interact with older adults, have frailty screening in their professional scope of practice, and can give reliable frailty screening scores, it creates an opportunity for them to identify older adults living with frailty.

Currently there is no study that has described the frailty screening tools practices in Alberta and no study that has explored the barriers or facilitators that nurses experience in Canada. A qualitative exploratory study has begun examining the opinions of Medical and/or Surgical (Med/Surg) nurses about screening and its influences on daily work in the Netherlands (Warnier et al., 2021), but how the specialty that nurses are trained in (i.e. their area of practice) influences the screening beliefs for frailty screening is an area not yet researched. Further, the type of license held by the nurse such as licensed practical nurse (LPN), registered nurse (RN), nurse practitioner (NP), and registered psychiatric nurse (RPN) and its impact upon frailty screening tool use and beliefs has also not been explored. This is important to research to make best practice recommendations in nurses' frailty screening practices and improve care for a large population of hospital users.

1.2 Study Purpose

The purpose of this study was to explore the barriers and facilitators to nurses screening for frailty in acute care in the province of Alberta, Canada. Specific objectives were to:

- i. Describe the current state of frailty screening performed by nurses in acute care;
- ii. Describe the barriers and facilitators to nurses screening for frailty in acute care;
- iii. Compare both the frailty screening approaches used (from objective i) and the barriers and facilitators (from objective ii) between nursing licensing groups and nursing specialties.

1.3 Personal Impetus

Frailty is a broad term that reflects a vaguely identifiable syndrome to most nurses that is associated with higher workload and greater healthcare needs. Older adults deserve care that is person and family centered; by screening for frailty the focus of care can be improved and additional risks mitigated. Nurses have the professional capacity to screen for frailty, but there are many influencers to being able to perform these assessments. There may be important differences in frailty screening practices between different types of licensed nurses and different areas of practice. There are many outstanding questions in regards to licensed nurses' engagement with frailty screening methods. A literature review was conducted to help narrow down the study focus on how nurses are engaging with older adults to screen for frailty.

1.3 Thesis Outline

Chapter One includes the introduction, which situates frailty research into the current context of screening by licensed nurses with the acute care older adult population. The study purpose is present followed by my personal impetus.

Chapter Two A literature review based upon a specific PICOT question is incorporated to understand current knowledge on the types of frailty screening tool used by licensed nurses. This literature review also described the currently known barriers and facilitators to screening for frailty.

Chapter Three describes the Theoretical Domains Framework and research methods undertaken for the study.

Chapter Four is a manuscript that is created according to the publication standards for submission to an international peer-reviewed journal called "The Journal of Frailty and Aging."

Chapter Five is an integrated discussion for the research findings in the context of current literature. Considerations for the application of the results through use of the Behaviour Change Wheel are included. Study limitations, risks/benefits to frailty screening, and future directions are considered, then finished with concluding remarks.

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Chapter Two

Literature Review

2.1 Literature Review Purpose

In my literature review I aimed to: 1) describe the screening tools and methods used by nurses in acute care and 2) identify the barriers and facilitators for frailty screening by nurses.

2.2 Search Strategy

The literature search was completed with the databases Medline, CINAHL, AgeLine, and Cochrane Reviews. Limitations were placed for English-language studies and studies published in peer-reviewed literature (when the search engine enabled this feature). The original search was completed on September 18th, 2016-2020 with additional publications obtained April 15th for the time range August 2020-2022. This time frame was chosen to capture currently used nursing frailty assessment methods. The Boolean search terms were designed to include four elements and were consistently used across search-engines: frailty, nurse, acute care, and screening. The search was broken down according to the PICOT framework (Riva et al., 2012) to reflect inclusion criteria.

Population: Nurses practicing with older adults (65 and older) in the acute care setting

Intervention: Screening for frailty with a tool

Comparison: Frailty not assessed, assessed with a different tool, or assessed by another means

Outcome: 1) Completion of frailty screening 2) Barriers and facilitators to frailty screening

Time: Anytime during acute care admission

2.2.1 Inclusion Criteria

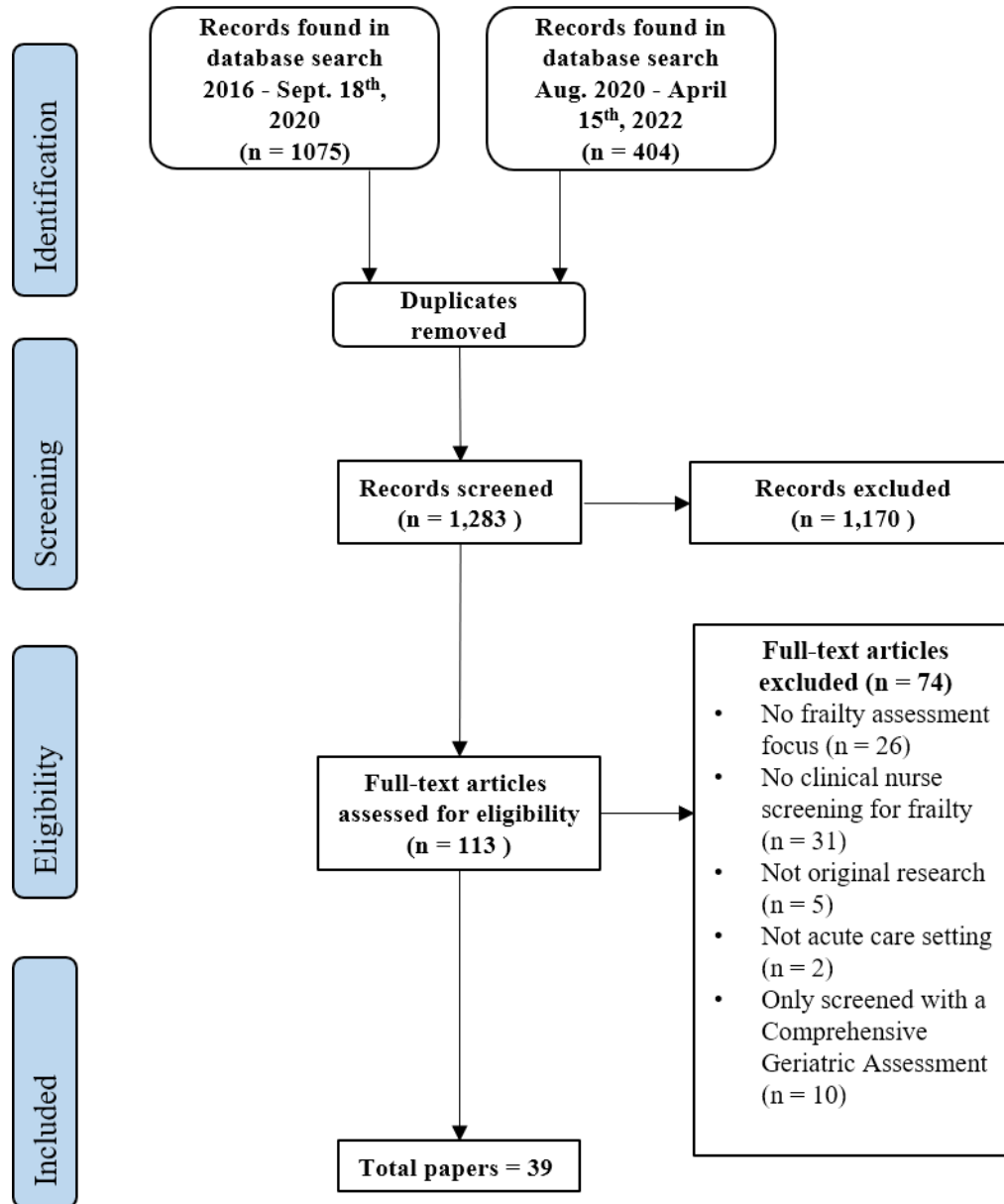
Studies were included if. they described at least one explicitly defined frailty screening tool used by nurses, or a barrier/facilitator to providing a frailty assessment. English language articles were only chosen (due to the singular fluency of the author). There had to be a clear focus on elderly experiencing frailty with nursing involvement. Screening tools were included when they had demonstrated use or were created for use by either nurse or a non-specialist clinician. Articles were chosen to be published between 2016-2022 to capture the most recent evidence.

2.2.2 Exclusion Criteria

Studies were excluded when: the focus was palliative care, lacked frailty focus, no nurse assessment (e.g. automated screening tools), had assessments nurses cannot perform, patients younger than 65 years of age, community focused (including day hospitals and virtual wards), specific drug or nutrition research, structured abstracts, and research protocols. The CGA was excluded as it has no set tool or one-size-fits-all approach to screen for frailty and cannot be completed by a nurse independently.

2.3 Review Findings

After duplicates removed 1,283 articles were identified. After the title review, abstract review, full paper review, and hand-searching (through reference lists) the total articles used for the literature synthesis was 39 (see **Figure 1**).

Figure 1*Literature Search for Frailty Screening by Nurses***2.3.1 Part 1: Completion of Frailty Screening**

In the 39 included studies, 28 established frailty screening tools were identified, and characteristics compared (see Appendix A, Table A1). The tools' original references often did

not describe who the tool's intended users were, but if they were demonstrated by the target population in the study it was accepted. The most common frailty screening tools used by nurses were the CFS (n = 12), FRAIL scale (n = 8) and FP (n = 6). Physical performance was the only domain of frailty in all 28 screening tools. The time to screen for the tools was often not reported numerically (n = 18), but ranged from less than 30sec (CFS) to 15min (Calgary Cardiac and Cognition Scale) (see Table A1).

2.3.1.1 Frailty Screening Tools

Hospital Admission Risk Profile (HARP). This 3-item screening tool was developed to identify older adults at risk for functional decline upon hospital admission (Sager et al., 1996). Risk stratifies patients into groups according to risk for functional decline on an ordinal scale; low risk, intermediate risk, and high risk. Includes a modified mini-mental status exam (MMSE) within the exam. It includes physical performance and cognitive domains.

Identification of Seniors at Risk (ISAR). Six item tool considering necessity of patient to be aided on regular basis or to care for themselves; history of hospitalizations in the past six months; eyesight challenges; memory problems; and medications (more than three per day) (McCusker et al., 1999). A score of two or more indicates high risk for adverse outcomes related to frailty. It includes physical performance and cognitive domains.

ISAR in Hospitalized Patients. Adaptation of the ISAR to the patients admitted to hospital (Hoogerduijn et al., 2014). Greater weight is given to the second question about use of a walking device compared to the other three to give a total risk; if even one risk is identified the patient is considered at risk for frailty. Only the physical performance domain is included.

Edmonton Frail Scale (EFS). This scale was created Edmonton, Alberta, Canada with

information collected from geriatric patients across different care settings (including acute care) (Rolfson et al., 2006). It was validated by non-specialists without geriatric training and takes less than five minutes for completion. It works as an ordinal scale that generates a score out of 17 with the highest scores reflecting severe frailty and low scores not frail. There are nine frailty domains, which include physical performance, nutritional status, mental health, and cognition.

Reported Edmonton Frail Scale. This scale was adapted from the original EFS to work in a hospital setting, tested in Australia (Hilmer et al., 2009). It was expanded to 13 items that creates a score out of 18 with the highest scores reflecting severe frailty and low scores not frail. There are nine frailty domains, which include physical performance, nutritional status, mental health, and cognition and was created to be used by non-geriatricians.

Score Hospitalier d'évaluation du risque de perte d'autonomie (SHERPA). Developed to identify older hospitalized patients at risk for functional decline by three months post-discharge (Cornette et al., 2006). This tool includes five domains, two of which are reflective of physical function and cognition. The score is out of 11, it is an ordinal scale with four tiers from no risk to high risk for functional decline.

SPICES (Acronym of skin integrity; problems eating; incontinence; confusion; evidence of falls; and sleep disturbance). An overall assessment tool for older adults with yes or no questions according to the acronym (Aronow et al., 2014). For skin integrity a yes indicates a problem. It generates a dichotomous scale with a score range 0-6. A score of two or more indicates risk for adverse outcomes during the hospital admission. It includes domains of physical function, nutritional status, and cognition.

Frailty Index from the Canadian Study of Health and Aging (FI). One of the oldest

indexes of frailty that counts the total number of different deficits across domains (Mitnitski et al., 2001). There were 92 items in this first iteration of an index, but the evidence supported smaller items of as low as 30 could accurately represent the frailty level. It was supported for both community and hospital use. It works on a continuous scale; the higher the index the greater the frailty level, however different cut off points were proposed for the frail group at 0.201. The original study included domains of physical function, mental health, and cognition but since it supported a flexible index this could possibly change.

Maastricht Frailty Screening Tool for Hospitalized Patients (MFST-HP). A modified hospital version of the TraAG tool (acronym not explained), used in the community (Warnier, Van Rossum, Van Leendert, et al., 2016). Expands upon this tool which has domains of: incidental and basic activities of daily living, nutrition, mobility and fall risk, incontinence, medication, vision and hearing impairment, cognition, and depressive symptoms. It adds items on delirium and pressure sores. Created as part of the initial nursing assessment in the hospital setting and is structured as yes or no questions for nurses to administer to older adults. It operates on a continuous scale out of 15 points; every point indicates higher frailty risk. It contained frailty domains of physical performance, nutritional status, mental health, and cognition and demonstrated nursing use in its generation.

Think Frailty. A triage tool designed for use in Healthcare Improvement Scotland for use with patients 75 years of age and older, and for those above 65 years who were nursing home residents or admitted from a different hospital (Taylor-Rowan et al., 2018). The purpose was to expedite a CGA for those with a high risk for frailty. Questions were based upon a FRAIL acronym: Functional impairment, resident in a care home, altered mental state, immobility/instability, and likely to require support for discharge. It was built as a dichotomous

scale with at least one positive indicating frailty. Physical performance and cognition domains were included.

Veiligheids management system (VMS) and VMS+ tool. Developed to screen hospitalized patients older than 70 years for risk of functional decline by evaluating domains in: ADLs, falls risk, weight loss, and delirium (Lim et al., 2019; Warnier et al., 2020). Physical performance, nutritional status, and mental health were included. Developed as a conditional four or five question (dependent on age) dichotomous scale with two ways to indicate risk for functional decline: with three or more positives indicating frailty (option one) or being aged 80 years or more and positive for one or more domains (option two).

Clinical Frailty Scale (CFS). This scale was originally created as a tool to help describe frailty after a CGA has been completed (K Rockwood et al., 2005). An initial score is created using clinical judgment knowing diagnoses, degree of comorbidity, function, and general patient information to help describe degrees of frailty then a secondary multidisciplinary team reviews it. It utilizes a pictorial aid and short description about each frailty level. It is a scale out of seven; three and less indicate no frailty, four indicates vulnerability, and five and higher indicates frailty. It captures all the domains of a CGA, which includes the four domains of physical performance, nutritional status, mental health, and cognition. The CFS is a rapid administration tool taking a mean time of 24sec by trained nurses and geriatricians (Oviedo-Briones et al., 2021).

Program of Research to Integrate Services for the Maintenance of Autonomy (PRISMA-7). This tool was designed for frailty detection in the community population of Canadians but has since been expanded and tested in acute care (Hoffmann et al., 2020). This tool asks seven dichotomous questions and assesses the individual as living with frailty when the

score is equal to or greater than three. It directly includes domains of physical performance, but also indirectly cognition and mental health and achieves it all simply and quickly.

Fatigue, Resistance, Ambulation, Illness, and Loss of weight (FRAIL) Scale. This scale uses five elements based upon: self-reported fatigue, resistance (climb a single flight of stairs), ambulation (ability to walk one block), illnesses (more than five), loss of weight (more than 5%) (van Kan et al., 2008). The focus was upon meeting all domains of frailty and keeping the scale simple. It is reliant upon self-reported experiences from the patient. It is an ordinal scale out of five with not frail (0 points), intermediate frailty (1-2 points) or frailty (three or more points). It includes domains of physical performance and nutritional status.

Vulnerable Elders Survey-13 (VES-13) Frailty Tool. A simple function-based frailty screening tool designed to also be administered by nonclinical personnel within the community (original study) and evidence supported for use in the hospital setting too (Vernon et al., 2019). Has four sections: the first is age, the second is overall health status, third is difficulty with physical activities, and the fourth is ability for incidental and basic activities of daily living. It includes 13 items with a total possible score of 15. There are four categories that each allocate pre-determined maximum points. Cut off score of three or greater indicates frailty. It includes domains of physical performance and cognition.

Groningen Frailty Indicator. Created to develop a short and easy to use screening instrument for level of frailty that included psychosocial indicators (Steverink et al., 2001). Four main domains; physical (items 1-9), cognitive (item 10), social (items 11-13), and psychological (items 14-15). The questions are either yes/no questions or independent or dependent in the activity. It is a dichotomous scale with a frailty score of five or higher indicating moderate frailty.

Calgary Cardiac and Cognition Scale. The index was created in the population of patients 60 and older undergoing non-emergent cardiac catheterization for coronary artery disease in Calgary, Alberta, Canada (Freiheit et al., 2010). It operated as an ordinal scale; one point for increased risk for each component out of five; the cut off point was three and greater to indicate high frailty risk. A portion of the index was informed by MSSA; the final model included: balance, abnormal body mass index (BMI), Trails B Test, Geriatric Depression Scale, and living alone (domains in physical performance, nutritional status, mental health, and cognition).

Frailty Phenotype (FP)/Fried Frailty Scale/Cardiovascular Health Study Scale. This is one of the oldest scales and is tied to the physical frailty definition (the only domain included) (Fried et al., 2001). The five assessed elements are: weight loss, measured weakness, self-reported exhaustion, measured slowness, and low activity questionnaire. Ranking 1-2 indicates pre-frailty, and three or more indicates frailty. This tool requires 5min for completion and utilizes specialized equipment to assess the measured weakness through a grip-strength test (Dent et al., 2016).

MacArthur Study of Successful Aging Scale (MSSA). An expanded tool of the Fried Phenotype factors from the original five to include five new factors (10 total): cognitive impairment, interleukin-6, C-reactive protein, subjective weakness, and anorexia (Sarkisian et al., 2008). It operated as an ordinal scale; 0-1 indicated no frailty, 2-3 intermediate frailty, and four or more indicates frailty. It includes domains of physical performance, mental health and cognition.

Tilburg Frailty Indicator (TFI). The TFI consists of two parts (Gobbens et al., 2010). The first part contains 10 questions on determinants of frailty and multimorbidity; the second

part contains the frailty assessment of three domains: physical, psychological, and social with a total of 15 questions for this section. There are 11 yes/no questions and four yes/sometimes/no questions. There are some negatively worded questions that are identified in the coding system within the scale. The scale is dichotomous with 0-4 points indicating no frailty and 5-15 indicating frailty. It includes domains of physical performance, nutritional status, mental health and cognition.

FRESH-Screening Instrument. This tool is not an acronym but is all capitalized as FRESH it was developed to create a clinical friendly screening instrument for use in the emergency department (Kajsa et al., 2016). The first four questions address mobility, fatigue, fear of falling, and dependence with shopping assistance. It includes domains of physical performance and cognition. This shopping dependence includes a consideration for the cognitive capacity for shopping. The fifth question which was excluded in part of the study testing asked about three or more ED visits in the last 12 months. It operates as a dichotomous scale 0-1 indicating not at risk for frailty and two or more being at risk for frailty.

Trauma Specific Frailty Index (TSFI). The TFSI was developed with a population of 100, 65 years and older trauma patients (Joseph, Pandit, Rhee, et al., 2014) and then validated with an additional 200 new patients (Joseph, Pandit, Zangbar, et al., 2014). This instrument has 15 different questions that help to predict for favourable or unfavourable discharge (death or increased care-level needs from baseline). The domains of frailty include: physical, psychological, social, and nutrition. The index score is created from the differently-weighted 15 questions with a dichotomous indication of frail or not frail if the index score is greater than 0.27. Its intention was for implementation in the ED to help with resource allocation and improve communication with families. It was built to have similar predictive abilities as the FI-

CSHA with fewer questions to be a faster tool while still having reasonably useful predictive abilities.

The Survey of Health, Ageing and Retirement in Europe Frailty Index (SHARE-FIt and SHARE-FIx). This frailty index was created to use in community populations in Europe (Romero-Ortuno, 2013), but was found in one of the studies to also be used in acute care (Oviedo-Briones et al., 2021), therefore included in this comprehensive list. The difference between the two is that SHARE-FIx has an additional 34 measurements. This continuous index cut offs suggested by the authors were less than .08 to be non-frail, .08 and up to .25 prefrail, and greater or equal to .25 frail. This index is an extension of the phenotypic frailty model (Fried et al., 2001) and added psychological and cognitive domains with two different models based upon gender.

The Frailty Trait Scale (FTS) and Three-Items (FTS-3) and Five-Items (FTS-5).

This continuous scale index was originally built from a 12-item scale then broken down into the three item and five item to be more useful for clinical application (García-García et al., 2020). This scale was created with the goal to stand apart from both the FP (Fried et al., 2001) and the FI (Mitnitski et al., 2001) by expressing its own vision of domains of frailty. This frailty ‘trait’ definition includes seven dimensions, but not all of these are represented directly in the FTS-5 and FTS-3 versions, with greater weight emphasized on the physical domain.

The G rontop le Frailty Screening Tool (GFST). This tool is unique to others in its direct integration of frailty screening with clinical judgement (Vellas et al., 2013). It was made for community general practitioners, but was included in one study for nurses in acute care (Oviedo-Briones et al., 2021), therefore included in this comprehensive list. It is a dichotomous yes/no for frailty presence or absence. It represents the frailty domains of physicality, nutrition,

and cognition, but based upon the clinicians' judgement could also include mental health.

2.3.1.2 Other Frailty Screening Methods

Three studies created their own context-specific frailty screening tool that were informed by the frailty literature but made for their local needs (Kirk et al., 2016; Reid, 2018; Solé-Casals et al., 2018). Some nurses assessed frailty using “gestalt” (Shoultz et al., 2019), visible frailty based on impression (Ibrahim et al., 2017), or another unspecified informal frailty risk screen (Leaker et al., 2020; Marsden et al., 2021). Some studies relied fully upon indirect non-frailty tools to assess for older adults living with while others complemented their frailty screening tool with another non-frailty tools during their screening process. There were nine multi-domain non-frailty tools identified with the Braden Scale (Bergstrom et al., 1988) being the mode ($n = 3$). There were three different physical domain non-frailty tools, including: the Morse Fall Risk (Morse et al., 1989) ($n = 1$) (Watkins et al., 2019), gait speed, hand grip strength, and Timed Up and Go ($n = 1$) (Muscedere et al., 2016), and Strength, assistance with walking, rising from a chair, climbing stairs, and falls (SARC-F) questionnaire ($n = 1$) (Malmstrom & Morley, 2013). Nutritional status domain had two different tools, with the mode being the simplified nutritional appetite questionnaire (SNAQ) ($n = 2$) (Wilson et al., 2005). Mental health had three different tools with the confusion assessment method (CAM) (Inouye et al., 1990) being the mode ($n = 2$). Cognition had eight different tests, with the mini-mental status exam (MMSE) (Folstein et al., 1975) and Pfeiffer test (Pfeiffer, 1975) being the modes ($n = 2$).

2.3.1.3 Feasibility of Frailty Screening Methods

Feasibility of frailty screening tools was one of the most important traits identified in the literature in choosing one tool over another. Of the frailty screening tools identified by Lim et al.

in their review, the MFST-HP and SPICES were recommended for acute care due to their higher perceived level of feasibility (2019). Comparing the studied tools that could be completed by nurses (ISAR, SHERPA, SPICES, HARP and three non-frailty multi-dimensional tools) ISAR was identified as the best for feasibility and level of sensitivity (Warnier, Van Rossum, Velthuijsen, et al., 2016). Another comparison study (FP, SHARE-FI, FTS-3 and FTS-5, FRAIL, FI, GFST, and CFS) identified the FRAIL scale as the most feasible because it could be self-reported, while the CFS was the most rapidly completed tool (Oviedo-Briones et al., 2021). A recent study conducted in Singapore found the CFS and EFS were the most favoured tools compared to other common tools in acute care (FP, FI, FRAIL scale, and Tilburg Frailty Indicator) (Liu et al., 2022). In intensive care the FRAIL scale and CFS were seen as practical for their simplicity and rapidness respectively (Gibson & Crowe, 2018). Comparing completion of three tools in the ED, the CFS was done 98.9% of the time, followed by PRISMA-7 (93%) and the TSFI (31.9%) (Jarman et al., 2021). Indirect frailty screening tools were primarily considered feasible to detect frailty characteristics due to already being embedded into the workflow of the staff nurses (Jentzer et al., 2019; Jia et al., 2020; Mandora et al., 2021; Watkins et al., 2019). Screening for frailty with clinical impression may be the most readily accessible method, but with it comes the greatest risks of subjectivity and bias. Characteristics that facilitate frailty screening in general will be discussed later this chapter.

2.3.1.4 When and Where is Frailty Assessed?

There was diversity in the time during the hospital stay when the screening occurred, which influenced the nursing specialty that conducted frailty screening. The review papers focused on nurses using frailty screening tools anywhere in acute care (Lim et al., 2019; Reid, 2018; Warnier, Van Rossum, Velthuijsen, et al., 2016), the ED (Leaker et al., 2020), cardiology

(Uchmanowicz et al., 2019), critical care (Gibson & Crowe, 2018), and the entire Canadian healthcare system (Muscedere et al., 2016). Quality improvement, quasi-experimental and experimental studies had nurses screening for frailty in: cardiac intensive care units and post ST-elevation myocardial infarction (Calvo et al., 2019; Jentzer et al., 2019), any time during the hospital stay (Ansryan et al., 2018; Jia et al., 2020; Sanford et al., 2020), the ED (Cardona et al., 2019; Jarman et al., 2021; Marsden et al., 2021; Puig Campmany et al., 2019; Shrapnel et al., 2019; Shrier et al., 2021; Solé-Casals et al., 2018; Wolf et al., 2019), preoperatively (Amini et al., 2019; Vernon et al., 2019; Watkins et al., 2019), postoperatively (Watkins et al., 2019), any admission entry point (Warnier et al., 2020; Warnier, Van Rossum, Van Leendert, et al., 2016), trauma care areas (Karlekar et al., 2017; Shoultz et al., 2019), geriatric nurse wards (Ekerstad et al., 2018; Oviedo-Briones et al., 2021), critical care (Pugh et al., 2019), respiratory units (Chin et al., 2020), medical and/or surgical (med/surg) units (Peig et al., 2021), and sub-acute unit admission and transfer to rehabilitation (Mandora et al., 2021). Additional studies that were non-experimental included nurses that were: Surgical LPNs and RNs (Eamer et al., 2017), working anywhere in the studied hospitals (de Vos et al., 2017; Warnier et al., 2021), worked in acute medicine wards (Ibrahim et al., 2017) or the ED (Kirk et al., 2016; Liu et al., 2022).

Some studies conducted the screening multiple times throughout different care areas within the hospital (Jentzer et al., 2019; Jia et al., 2020; Shrapnel et al., 2019) or within the same unit at least 20 times (Pugh et al., 2019). One research study completed screening specifically at 48-72 hours after admission post ST-elevation myocardial infarction (Calvo et al., 2019). The ED was the most common ($n = 11$) place where frailty screening occurred followed by anywhere in the hospital ($n = 7$) and med/surg nursing units ($n = 4$). Regardless of the point of entry, admission into the hospital was a key point for frailty assessment.

2.3.1.5 Which Nurses are Assessing Frailty?

Throughout the hospital stay, specific types of nurses were involved in screening practices including geriatric nurses, case manager nurses, and consulting psychiatric nurses (de Vos et al., 2017). Bedside nurses, consult nurses, case management, and research-specific nurses are the broad categories that were identified. Advanced practice nurses (APNs) conducted frailty screening within the ED (Leaker et al., 2020; Solé-Casals et al., 2018), during encounters with trauma patients (Shoultz et al., 2019), and helped spread success of frailty screening to the entire hospital (Ansryan et al., 2018; Peig et al., 2021). In large part because the ED was the most common place of frailty screening, critical care nurses were the most frequent (n = 13) nursing specialty conducting frailty screening.

2.3.2 Part 2: Facilitators and Barriers to Frailty Screening

Of the 39 studies, 29 studies described facilitators and 22 described barriers to screening for frailty in acute care by nurses. Three broad themes for potential barriers or facilitators to using the studied frailty screening tools were identified by Lieu et al. (2022): knowledge about frailty, perceived importance of frailty and frailty screening, and the barriers and facilitators to frailty screening, frailty management and implementation of frailty screening.

2.3.2.1 Behavioural Domains

With their implementation of a frailty screening tool for nurses and a geriatric team to use in the ED, Kirk et al. (2016) identified the top behavioural domains influencing implementation. The domains were structured accord to the 14 item Theoretical Domains Framework (Cane et al., 2012) and top four themes were: professional role (n = 15.7%), environment and resources (n = 15.2%), beliefs about consequences (n = 14.7%), and optimism (n = 12.4%). There was a

difference between the geriatric team nurses compared to the ED team nurses in willingness to use the tool; the ED nurses saw the tool as a support to their professional identity, while the geriatric team nurses could not believe the tool had utility in their daily routine (Kirk et al., 2016). Four sub-themes of influential beliefs for the perceived importance of frailty and frailty screening were identified: i) frailty is important because of the increasing proportion of older adults in hospital, ii) frailty screening identifies higher risk patients, iii) patients with frailty need different care for improved outcomes, and iv) frailty screening helps with decision making (Liu et al., 2022).

2.3.2.2 Facilitators

Multidisciplinary and integrated teams were identified as a strength to screening for frailty (de Vos et al., 2017; Karlekar et al., 2017). Team members could include: APNs, pharmacists, primary (bedside) RNs, physicians, social workers, physiotherapists, occupational therapists, speech-language pathologists, and unit clerks (Ansryan et al., 2018). More providers or adequate staff levels (Eamer et al., 2017; Lim et al., 2019; Shoultz et al., 2019; Wolf et al., 2019) delivered by members with a passion for geriatric care (Wolf et al., 2019) were valued. Program experts such as specialty trained nurses (de Vos et al., 2017; Shrapnel et al., 2019) or APNs (Marsden et al., 2021) were effective frailty assessment facilitators.

It was supportive to use systems that already exist (Muscedere et al., 2016; Shrapnel et al., 2019) and systems that are highly integrated across care areas including community (Puig Campmany et al., 2019; Shrapnel et al., 2019; Wolf et al., 2019). Electronic medical records (EMR) were frequently identified as a facilitator (Ansryan et al., 2018; de Vos et al., 2017; Vernon et al., 2019; Warnier, Van Rossum, Van Leendert, et al., 2016) and the integration with the EMR that automates part of the process (Vernon et al., 2019; Warnier, Van Rossum, Van

Leendert, et al., 2016) for example a frailty index score (Muscedere et al., 2016). Programs that were context specific improved implementation (de Vos et al., 2017; Uchmanowicz et al., 2019; Warnier et al., 2020) as was obtaining consensus from program leaders and users (stakeholders) on which frailty tool to use and who to conduct the screening (Ansryan et al., 2018; Gibson & Crowe, 2018; Kirk et al., 2016; Muscedere et al., 2016; Vernon et al., 2019). Local program champions being identified and engaged with the project was also valuable to frailty assessment success (Marsden et al., 2021; Vernon et al., 2019).

The assessment was more valuable if it could increase the patient centeredness of care (de Vos et al., 2017), recognize at-risk patients early (Ibrahim et al., 2017; Liu et al., 2022; Reid, 2018), lead to treatment decision making or pathway implementation (Ansryan et al., 2018; Liu et al., 2022; Muscedere et al., 2016; Shoultz et al., 2019; Watkins et al., 2019) or lead to increased service access (Oviedo-Briones et al., 2021). Professional training (especially in geriatric care) (de Vos et al., 2017; Wolf et al., 2019) led to improvements in frailty screening occurring and improvements in its delivery.

Assessments that were fast (five minutes or less) (Jia et al., 2020; Sanford et al., 2020; Warnier, Van Rossum, Van Leendert, et al., 2016; Warnier, Van Rossum, Velthuijsen, et al., 2016), non-burdensome from patient perspective (Warnier, Van Rossum, Van Leendert, et al., 2016) or user perspective (Shoultz et al., 2019), non-invasive (Jia et al., 2020), validated for use by non-specialists (Gibson & Crowe, 2018; Muscedere et al., 2016; Sanford et al., 2020), and validated for the care area (Shrapnel et al., 2019; Warnier, Van Rossum, Velthuijsen, et al., 2016) were important strengths of the tool. Additional strengths for tools were their: objectivity, simplicity, when they included pictures, self-reported tools, and being comprehensive (Liu et al., 2022). Tools that required no special equipment (Gibson & Crowe, 2018; Muscedere et al.,

2016), were inexpensive (Gray et al., 2016; Jentzer et al., 2019), were easy to implement (Jentzer et al., 2019; Muscedere et al., 2016; Shoultz et al., 2019), chosen using a theory-informed implementation process (Vernon et al., 2019) or a multidisciplinary leadership taskforce (Ansryan et al., 2018) were valued.

2.3.2.3 Barriers

Time consuming to complete frailty screening by healthcare professionals and staff was the most frequently discussed barrier (n = 7) (Amini et al., 2019; Kirk et al., 2016; Liu et al., 2022; Peig et al., 2021; Sanford et al., 2020; Shoultz et al., 2019; Wolf et al., 2019). Working in an area with high patient workload (Amini et al., 2019; Eamer et al., 2017; Lim et al., 2019; Wolf et al., 2019) and lack of resources to intervene properly (Eamer et al., 2017; Lim et al., 2019; Wolf et al., 2019) were other frequent challenges. Lack of training for frailty screening in general and use of the specific tool(s) was a major pitfall for implemented frailty screening tools (Warnier et al., 2021).

A phenomena that was particularly important in the ED was a risk to the disruption of the flow to care which was called ‘flow culture’ (de Vos et al., 2017; Kirk et al., 2016). Maintenance of the flow was important to both the staff as well as the managers of the ED (de Vos et al., 2017; Kirk et al., 2016). Barriers from ED nurses were rooted in a belief that it did not belong as part of their professional role and would disrupt the flow of the work, while the geriatric team nurses saw the tool as too simple and a waste of their competencies and their time. Implementing a geriatric nurse APN role into the ED led to cultural acceptance barriers with other staff nurses (Marsden et al., 2021). Screening for frailty was considered a risk for disruptive professional identity, especially among advanced-practice geriatric nurses who valued their professional clinical judgement skills (Kirk et al., 2016). Some nurses perceived frailty screening tools as

useful to substantiate their own clinical judgement and therefore were more useful for less experienced nurses (Warnier et al., 2021). This supported that the value given to clinical judgment to assess for frailty may be a barrier to using a screening tool to assess for frailty. Another important component when using the frailty screening tools was whether clinical judgement was used with it. When there was a paucity in clinical judgement (when screening with a frailty screening tool), it could lead to decreased value of the assessment completed (de Vos et al., 2017).

Push from the healthcare system for early discharge (Eamer et al., 2017; Lim et al., 2019) and inconsistent use of early frailty screening (Wolf et al., 2019) impaired frailty assessment. Resources and organizational conditions set the agenda more than the person's real needs; sometimes nurses would not assess areas that there were no known services available (Ivanoff et al., 2018). If the hospital management were not fully engaged in a project as stakeholders it could create opposition (i.e. by not improving discharge times) and fail to fully realize the goals of improving elderly patient care (de Vos et al., 2017). Gaps in services from frailty screening nurses (i.e. outside of the work hours), funding for these providers, and maintaining the APN role long-term were ongoing challenges with a larger geriatric-care program (Marsden et al., 2021).

Lack of family involvement could lead to poor communication (Eamer et al., 2017; Lim et al., 2019), but was also insufficient alone to conduct meaningful frailty screening (Warnier, Van Rossum, Van Leendert, et al., 2016). Frailty assessments requiring reliance upon surrogate information sources such as charts or caregivers (Warnier, Van Rossum, Van Leendert, et al., 2016) or tools that could not be completed with high severity of illness or disabilities (Gibson & Crowe, 2018; Ivanoff et al., 2018) impaired quality. Equipment that was problematic to use (e.g.

hand-grip device) (Amini et al., 2019) and tools that had had unclear instructions (Warnier, van Rossum, et al., 2016) were also impediments. Training required for all hospital staff was challenging to implement (Shrapnel et al., 2019) but low self or staff knowledge about frailty also impaired assessment (Eamer et al., 2017; Lim et al., 2019). Different levels of training lead to variability in ability to complete scales (Watkins et al., 2019).

Different language is used for frailty: among researchers, health care providers, administrators, policy makers, and the public, particularly in defining frailty creates inconsistency and implementation challenges (Muscedere et al., 2016). Further, no single tool has clear validity, reliability, and feasibility for use (Warnier, Van Rossum, Velthuisen, et al., 2016). These factors may be impacting the impairment of no clear usefulness to the job (Sanford et al., 2020; Vernon et al., 2019) and unfamiliar to the clinician for purpose or appropriate time to perform the assessment (Watkins et al., 2019).

2.4 Summary Statement

Frailty assessments are currently being completed by nurses across all areas in acute care with gateways to entry (especially the ED) being the key time that frailty screening may occur. There is no current consensus on best practice guidelines for frailty screening methods and there is a plethora of options available for clinicians to choose from. The three methods of frailty assessments are: by formal frailty screening tools, by informal or non-frailty screening tools, and by clinical judgement. Clinical judgement could either help or hinder the implementation of formalized frailty screening tools depending upon the beliefs held by nurses. The barriers to frailty screening have been evidenced in insufficient training of the frailty screening method or by it being deemed incompatible with current work (especially when it was perceived to increase workload). Notable facilitators to frailty screening included: overall feasibility of the method, the

speed of delivery of the tool and whether the frailty screening tool could lead to improving care for the older adults being screened.

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Chapter Three

Methodology

3.1 Study Design

I conducted a cross-sectional, non-experimental, descriptive study. A cross-sectional design was chosen because it is better able to reflect the current situation of nursing practice and allows more reliable comparisons between groups that are observed at a simultaneous point in time. A survey was chosen to enable larger access to the population of interest and get a larger sample size to support statistical significance of results.

3.2 Frailty Screening Tools and Definitions

The World Health Organization supports acute care practice as encompassing a range of functions including: emergency medicine, trauma care, pre-hospital emergency care, surgery care, critical care, urgent care, and short-term inpatient stabilization (Hirshon et al., 2013). This definition was simplified to any area of practice in the hospital, emergency, urgent care, or short-term care setting. The four most commonly identified tools in acute care identified previously (Theou et al., 2018) were specifically chosen to assess use in the study population. This included: Frailty Index (FI), Edmonton Frail Scale (EFS), Clinical Frailty Scale (CFS), and Frailty Phenotype (FP). The EFS and CFS were expected to be the most commonly used frailty screening tools in the study population, as identified by a geriatric-specialized RN colleague (T. Sawchuk, personal communication, April 22, 2021). An operationalized definition of frailty by international frailty experts (Rodríguez-Mañas et al., 2013) was selected to inform the survey development and interpretation. This definition supports frailty as a multi-domain accumulation of deficits including physical performance, nutritional status, mental health, and cognition where little stress may lead to functional impairment. This definition aligns well to the designs of the CFS, EFS, and FI screening tools.

3.3 Theoretical Domains Framework

The Theoretical Domains Framework (TDF) (Cane et al., 2012; S. Michie et al., 2005) was chosen to structure the research project. This framework has been developed as a method for assessing strengths and weaknesses for intervention development (Cane et al., 2012). This model is flexible for a wide range of applications including qualitative and quantitative research designs. The TDF is helpful for identifying the reasons behind healthcare professionals' behaviour, which can be useful to inform targeted changes to meet goals. These reasons are structured within 14 different domains for behavioural reasoning with TDF that each have additional constructs within the domains (Cane et al., 2012). These domains of behaviour change are: (1) knowledge, (2) skills, (3) social/professional role and identity, (4) beliefs about capabilities, (5) optimism, (6) beliefs about consequences, (7) reinforcement, (8) intentions, (9) goals, (10) memory, attention and decision processes, (11) environmental context and resources, (12) social influences, (13) emotion, and (14) behavioural regulation (Cane et al., 2012). Using this framework to identify the facilitators and barriers reduces assumptions for behaviours in engagement in frailty screening. Huijg and colleagues (Huijg, Gebhardt, Crone, et al., 2014; Huijg, Gebhardt, Dusseldorp, et al., 2014) developed a quantitative questionnaire structure of the TDF for healthcare implementation questions; these studies were used to structure this study's survey. The TDF specifically guides aims 2 and 3 (see **Table 1**), which is appropriate for its relevance to nursing science, making it relevant to the population of study and to interpreting the results.

Table 1*Study Aims and Relevant Analyses*

	Complementary Data	Aim 1	Aim 2	Aim 3
Description	Describe the characteristics of the nurses who completed the survey	Determine the type and the extent of frailty screening provided in acute care by nurses	Describe the barriers and facilitators to nurses' use of frailty screening tools in acute care	Compare both a) frailty screening approaches used and b) barriers and facilitators between nursing licensing groups and nursing specialties
Survey Section(s)	1	2	3	2 and 3
Type of Analyses Used	Descriptive statistics (frequency, mean, range, and standard deviation), Fisher's Exact Test, and qualitative description	Descriptive statistics (frequency, mean or median, mode, range, and standard deviation or interquartile range) and qualitative description	Descriptive statistics (frequency, mean, range, and standard deviation)	Simple linear regression and descriptive statistics for top-five facilitators and barriers (frequency, mean or median, range, and standard deviation or interquartile range)
Reliability Tests	Comparison to population sample characteristics. Missing data analysis: Little's MCAR, item-list of missing data, and evaluation of missing value patterns.			Scatterplot analysis and Durbin-Watson statistic

3.4 Purpose

The aims of the study were to explore the barriers and facilitators to nurses' screening for frailty in acute care in Alberta, Canada (see Table 1). Complementary data was first generated to describe the sample of nurses who completed the survey and used to situate the data for aims 1-3 to:

- 1) Determine the type and extent of frailty screening provided in acute care by nurses
- 2) Describe the barriers and facilitators to nurses' use of frailty screening tools in acute care
- 3) Compare both 1) and 2) between the nursing license groups and nurse specialties

3.5 Study Design

3.5.1 Sample

The targeted population was the four licensed nursing groups that provide care to older adults with frailty in acute care in Alberta: Registered Psychiatric Nurses (RPNs), RNs, Licensed Practical Nurses (LPNs), and NPs. These four licensed groups in Alberta all practice assessments from evidence-informed or evidence-based nursing as a standard of care within their scope of practice (College and Association of Registered Nurses of Alberta, 2011, 2017; College of Registered Psychiatric Nurses of Alberta, 2013; The Canadian Council for Practical Nurse Regulators, 2013). Graduate nurses were excluded as they have not yet passed their licensing exam and are not a large population to consider. The inclusion criteria were limited to licensed nurses who:

- 1) Were practicing as a fully licensed nurse in Alberta, Canada for at least three months
- 2) Primarily work in the acute care setting

3) Care for older adults in their area of practice

3.5.2 Sample Size

Sample size estimates were generated from known 2019-2020 data of RPNs, RNs, LPNs, and NPs currently practicing in Alberta; there was a paucity of data on specializations within these groups. After applying parameters to estimate total population working in acute care with older adults it was estimated that the sample size for RNs would be 1,400, NPs 21, RPNs 140, and LPNs 1,200. Using a 95% confidence interval and a 5% margin of error for a total nursing population size of 23,950 (Canadian Institute for Health Information, 2020), it was estimated an ideal sample size of 379 research participants for appropriate power to represent the population using a quantitative survey method.

3.5.3 Recruitment Process

Through collaboration with the College and Association of Registered Nurses of Alberta (CARNA) and the College of Licensed Practical Nurses of Alberta (CLPNA), the survey was sent to currently practicing RNs, NPs, and LPNs during the recruitment period. RPNs were originally included in the proposed design after initial discussions with the College of Registered Psychiatric Nurses of Alberta (CRPNA); however, CRPNA chose not to participate in the research project. CARNA and CLPNA had different established methods of participant recruitment, which required two different recruitment strategies that occurred during the same time period. For both recruitment methods, principles of a modified Dillman approach to recruitment via emailing (Dillman, 2011) were applied. Respondents could optionally choose to provide their email addresses to receive a summary of the research findings and/or a nominal reward based upon a draw-basis after completion of the survey.

3.5.3.1 CARNA Recruitment Method

CARNA's research coordinator provided the unique email(s) of RNs and NPs who had agreed to be contacted for research participation. The coordinator had originally speculated that they could limit the list to those who just worked in the acute care setting, but this was ultimately not feasible. The email list was reviewed and several email addresses that were incorrect were corrected by the first day of the survey launch, therefore all participants received the initial recruitment email the same launch day during business hours. The email contained an invitation to the link to the web-based survey and had a hyperlink imbedded in the email to enable a click to reach the eligibility questions, consent form, and the survey (see Appendix B). Two reminder emails (Appendices C and D) had the same content and were sent two and four weeks after the initial recruitment email during the collection time period.

3.5.3.1 CLPNA Recruitment Method

CLPNA's research coordinator facilitated the recruitment of LPNs through their members' emailed bulletin, therefore not requiring any management of their member's emails by the research team. The bulletin reached all LPNs and affiliates on the email list during the recruitment period. LPNs were required to scroll down on the weekly online bulletin to the particular recruitment section to read the 100-word recruitment text (Appendix E). This had a link to the initial recruitment email information presented in SurveyMonkey (Appendix B) then led to the same eligibility questions, consent, and survey as the CARNA population received.

3.5.4 Eligibility

To those participants who were recruited through the above means, they were able to reach the online survey eligibility screening prior to consenting. The three eligibility questions

(see Appendix F) were all mandatory. Individuals who were ineligible were not able to complete the survey and were redirected to the ineligible page (see Appendix G).

3.5.5 Consent

The research was collected anonymously; participants were provided the study consent form then could either consent by clicking “I agree” or could choose not to and click “I disagree. The consent form included: title of the study, principal investigator and supervisor, invitation to participation, participation, study purpose, benefits, risks, confidentiality and anonymity, conservation of data, voluntary participation, information about the study results, and compensation or incentive (Appendix H). The participants’ right to refuse consent or withdrawal at any time during the survey was outlined, but because no unique identifiers were collected or tied to the optional email address, removal of the individual data once submitted was not possible.

3.6 Survey Development

The survey was developed based on the TDF (Cane et al., 2012), and followed characteristics from a Dillman’s approach (Dillman, 2011). These characteristics included: a multiple-contact strategy, not revealing multiple recipient addresses, direct emailing participants where possible, keeping the recruitment email brief, thoughtful use of bold text, appropriate grouping of question components, thoughtful (minimal) use of colour, using a welcome screen that is motivational and instructs on how to proceed to the next page, number the questions, ensure visually pleasing across different modalities (avoiding any abnormal wrap-around text), consider question mode implications (providing instructions for the slider question), not requiring answers to questions before being allowed to answer subsequent ones, providing skip

instructions, auto-scrolling from question to question, reduced number of open-ended questions, provide a completion progress bar, and a token financial incentive (draw for Starbucks eGift cards). Additional web-based survey considerations incorporated to increase survey responses (Saleh & Bista, 2017) were: eliciting the aid of authority figures (the nursing colleges), targeting nurses who work with older adults living with frailty, reducing length, time to complete survey, assure anonymity and confidentiality, how data is handled, professional looking invitations, send at least one but no more than three reminders (two reminders sent), and consider the timing in relation to the calendar period of recruitment (completed outside from winter and summer holiday time periods). Duration of the survey was reduced as much as feasible to collect all relevant information, keeping the total number of TDF domain questions to at least two. After informed consent and the eligibility screening, there were three survey sections: 1) socio-demographics, 2) frailty screening methods, and 3) facilitators and barriers to using frailty screening tools.

3.6.1 Survey Section I. Demographic Characteristics

The demographics were matched by types of groups to enable direct comparison to the Canadian Institute for Health Information (CIHI) population level data (Canadian Institute for Health Information, 2020). Only four additional key nursing characteristics for the Alberta nursing population were included to not overly lengthen the duration of the survey. The categorical variables of interest were: age, gender, years of experience, common shift worked, employment status, area of responsibility, highest education level in nursing and in non-nursing (see Appendix F). The question asking about gender was worded to comply with the ethical standards set by the overseeing ethics board. Question 6, 8, and 12 also included a free-text response to capture other responses.

3.6.2 Survey Section II. Frailty Screening Methods

This section of the survey started with a multi-domain definition of frailty and asked participants to discuss their frailty screening practices with older adults in their primary area of nursing practice. There was a total possible response of 10 questions, with two of them being conditional (see Appendix F). Questions 15-18, 21-23 all used 5-point frequency (never to always) question format. In questions 15-18 respondents were asked about using frailty screening tools with the associated picture of the tool. The four most commonly used tools in acute care (Theou et al., 2018) were chosen to structure the survey, with an open-text response (question 20) used to gather other tools used. Consent was obtained from the publishing sources to utilize these pictures of frailty screening tools for research purposes.

Question 19 asked if there were additional frailty screening tools used; if yes it conditionally would ask questions 20 and 21. The survey maintain the sequence of the survey regardless of response to question 19. Question 20 was a free-text to describe the other screening tools and 21 a five-point frequency question. Questions 22-24 asked about frailty screening in general (22), assessing using clinical impression (no tool; 23), and to use a sliding scale 0-100 on preference of these two methods (24). This last question for section two was included due to its relevance identified from the literature.

3.6.3 Survey Section III. Barriers and Facilitators to Using Frailty Screening Tools

Nurses' behaviours and beliefs impacting efficacy of frailty screening tools were captured in the survey based on the 14 TDF domain model (Cane et al., 2012). The survey was informed by a previously supported TDF questionnaire that was found to capture 11 of the 14 domains identified by Cane et al. (2012) (Huijg, Gebhardt, Dusseldorp, et al., 2014). This

questionnaire was chosen for its relative brevity compared to others while still achieving content validation among experts ($\kappa = .73$; 95% CI [0.60, 0.81]) (Huijg, Gebhardt, Crone, et al., 2014). A minimum of two questions per domain were maintained to help with clarity of the different aspects within each domain. The 43-question section was structured on a 6-point Likert-type scale and tailored to reflect the questions for frailty screening tool use with older adults (see Appendix F). The seven negatively phrased questions were identified for reverse-coding during data analysis to enable comparative interpretation.

3.6.3.1 Pre-Testing of the Questionnaire

The survey was reviewed by all committee members, then qualitatively pilot tested by convenience sampling of nine individuals with either registered or practical nursing experience. These individuals did not meet qualifications to be within the study sample due to not being licensed ($n = 6$), or not currently work in acute care in the last three months ($n = 3$). A process of think-aloud interviewing was used to have participants paraphrase their understanding of each question and were followed up with cognitive probes if there was dissonance between expected responses and actual responses (Collins, 2003). This testing improved upon the flow, comprehension of the survey, grammatical errors and explanation of using the slider scale (question 24). The last four individuals to pilot the study were timed for duration of completion, and the mean of 12min was used to inform expected length for completion.

3.7 Ethical approval

Initial research ethics board approval from the University of Ottawa Office of Research Ethics and Integrity (H-02-21-5958) was obtained on March 13, 2021. Due to recruitment design change, an application for a revision was submitted and approved on March 31, 2021.

3.8 Data Collection

Data was collected anonymously by voluntary participation. Participants had the option to provide their email address for a nominal award and for a summary of the results from the study. The collection of the data was completed in a separate clickable survey, where the email addresses was not linked to the individuals' survey dataset data. The principal investigator was the only one that has access to this part of the data. The modality for the web-based survey was with the University of Ottawa's license with SurveyMonkey (<https://www.surveymonkey.com/>), which allowed computer, tablet and cell-phone survey responses and enable the survey design principles desired and will secure and encrypt the data in Canada. The data was downloaded directly from the platform into an SPSS and Excel file format and secured in a two-step (multifactor authentication) login file on OneDrive (<https://onedrive.live.com/>) with the University of Ottawa's network.

Data collection occurred between April 7th to May 18th, 2021. The survey was maintained open until May 30th, but no new respondents were brought in between the 19th to the 30th. The draw for the nominal reward of \$20 Starbucks eGift card was completed on June 7th and the three participants were notified. By June 9th all three individuals had responded correctly to their skill-testing question. The reward was emailed and confirmed to have been successfully received by all three winners by June 30th, 2021. Summary of results of the research findings will be sent to all individuals who provided their emails as well as CARNA and CLPNA after thesis defense.

3.8.1 CARNA Recruitment

The initial recruitment email was sent out on April 7th (Appendix B), the first follow-up email sent April 21st (Appendix C), and the final reminder email was sent May 5th (Appendix D).

The survey link initially sent on the 21st became corrupted after 1 hour into the release, which required a follow-up email sent out within three hours of the initial email that included an explanation and new link. Participants were able to email the research team with questions or comments; these were responded to within 24 hours of normal business hours. There were 2114 RNs and 55 NPs included in the initial recruitment email list. Several RN or NP participants emailed the primary researcher directly that they were not eligible ($n = 11$), had already completed the survey ($n = 7$), or asked for no further communication ($n = 2$) and were removed from following reminder emails if applicable. There were nine emails that were confirmed to be correct by the college but were undeliverable either the initial, second, or final emails, which were speculated to be from full inboxes. Only two of these emails were undeliverable all three times.

3.8.2 CLPNA Recruitment

CLPNA issued their weekly online bulletin with the recruitment information on the days of April 7, 14, and 28, May 5 and 12. This resulted in five recruitment emails being sent in total. The CLPNA confirmed the link was functional, did not receive any emails from participants reporting broken links during the recruitment period, and several survey respondents indicated they were LPNs.

3.9 Data Analysis

Statistical analysis was run using SPSS version 28.0 (IBM Corp, Armonk, New York) with 95% confidence intervals and α set to 0.05. How the data applies to each study aim and the analyses used is summarized in Table 1.

3.9.1 Sample Size and Eligibility

The initial estimate of sample sizes was adjusted after the population size information was obtained at the start of the data collection period. Using a 95% CI and a 5% margin of error for total population size of 27,697 (Canadian Institute for Health Information, 2022) it was estimated an ideal sample size of 379 research participants for appropriate power to represent the population. Response rates and differences in expected to actual sample sizes were calculated. The differences in estimate verse actual survey sample size are reported in supplemental data (appendix I). A review of the demographic open-response primary area of practice was completed to ensure all participants were in an eligible position. Eligible compared to ineligible respondents were reported by n proportions only.

3.9.2 Survey Section I. Demographic Characteristics

Descriptive representation of the demographic data is represented by n proportions, mean, range, and standard deviation. Population data provided from the nursing colleges and the CIHI (Canadian Institute for Health Information, 2020) was used to compare to the sample where possible and reported in supplemental data (appendix I). Descriptive statistics were generated for the total sample, as well as stratified by nursing specialties. The open-text responses were individually assessed, reviewed with CB and either included into an existing category or maintained in an “other” category with a list of reported responses. The demographic characteristics of the nursing sample were discussed with the research team and three meta groups of primary practice area (nursing specializations) were agreed upon based upon group sizes and types of nurses to compare: Critical Care, Medical and/or Surgical, and Other Acute Care. The initial plan was to also stratify by license group, but this was decided against as a research team due to violation of normalcy related to insufficient group sizes of LPNs and NPs.

All variables were categorical, therefore a test for independence between the three primary areas of practice was employed. The assumptions for Chi-square test of independence were violated based on less than five responses expected for each cell (Polit, 2010), therefore Fisher's exact test was used. Only the *p* values were discussed in the manuscript, additional information was considered supplemental and reported in the thesis only.

3.9.3 Survey Section II. Frailty Screening Methods

3.9.3.1 Data Contributing to Aim 1

Quantitative Data. The Likert-type scale responses were converted in the range of numbers in SPSS from "Never = 1" and "Always = 5". Skewness to the right was substantial (greater than 1.0) for all except one frailty screening tool questions (15-18, 21-23), therefore these data were chosen to all be represented by medians and interquartile range. Question 24 maintained as mean and standard deviation as it was not skewed and was a continuous variable. Range and n statistics were also reported for these questions.

Qualitative Data. The free-text "Other" frailty screening tool responses (question 20) were codified according to a qualitative description approach (Sandelowski, 2000). This qualitative content analysis is data-derived; the codes that are identified are from the data itself (Sandelowski, 2000). The identified screening tools were searched in the data bases CINHALL, Medline, and AgeLine to identify if the tool had been published. Grey literature was also searched if not found in any of the three data bases including Google and the Alberta Health Services' internal staff website.

After coding the first thirty surveys, I verified the coding process with CB before proceeding with the rest of the data. There was additional qualitative interpretive data that was

observed in question 20, where some respondents included information about their frailty screening use. This additional information was also codified based upon themes and reported separately by n-proportions only. The types of frailty screening tools used were counted by number of responses by individual category and grouped together by four frailty domain (Rodríguez-Mañas et al., 2013): physical performance, nutritional status, mental health, and cognition. Tools that included several but not all of these domains were included as non-frailty tool multiple domains. Tools that were either called a frailty screening tool or were found in the literature were grouped together under frailty screening tool. Additional categories were made for people who reported no tool, tool not recalled, and repeating a survey frailty screening tool (one from questions 15-18). This information was reported by frequency and percentage but only the modes reported in the manuscript; full data reported in supplemental data (appendix I).

3.9.3.2 Data Contributing to Aim 3

Questions 15-18 and 21-24 were analyzed further to test for differences between groups. The five-point questions were assumed to be on a continuous scale from one to five (i.e., this construct represents an underlying continuous variable), which supported the choice for parametric analysis using simple linear regression. Question 24 is a 101-point slider scale question on a continuous scale 0-100. Each model had the question response as the dependent variable, with the three meta groupings of primary practice area as the independent input. Output data for the purposes of this project included: unstandardized coefficients (B) and standard error, standardized coefficient (β), t -value, significance ($\alpha = 0.05$), and 95% confidence intervals. Tests for assumptions of model normalcy were completed using: Durbin-Watson statistic (between 1.5-2.5 was the expected range) and scatter plot analysis.

Both the critical care and med/surg nursing groups were run in the simple linear regression as the dummy-group reference, but after analyzing the descriptive statistics the med/surg group was determined to have more interpretive value due to their higher mean rates of using the frailty screening tools. Exploratory comparison between licensed nursing groups was completed as the independent input (using simple linear regressions), however was decided to not be analyzed further due to violation of assumptions for data normalcy.

3.9.4 Survey Section III. Barriers and Facilitators to Using Frailty Screening Tools

3.9.4.1 Data Contributing to Aim 2

The 43 TDF questions were converted in the range of numbers in SPSS from “Very strongly disagree = 1” and “Very strongly agree = 6”. The seven negatively worded questions were reverse coded in SPSS and indicated for comparative interpretation. The 43 individual questions and 14 domains were analyzed using descriptive statistics including: n proportions, mean, range, and standard deviation (see supplemental data, appendix I). The midpoint for the questions was 3.50, which was used as a reference value. All 43 individual TDF questions with means greater than 3.50 were considered a facilitator and less than 3.50 were considered a barrier. The 14 TDF domains were assigned as a barrier if all questions were individually barriers, facilitator if all questions were facilitators, and mixed if there was at least one different question; this data was considered supplemental to the manuscript only.

3.9.4.2 Data Contributing to Aim 3

Between group comparisons were assessed between three meta groups of primary practice area (Critical Care, Medical and/or Surgical, and Other Acute Care). The descriptive statistics were the primary method to compare the groups after recommendations from JS for

most meaningful interpretation of TDF results. Therefore, the total samples' top-five barriers and facilitator questions (of the 43) were reported with the descriptive statistics provided for all three primary practice areas.

Supplemental data that was not included in the manuscript includes the identification of the most different primary practice TDF domain mean scores (through simple linear regression) and the descriptive statistics of the top-five most different scores identified. Fourteen separate simple linear regressions for each domain with the independent variable being the primary practice areas (dummy-coded and critical care reference group) and the dependent variable TDF domain mean. Output data included: unstandardized coefficients (B) and standard error, standardized coefficient (β), t -value, significance ($\alpha = 0.05$), and 95% confidence intervals. Tests for assumptions of model normalcy were completed using: Durbin-Watson statistic (the expected range 1.5-2.5 was achieved), and scatter plot analysis (no observed outliers in the data). With discussion as a research team and analysis of the assumptions for normalcy of regression analyses were considered met.

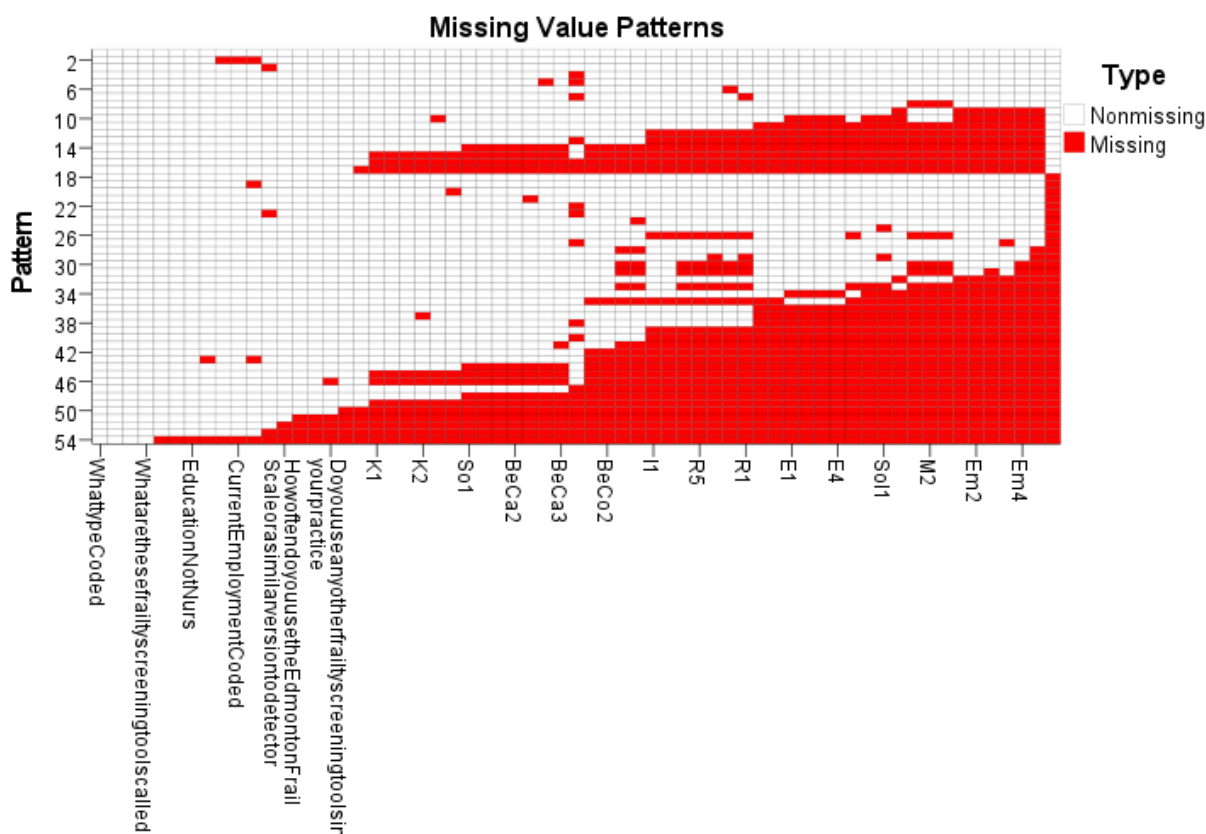
3.9.5 Missing Data Management

Missing value analysis was conducted and used to assess the type of missing data. Patterns of missingness were visually assessed using graphic representation (see Figure 2): missing at random, missing not at random, and missing completely at random (MCAR). Little's MCAR test was run and tested for significance. The missing data estimated mean was compared to the all-data mean. A preliminary test was also run for question 24 with a dummy variable inserted (0) for missing variables compared and compared to complete case data. The 0 was chosen as this was the default starting point on the sliding scale within the survey tool (see

Appendix F). After discussion with the research team and conducting these tests, complete case analysis was maintained as the best choice for optimal use of the data.

Figure 2

Missing Data Patterns of Missingness Visual Analysis



Note. Missing value patterns of survey items excluding the two conditional questions (20 and 21) in order of missing data. Demonstrates a general pattern of a step-wise increase towards completion of the survey by missing data (missing not at random).

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Chapter Four

Facilitators and Barriers to Nurses Screening for Frailty in Acute Care in a Provincial Health Care System: A Survey Study Guided by the Theoretical Domains Framework

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ABSTRACT

BACKGROUND: Older adults living with frailty represent the largest population of hospitalized patients in Canada, but they do not always receive optimal quality of care. Nurses are well positioned to screen for frailty, but current frailty screening practices are poorly understood.

OBJECTIVES: To explore frailty screening practices and describe the barriers and facilitators to frailty screening identified by nurses practicing in: critical care, medical and/or surgical, and other acute care.

DESIGN: Cross-sectional survey study conducted over a 6-week period.

PARTICIPANTS: Nurses in Alberta, Canada working in acute care with older adults.

MEASUREMENTS: Frailty screening tools/methods were quantified on 5-point frequency scales with one 101-point slider-scale question. Descriptive statistics were generated and practice areas compared using linear regression. The top-five barrier and facilitator mean scores from a 43-item 6-point Likert-type questionnaire based on the Theoretical Domains Framework were compared by practice area.

RESULTS: Respondents ($n = 228$) reported “usually” screening by clinical impression (median = 4, interquartile range = 4-5) and preferring it to formal frailty tools ($M = 67.1$, $SD = 25.7$). Practice area influenced general frailty screening ($B = 0.81$, $r = .31$, $p < .001$). Medical and/or surgical nursing had higher general frailty screening tool use ($B = 0.81$, $r = .31$, $p < .001$), but had no significant ($p > .05$) differences for using clinical impression ($r = .03$), or preference of frailty screening method ($r = .09$). The top barrier was belief conducting frailty screening was routine ($M = 2.68$, $SD = 1.42$, $p > .05$). The top facilitator was the disbelief that frailty screening negatively impacts relationships with older adults ($M = 4.48$, $SD = 0.88$, $p < .05$).

CONCLUSIONS: Frailty screening tools supporting clinical judgement and embedded into routine have greater likelihood for uptake.

Key words: Frailty, older adult, nurse, theoretical domains framework.

INTRODUCTION

Older adults are significant users of the Canadian public healthcare system and older adults living with frailty represent the largest primary and tertiary service users (1). Frailty is a state of vulnerability especially common to the older adult population developed as a consequence of multidimensional deficits that accumulate over time (2, 3). It has been conservatively estimated that 47-58% of all individuals 65-85 years of age are living with at least a mild level of frailty in Canada (4).

There is debate on how best to measure or operationalize frailty assessment (5), which creates dissonance in clinical recommendations. Expert consensus suggests that four agreed upon aspects of a frailty definition should include: physical performance (including gait speed and mobility), nutritional status, mental health, and cognition (3). One scoping review (6) found the four most commonly used frailty scales in acute care with predictive ability for relevant adverse outcomes were: Frailty Index (FI) (89% predictive ability), Edmonton Frail Scale (EFS) (88%), Clinical Frailty Scale (CFS) (73%), and Frailty Phenotype (FP) (53%).

Frailty is one measurable way to identify vulnerable older adults to facilitate the best utilization of health resources. Indirect ways to assess for frailty include: non-frailty tools (validated risk scales but not specifically for frailty), study-specific measures (such as risk-stratification criteria according to number of chronic diseases and age), and clinical judgement (6). Studies published from Canadian populations on acute care screening tools were more likely to use established frailty tools than indirect frailty assessments, especially the CFS (6). During the COVID-19 pandemic, frailty screening using the CFS has become an important tool for critical care triage (7). Some research has explored development of frailty measurement tools electronically based upon administrative health data, including in a Canadian preoperative context (8), however the clinical usefulness for these tools and impact upon clinical practice are not known (9).

Licensed nurses in Alberta include: registered nurses (RNs), licensed practical nurses (LPNs), registered psychiatric nurses (RPNs), and nurse practitioners (NPs). These nurses have the professional capacity to use evidence to inform assessments to meet client or patient health goals (10–12) and are the most populous providers of care to older adults in the acute care setting. Although there has been some initial information about what frailty screening tools nurses use (13) further understanding is needed from a Canadian population perspective. Exploratory, qualitative research with nurses on medical and/or surgical units found frailty screening tools could help to structure the nurses' days overall, but the nurses preferred their own clinical judgement to assess for frailty (14). Expanding this preliminary research into alternative populations, frailty screening tools, and using different research methods has the potential to strengthen the understanding of nurses' preferences. How different nursing specialties (critical care, medical and/or surgical, and other acute care) use impact frailty screening tools is important to explore for targeted change management solutions. In this study, we explored and compared i) the current state of frailty screening by nurses and ii) the barriers and facilitators of frailty screening performed by nurses in acute care with older adults in one Canadian province.

METHODS

Study Design

A cross-sectional, non-experimental, descriptive study approach was undertaken using a survey as the format for data collection. The survey (supplement 1) consisted of three sections:

Section i: Demographics

Demographic questions were developed for this study guided by the Canadian Institute for Health Information (CIHI) population level data characteristics (15) and additional nursing characteristics considered relevant by the research team for the Albertan nursing population. These ten categorical variables were: license type, primary area of practice, age, gender, years in current position, most common shift, current employment status, area of responsibility, highest education level in nursing and in non-nursing.

Section ii: Frailty Screening Methods

An operationalized definition of frailty by international frailty experts that supports a multi-domain deficit accumulation understanding (3) was selected to inform the survey development and interpretation in section ii. Four commonly used frailty screening tools were examined with visual aids: CFS, EFS, FI, and FP. A fifth item that was an open-text response of other frailty screening tools was included. These five items were rated based upon respondents' agreement to how often they use the tool on a 5-point frequency scale. Two additional 5-point questions asked about frailty screening in general and assessing for frailty using clinical impression; this was followed by a question on a 101-point sliding scale choice of preference of these two methods (survey available in supplement 1).

Section iii: Theoretical Domains Framework (TDF) Questions

The TDF (16, 17) was chosen to structure section iii to understand a broad range of barriers and facilitators to nurses using frailty screening tools. The TDF is advantageous as it has multidisciplinary applications, is specific to health care research, and is designed to overcome the hurdle from theoretical behavioural information to knowledge translation. Behavioural reasons are structured within 14 different domains that each have additional constructs within the domains (16). Huijg and colleagues (18, 19) developed a quantitative questionnaire structure of the TDF for healthcare implementation questions, which were used to structure the TDF portion of the survey. A 6-point Likert-type scale was chosen, and questions were tailored to reflect the population being surveyed for frailty screening tool use with older adults.

After input from the research team, the survey was pilot tested by a convenience sample of nine individuals with either RN or LPN experience in Alberta but not in the eligible group of nurses. A process of think-aloud interviewing was used to have participants paraphrase their understanding of each question and were followed up with cognitive probes if there was dissonance between expected responses and actual responses (20). This testing improved upon

the flow, comprehension of the survey, grammatical errors and explanation of the slider scale question. The last four individuals to pilot the study were timed for an estimated time to complete the survey; the mean time was approximately 12min.

Eligibility Criteria

The target population was all licensed nurses (RN, LPN, RPN, and NP) within the province of Alberta, Canada. Inclusion criteria were: (i) practicing as any type of licensed practical nurse in Alberta, Canada for at least three months (ii) primary practice in acute care and (iii) provide care for older adults. Graduate nurses were excluded as they have not yet passed their licensing exam and are not a large population to consider. Using a standardized sample size calculator (21) with a 95% *CI* and a margin of error of 5% for total population size of 23,950 (15), it was estimated an ideal sample size of 379 research participants for appropriate power to represent the populations' studied traits. Based on early information provided to the team from the collaborating nursing colleges from previous survey studies completed (unpublished data), it was estimated that the goal sample size could be achieved.

Recruitment Method

Through collaboration with the College and Association of Registered Nurses of Alberta (CARNA) and the College of Licensed Practical Nurses of Alberta (CLPNA), the online survey was sent to currently practicing RNs, NPs, and LPNs during the recruitment period April 7th to May 18th, 2021. RPNs were not able to be recruited as the affiliated nursing college declined to participate. Computer, tablet and cell-phone survey responses were accepted through the platform SurveyMonkey (<https://www.surveymonkey.com/>). Principles of a modified Dillman approach to recruitment via emailing were applied (22), however the direct email component could not be applied for the LPN population. LPNs were recruited through their weekly online nursing college bulletin containing a 100-word recruitment text with an embedded link to reach the survey eligibility information. The researcher (JF) emailed the study information as well as the link to the survey to the eligible RNs and NPs three time during the recruitment period. The total emailed population was 19,329 nurses.

Statistical Analysis

Statistical analysis was run using SPSS version 28.0 (IBM Corp, Armonk, New York) with 95% confidence intervals and α set to .05. Missing value analysis was assessed using Little's MCAR and patterns of missingness visual analysis. Complete case analysis was used for the data. Demographic data was analyzed for potential differences evidenced by including LPN and NP with the larger RN sample by running all statistical analyses twice with and without these groups.

Section i) The demographic information was represented by n, mean, range, and standard deviation. Three main practice areas emerged from the data: critical care (emergency department (ED) and intensive care unit), medical and/or surgical (med/surg), and other acute care settings. The assumptions for Chi-square test of independence were violated based on less than five responses expected for each cell, therefore the Fisher's exact test was used to compare the main

practice areas with the contingency table analyzed to understand the nature of the relationships between variables.

Section ii) Descriptive statistics of n and range reported for all questions. The M and SD were reported for the preferred method question. Skewness to the right was significant at $\alpha = .05$ using the Shapiro-Wilk test for most frailty screening tool questions, therefore these data were chosen to be represented by medians and interquartile range. Parametric analyses were conducted by linear regression including outputs of: unstandardized coefficients (B) and standard error, standardized coefficient (β), t -value, significance ($\alpha = .05$), and 95% confidence intervals. After looking at the descriptive statistics, med/surg was chosen as the reference group because of the comparatively higher mean rates of frailty screening tool use. Tests for assumptions of regression model normalcy were verified using Durbin-Watson statistic and scatter plot analysis.

The open-text response was codified according to a qualitative description approach (23) and grouped by domains of frailty (3). The identified screening tools were searched in the data bases CINAHL, Medline, and AgeLine and if not found in any of the three data bases, searched in the first 50 responses in Google and the Alberta Health Services internal staff website. All identified frailty screening tools and the mode of non-frailty screening tools were reported.

Section iii) The 43 TDF 6-point Likert-type responses were converted for “Very strongly disagree” = 1 and “Very strongly agree” = 6. The seven negatively phrased questions were identified for reverse-coding during data analysis to enable comparative interpretation. The mid-point for the range of these questions was 3.50, which was used as a reference with values below being considered a barrier and above a facilitator. The top-five barriers and facilitators by primary practice areas were identified and descriptive statistics of n , M , SD , and range reported.

RESULTS

Eligibility and Demographics

Of the 7,690 nurses emailed, 288 participants completed the eligibility questions (3.7%). There were 58 ineligible and one was eligible but did not agree to participate leaving 229 eligible and agreed to participate. Of these 229, one was additionally eliminated based upon their area of practice being ineligible (assisted living) ($n = 1$). This created a total sample size of 228 licensed nurses from the recruited population (3.0%). This sample included: 10.1% LPNs ($n = 23$), 88.2% RN ($n = 201$), and 1.8% NP ($n = 4$) (see Chapter 4 Table 1). When the LPN and NP groups were removed from the RN sample, there were no significant differences ($p > .05$) noted or changes in interpretation of results, therefore the full sample of 228 licensed nurses was used to inform the study findings.

When grouping nurses based upon their primary practice area ($n = 224$), 90 worked in critical care, 101 worked in med/surg, and 22 worked in other acute care ($p = .072$). Sixty-four of the 90 critical care nurses worked in the ED; 102 of 111 med/surg nurses were general practice, and 15 of the 23 other acute care worked in psychiatry. When comparing primary practice area, there was no statistical difference ($p > .05$) in the characteristics of gender, years in current position, current employment status, area of responsibility, and highest levels of education in nursing or non-nursing. There were statistical differences in age ($p < .001$) with a higher proportion of med/surg representing the less than 30 age group (35 out of 54) and other acute care a higher proportion representing 60 or older (seven out of 20). The most common shift had significant differences ($p = .002$) with other acute care having a lower proportion working evening (one out of 19), night (one out of 12), and mixed shift (nine out of 140).

Frailty Screening

For the total sample, the four frailty screening tools were reported to be used “never” (median = 1, IQR = 1-3; see Chapter 4 Table 2). Frailty screening by clinical impression was used “usually” (median = 4, IQR = 4-5) while frailty screening tools were used “rarely” in general (median = 2, IQR = 1-3). The preferred method between general frailty screening (0) and clinical impression (100) was clinical impression with a mean score of 67.1 (SD = 25.7).

When comparing between practice areas, the med/surg nurses consistently had higher median and IQR scores showing more tool utilization, especially with the CFS and EFS tools. The data was then assessed with simple linear regression on a 5-point scale for the relationship between working in med/surg compared to other practice areas. Working in med/surg increased use of frailty screening tools in general by 0.81 ($r = .31, p < .001$), CFS by 0.59 ($r = .25, p < .001$), and EFS by 0.61 ($r = .28, p < .001$). There were also significant decreases observed for the FP by 0.37 ($r = .20, p = .004$) and FI by 0.37 ($r = .18, p = .009$). There were no significant ($p > .05$) differences between med/surg to other practice areas for other frailty screening tools ($r = .02$), using clinical impression ($r = .03$), or preference for frailty screening method ($r = .09$).

Of those ($n = 64$) that reported using a different frailty screening tool, these were “always” used (IQR = “usually” to “always”). There were 103 individual items from the free-text about Other Frailty Screening Tools and 27 different codes within four broad categories. The two modes of other frailty screening tools were “Fall Risk Screen – Non-Specific” ($n = 16$) and the “Braden Scale” ($n = 16$). The two frailty screening tool codes were: unit specific frailty screening ($n = 4$) and the “RAI” ($n = 2$). The “RAI” was interpreted as The Risk Analysis Index (RAI) (24); a 14-item instrument for frailty measurement in surgical populations with both a prospective (RAI-C) and retrospective (RAI-A) questionnaire. This was the only additional frailty screening tool identified.

Barriers and Facilitators

Top-Five Facilitators

The top-five facilitators to using frailty screening tools are presented in Chapter 4 Table 4. The top facilitator for the total sample was the disbelief that frailty screening would negatively impact their relationship with older adults ($M = 4.48$, $SD = 0.88$) and was the only significant question ($p < .05$). The second-highest facilitator was the disbelief “When I conduct frailty screening, I get criticized by health care professionals that are important to me” ($M = 4.44$, $SD = 0.96$). The third and fourth top facilitators were disbelief that thinking about frailty screening makes the nurses feel anxious ($M = 4.38$, $SD = 1.06$) and is stressful ($M = 4.35$, $SD = 1.02$). The fifth facilitator was the belief conducting frailty screening benefits public health ($M = 4.35$, $SD = 1.02$).

The top-five facilitators were within the domains of Beliefs about Consequences, Reinforcement, and Emotions across practice areas ($n = 3$); only med/surg nurses had one facilitator from Beliefs about Capabilities. For med/surg and other acute care, the question “When I conduct frailty screening, it is discouraged by my patients and their families” was significant ($p < .05$). In other acute care practice “When I conduct frailty screening, I get criticized by health care professionals that are important to me” was significant ($p < .05$).

Top-Five Barriers

The top-five barriers to using frailty screening tools are shown in Chapter 4 Table 5. Three domains emerged for barriers to using frailty screening tools: Environmental Context and Resources, Skills, and Goals (Chapter 4 Table 5). All three of the questions from the domain of Environmental Context and Resources were in the top-five barriers. The top barrier for the total sample was the belief that conducting frailty screening is routine ($M = 2.68$, $SD = 1.42$). This was not significant at the total sample level, but was significant ($p < .05$) for both critical care and other acute care nurses ($M = 2.27$, $SD = 1.22$ and $M = 2.47$, $SD = 0.94$ respectively). The second through five top barriers were beliefs that: there was insufficient training on conducting frailty screening ($M = 2.74$, $SD = 1.27$), there were often other priorities ($M = 2.75$, $SD = 1.15$), there was insufficient necessary resources available ($M = 2.78$, $SD = 1.24$), and there was insufficient time ($M = 2.85$, $SD = 1.17$).

Other acute care practice differed by having a barrier in domain of Social/Professional Role and Identity “Conducting frailty screening in my primary area of practice is part of my work as a nurse” ($M = 2.89$, $SD = 1.45$) and no barrier in Goals. A barrier for other acute care nurses was “I have conducted frailty screening” ($M = 2.68$, $SD = 1.58$), while the other two groups did not have this in their top-five. The med/surg group differed with having higher mean scores compared to the other two groups and no statistically significant barriers ($p > .05$).

DISCUSSION

This study contributes to the understanding of how acute care nurses are using frailty screening tools and their beliefs surrounding utilization of frailty screening. The nurses in this study “usually” used clinical impression to guide their frailty interpretation and it was their preferred method compared to frailty screening tools. Medical and/or surgical nurses used the frailty screening tools in general and for each of the four studied tools more compared to other primary practice areas. The top-five facilitators for using frailty screening tools were in the domains of Beliefs about Consequences and Reinforcement; the top-five barriers were in the domain of Environmental Context and Resources. Practice areas demonstrated differences in the top-five facilitators and barriers to frailty screening. This information can be used to guide hospital administration and educators towards theory-informed integration of frailty screening into the practices of their nursing staff members.

Assessing Frailty with Clinical Impression

The preference for clinical impression complements previous findings in the med/surg population (14). A difference compared to Warnier et al. was there was no evidence that the younger age group (med/surg) had increased preference for frailty screening use compared to clinical impression. The importance of critical thinking is a strong mandate across nursing colleges in Canada and a mandatory component of curricula (25, 26), which may be strengthening the preference towards clinical judgement in the studied population, especially in recently graduated nurses.

Given the preference for clinical impression expressed by the nurses, to successfully implement a frailty screening tool it would be appropriate to select one that incorporates or strengthens clinical impression. Of the frailty screening tools being used in Alberta, the CFS is the frailty screening tool that best encompasses the clinical judgement by utilizing the impressions from non-specialists to assign a frailty classification score (27). The CFS is more open-ended compared to the other studied tools, which creates more opportunity for nurses to utilize their clinical judgement in assigning frailty scores. Use of frailty screening tools that are more itemized or question driven still require clinical judgement to be useful tools (28). The CFS has been criticized for its subjectivity by the user, but robust evidence-based multidisciplinary training modules can increase user confidence with minimal burden upon the user (29). Since the nurses in the study reported clinical judgement was of greater importance, emphasizing the incorporation of it into using the selected tool may create more usefulness of the frailty screening tool, and therefore greater likelihood of integration into practice.

Assessing Frailty with Screening Tools

Although frailty tools were “rarely” used during the data collection time, there was indication of some use, particularly in the med/surg nurse population. The CFS and EFS were both created in Canada (30), while the EFS was originally published in Edmonton, Alberta (31) which may help explain greater uptake of these two tools compared to others. Frailty screening tools were previously found to be more successfully adopted when using systems that already

exist (32–34), giving support to using one of tools herein identified (especially the CFS and EFS). Screening tools that are highly integrated across care areas also have greater adoption, including community care (34–36). The CFS has been used by nurses before across care sectors including: in-patient acute care, long-term care and primary health care (37), and critical care: intensive care units (38) or the ED (34). The CFS is already showing some use in ICUs in Alberta (39) and the med/surg population (demonstrated in this study) improving potential for expansion across further care-settings.

This study found that the population of nurses studied at the time of data collection did not use frailty screening routinely and this barrier has been identified elsewhere in the literature. Integration into a routine is a multifaceted concept from a behaviour change perspective. Faster tools are more easily integrated into routines (40). The CFS is the fastest of all the studied frailty screening tools, taking 24sec by trained nurses and geriatricians (37). The CFS also captures physical performance, nutritional status, mental health, and cognition domains of frailty and includes pictorial aids (27). By not reducing frailty screening to just the physical domain, the frailty picture captured can potentially translate to more useful interventions or treatment plans. This is important as screening tools that lead to directing clinical decisions for the patients involved also improve routine integration (41). The EFS and a FI also capture these broader frailty domains, but the EFS takes up to 5min to complete (31) and the FI could take up to 15–30min depending on how many indicators are included (30). The FP only measures the physical domain, requires specialized equipment to perform the hand-grip strength test question and the entire screening takes up to 10min for completion (30).

Tools that do not require specialized equipment and can be use with most patient populations in the care area can be key to success with screening tool uptake (42). Critical care patients are more likely to be non-ambulatory and non-verbal (i.e. from intubation and/or sedation), which may be why the critical care nurses found screening tools to be less useful in general compared to med/surg nurses. The CFS is the only frailty screening tool from this study that is not reliant upon the responses from the patient and has begun to be use in triage prior to admission to ICUs (7), therefore creating more utility for all critical care nurses. Another important routine enabler are electronic medical records (EMR) (43–46) especially when the screening tool has integration within the EMR that automates part of the process (43, 45). With the current health system in Alberta implementing a province-wide connect care e-Health system, there is an additional opportunity to start a frailty screening project early when nurses are just starting to build their new routines with this new charting system.

The nurses that responded to other frailty screening tools primarily identified single-domain non-frailty tools, especially in the physical domain (i.e. fall risk). This could be a strength to build upon when considering an implementation program, given that fall risk is a direct or indirect question in all four of the studied frailty screening tools and a comprehensive geriatric assessment (6). It is unclear if the unit-level frailty screening tools were designed for nurses or created for a different healthcare provider but adapted for nurses to use. The unit-level screening tools could be new tools created for a local context or an adaptation from a previously established frailty screening tool. Using these types of tools can meet local needs (47, 48) but does not ensure validity like previously tested frailty screening tools or enable easy translation of information outside of the care setting.

Beliefs Influencing Frailty Screening

It is assistive to frailty screening tool utilization that nurses in all care areas “disagreed” that “If I conduct frailty screening with older adults it will have disadvantages for my relationship with these patients” in the domain about Beliefs about Consequences. This is in some contrast to previous findings from Kirk et al. where the domain Belief’s about Consequences in general was identified as a barrier (47). Nurses had responded that by completing frailty screening it would not only be a matter of completing a task, but the additional interaction with the patient could potentially lead to additional care tasks that the nurses would feel obligated to assist with (47). This difference may be due to our study structuring the question “In general, I have enough time to conduct frailty screening” to the domain of Environmental Context and Resources, which was one of the top-five barriers. Another theme that Kirk et al. identified in Beliefs about Consequences was that the frailty screening could risk their professional identity and role by diminishing time for their clinical judgement and not leave time for what the geriatric ED nurses identified as important expert tasks (47). This conflict with frailty screening may specifically be a challenge for NPs or specialized geriatric nurses that are trained to complete portions or full assessments of comprehensive geriatric assessments and are threatened by the reductionism of their work in comprehending the complex situation of living with frailty. Since our study was predominantly Bachelor’s prepared RNs, this population may not be experiencing this same risk to identity.

Med/surg nurses had significantly higher rate of frailty screening, had lower mean barrier scores, and had evidence of beliefs in their capabilities to perform frailty screening compared to the other two practice areas. Despite these facilitators, they too agreed with the other practice areas they had not received adequate training for frailty screening. This leads to question the quality of the screening practices that are currently being completed. Professional training (especially in geriatric care leads to improvements in frailty screening occurring and improvements in its delivery) (35, 44). Inadequate training and instructions for completing frailty screening tools was found elsewhere to be a significant barrier in the generalist Med/Surg nursing population (14). One study assessed the inter-rater reliability between professions using the CFS in the intensive care unit context and found the agreement between nurse-nurse was substantial ($\kappa = .63$; 95% *CI*), nurse-physicians was moderate ($\kappa = .59$; 95% *CI*), and nurse-physiotherapists near perfect agreement ($\kappa = .88$; 95% *CI*) (38). This is suggestive that nurses can be the appropriate health professional to collect reliable frailty screening assessment data, but should be supported with training on the screening tools.

Observed differences found between primary practice areas for the question “When I conduct frailty screening, I get criticized by health care professionals that are important to me” may be due to diversity in healthcare members and their unique dynamics. This was only significant for other acute care nurse (which were predominantly psychiatric nurses), but was in the top-five facilitators for all practice settings. Multidisciplinary and integrated teams facilitate screening for frailty (44, 49) especially when all the health care professionals are given equal value for their assessment (50). It may be that the other acute care area (which was predominantly psychiatric nurses) has a particularly strong integrated team that supports screening for frailty. Psychiatric nurses are a known sub-set of the nursing population that have specialized professional knowledge and different interdisciplinary communication (51) that may

influence their perception of criticism from coworkers. These potential group differences may be incidental findings related to a small sample size and should be explored further.

Limitations

The original studies (18, 19) on which this survey was built did not have discriminant content validity of the items measured within reinforcement, goals, and behavioural regulation. Although the TDF guided questions were built from a previously tested survey study, it is possible that the questions asked within a domain header are not capturing the true essence of that domain. Factor analysis and construct validity testing was not a part of the aims for this study to test for these assumptions.

Due to few respondents using frailty screening tools, the barriers and facilitators identified predominantly represent a pre-implementation context. The potential differences in barriers and facilitators for frailty screening dependent upon stages in frailty screening tool implementation was not captured. How beliefs change based on the type of frailty screening tool utilized was also not extrapolated. The survey responses were less than required to meet power goals; this suggests there may be additional between group differences that exist in the population and that observed differences may be stronger than elicited (52). The potential differences between LPN, RN, and NP frailty screening methods and beliefs were also not captured due to the limited sample collected of LPN and NP groups. How reliably the nursing population is currently performing in their frailty screening and how the inter- and intra- rater reliability compares to their multidisciplinary team members remains unclear.

Conclusions and Future Directions

There is an opportunity to implement frailty screening tools into the nursing practice of Alberta' nurses. This study gives support towards implementation of the CFS based on its support of clinical judgement, early implementation in the population, its rapid administration time, its multi-domain consideration, its integration into an EMR, and its utility across health sectors. Addressing barriers from Environmental Context and Resources could have the greatest influence upon successful frailty screening implementation. Stakeholders who seek to implement a new or improve upon a frailty screening program in the studied population can use the evidence from this study to inform their decisions. One way to complete this is by utilizing the complementary implementation tool for TDF studies the Behaviour Change Wheel (53) to allow for targeted selection of evidence-informed interventions. Further exploration is warranted on how both clinical impression or the frailty screening tools are used to guide nursing care practices for older adults perceived as living with frailty.

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GRAPHICS

Chapter 4 Table 1. Demographic Characteristics of Participants

Characteristic	n (%)
License Type	228 (100)
LPN	23 (10.1)
RN	201 (88.2)
NP	4 (1.8)
Primary Area of Practice	224 (100)
Critical Care	90 (39.5)
ED	64 (28.1)
ICU/CCU	26 (11.4)
Med/surg	111 (48.7)
General med/surg	102 (44.7)
Gerontology	3 (1.3)
Nephrology	3 (1.3)
Oncology	1 (0.4)
Palliative	2 (0.9)
Other Acute Care	23 (10.1)
Psychiatry	15 (6.6)
WOC	2 (0.9)
OR and PACU	1 (0.4)
Additional Areas ^a	5 (2.2)
Gender	228 (100)
Male	22 (9.6)
Female	204 (89.5)
Other ^b	2 (0.9)
Age	228 (100)
Less than 30	55 (24.1)
30-39	65 (28.5)
40-49	46 (20.2)
50-59	41 (18.0)
60 or older	21 (9.2)
Years in Current Position	226 (100)
Less than 1 year	18 (7.9)
1-3	52 (22.8)
4-6	45 (19.7)
7-9	33 (14.5)
10-14	28 (12.3)
15-19	23 (10.1)
20 or more	27 (11.8)
Most Common Shift	226 (100)
Days	54 (23.7)
Evenings	19 (8.3)
Nights	12 (5.3)
Mixed	141 (61.8)

Characteristic	n (%)
Current Employment Status	226 (100)
Full-time	108 (47.4)
Part-time	88 (38.6)
Casual	28 (12.3)
Locum	2 (0.9)
Area of Responsibility	227 (100)
Direct Care	211 (92.5)
Administration	8 (3.5)
Education	8 (3.5)
Highest Level of Education in Nursing	227 (100)
Diploma	48 (21.1)
Bachelors	167 (73.2)
Masters	11 (4.8)
PhD	1 (0.4)
Highest Level of Education non-Nursing	227 (100)
NA	111 (48.7)
Diploma	53 (23.2)
Bachelors	53 (23.2)
Masters	7 (3.1)
PhD	3 (1.3)

Abbreviations: ED, emergency department; ICU/CCU, intensive and/or cardiac care units; Med/surg, medical and/or surgical care; WOC, wounds, ostomy, and continence; OR, operating room; PACU, post-anesthetic care unit; NA, not applicable.

^a Additional Areas: Diagnostic imaging (n = 1), endoscopy (n = 1), “rehab” (n = 1), “IV therapy” (n = 1), and transition services (n = 1).

^b Other Genders: Non-binary (n = 1) and Two-spirit (n = 1).

Chapter 4 Table 2. Use of Frailty Screening Methods by Practice Area^a

Practice Area	Factor	Clinical Frailty Scale	Edmonton Frail Scale	Frailty Phenotype	Frailty Index	Other Frailty Screening Tools ^b	General Frailty Screening Tool Use	Clinical Impression	Preferred Method ^c
Critical Care	Median (IQR)	1 (1-2)	1 (1-1)	1 (1-1)	1 (1-1)	4 (4-5)	1 (1-3)	5 (4-5)	71.1 (25.1) ^c
	n	88	87	85	85	12	85	85	74
Medical and/or Surgical	Median (IQR)	1 (1-3)	2 (1-3)	1 (1-2)	1 (1-2)	5 (4-5)	3 (1-4)	4 (4-5)	64.9 (26.2) ^c
	n	108	107	107	107	44	105	105	92
Other Acute Care	Median (IQR)	1 (1-2)	1 (1-1)	1 (1-1)	1 (1-1)	4 (3-5)	2 (1-2)	4 (3-5)	60.8 (26.9) ^c
	n	23	23	23	23	7	22	21	16
Total	Median (IQR)	1 (1-2)	1 (1-2)	1 (1-2)	1 (1-2)	5 (4-5)	2 (1-3)	4 (4-5)	67.1 (25.7) ^c
	n	222	220	218	218	64	215	214	185
	Range	1-5	1-5	1-5	1-5	2-5	1-5	1-5	3-100

^a Items quantified on a 5-point scale with 1 = “never”, 2 = “rarely”, 3 = “sometimes”, 4 = “usually” and 5 = “always.”

^b The Other Frailty Screening Tools were conditionally reported if “yes” to using other frailty screening tools.

^c Preferred Method was quantified on a 101-point sliding scale; 0 = “Frailty Screening Tool,” 50 = “Equally Useful,” and 100 = “Clinical Impression.” This question was represented by *M (SD)*.

Chapter 4 Table 3. Medical and/or Surgical Nurses Compared to All Other Nurses' Frailty Screening Method Use^a

Frailty Screening Method	B	SE	<i>B</i>	<i>t</i>	Sig.	95% <i>CI</i>	
						Lower Bound	Upper Bound
Clinical Frailty Scale (n = 219)	-0.59	0.15	-0.25	-3.85	.000**	-0.89	-0.29
Edmonton Frail Scale (n = 217)	-0.61	0.14	-0.28	-4.32	.000**	-0.89	-0.33
Frailty Phenotype (n = 215)	-0.37	0.13	-0.20	-2.93	.004*	-0.62	-0.12
Frailty Index (n = 215)	-0.37	0.14	-0.18	-2.63	.009*	-0.64	-0.09
Other Frailty Screening Tools (n = 63)	-0.03	0.25	-0.02	-0.13	.898	-0.53	0.47
General Frailty Screening (n = 212)	-0.81	0.17	-0.31	-4.72	.000**	-1.14	-0.47
Clinical Impression (n = 211)	-0.05	0.13	-0.03	-0.39	.698	-0.30	0.20
Preferred Method (n = 182) ^b	4.39	3.84	0.08	1.14	.255	-3.19	11.96

^a All items run individually as simple linear regressions with the Medical and/or Surgical practice area set as the reference group.

* $p < .05$

** $p < .001$

Chapter 4 Table 4. Top-Five Facilitators to Frailty Screening by Practice Area^a

Practice Area	Factor	Ranking				
		1	2	3	4	5
Critical Care	Domain	Beliefs about Consequences	Emotions	Reinforcement	Emotions	Beliefs about Consequences
	Question	If I conduct frailty screening with older adults it will have disadvantages for my relationship with these patients. ^b	I feel anxious when I start to think about conducting frailty screening. ^b	When I conduct frailty screening, I get criticized by health care professionals that are important to me. ^b	Conducting frailty screening for my patients is stressful to me. ^b	If I conduct frailty screening with older adults it will benefit public health.
	<i>M(SD)</i>	4.43(0.86)*	4.36(1.03)	4.35(0.89)	4.31(1.00)	4.16(0.85)
	<i>n</i>	75	61	65	62	75
Medical and/or Surgical	Domain	Beliefs about Consequences	Beliefs about Consequences	Reinforcement	Reinforcement	Beliefs about Capabilities
	Question	If I conduct frailty screening with older adults it will have disadvantages for my relationship with these patients. ^b	If I conduct frailty screening with older adults it will benefit public health.	When I conduct frailty screening, I get criticized by health care professionals that are important to me. ^b	When I conduct frailty screening, it is discouraged by my patients and their families. ^b	I am confident that if I was motivated and wanted to, I could conduct frailty screening.
	<i>M(SD)</i>	4.53(0.89)*	4.51(1.06)	4.45(0.99)	4.41(0.90)*	4.39(1.05)
	<i>n</i>	89	89	84	85	90
Other Acute Care	Domain	Reinforcement	Reinforcement	Beliefs about Consequences	Emotions	Beliefs about Consequences
	Question	When I conduct frailty screening, I get criticized by health care professionals that	When I conduct frailty screening, it is discouraged by my patients and their families. ^b	If I conduct frailty screening with older adults it will have disadvantages for my relationship	I feel anxious when I start to think about conducting frailty screening. ^b	If I conduct frailty screening with older adults it will benefit public health.

		are important to me. ^b		with these patients. ^b		
	<i>M(SD)</i>	4.88(0.89)*	4.56(0.96)*	4.50(0.92)*	4.38(1.02)	4.27(1.03)
	<i>n</i>	16	16	18	16	15
Total	Domain	Beliefs about Consequences	Reinforcement	Emotions	Emotions	Beliefs about Consequences
	Question	If I conduct frailty screening with older adults it will have disadvantages for my relationship with these patients. ^b	When I conduct frailty screening, I get criticized by health care professionals that are important to me. ^b	I feel anxious when I start to think about conducting frailty screening. ^b	Conducting frailty screening for my patients is stressful to me. ^b	If I conduct frailty screening with older adults it will benefit public health.
	<i>M(SD)</i>	4.48(0.88)*	4.44(0.96)	4.38(1.06)	4.35(1.08)	4.30(1.02)
	<i>n</i>	184	167	159	160	184
	Range	1-6	1-6	1-6	1-6	1-6

^a Means were generated from a 6-point Likert-type scale (midpoint 3.50) 1 = “Very strongly disagree” and 6 = “Very strongly agree.”
Questions are ranked from 1 being the highest mean score (greatest facilitator) to 5 the fifth highest mean score out of all 43
Theoretical Domains Framework guided questions.

^b Reverse coded.

* $p < .05$; 95% *CI*

Chapter 4 Table 5. Top-Five Barriers to Frailty Screening by Practice Area^a

Practice Area	Factor	Ranking				
		1	2	3	4	5
Critical Care	Domain	Environment Context and Resources	Skills	Goals	Environment Context and Resources	Environment Context and Resources
	Question	On the unit that I work on, conducting frailty screening is routine.	I have been trained how to conduct frailty screening.	There often is something else more important than conducting frailty screening. ^b	I have the necessary resources (including physical resources, technologies, and staff) to conduct frailty screening.	In general, I have enough time to conduct frailty screening.
	<i>M(SD)</i> n	2.27(1.22)* 64	2.48(1.11) 80	2.50(1.03) 66	2.52(1.17) 64	2.66(1.12) 64
Medical and/or Surgical	Domain	Goals	Environment Context and Resources	Environment Context and Resources	Environment Context and Resources	Skills
	Question	There often is something else more important than conducting frailty screening. ^b	In general, I have enough time to conduct frailty screening.	I have the necessary resources (including physical resources, technologies, and staff) to conduct frailty screening.	On the unit that I work on, conducting frailty screening is routine.	I have been trained how to conduct frailty screening.
	<i>M(SD)</i> n	2.73(1.12) 82	2.95(1.20) 82	2.96(1.30) 82	3.00(1.53) 82	3.04(1.34) 98
Other Acute Care	Domain	Skills	Environment Context and Resources	Skills	Environment Context and Resources	Social/Professional Role and Identity
	Question	I have been trained how to conduct frailty screening.	On the unit that I work on, conducting frailty screening is routine.	I have conducted frailty screening.	I have the necessary resources (including physical resources, technologies, and	Conducting frailty screening in my primary area of practice is part of my work as a nurse.

					staff) to conduct frailty screening.	
	<i>M(SD)</i>	2.37(1.30)	2.47(0.94)*	2.68(1.53)	2.82(1.07)	2.89(1.45)
	<i>n</i>	19	17	19	17	19
Total	Domain	Environment Context and Resources	Skills	Goals	Environment Context and Resources	Environment Context and Resources
	Question	On the unit that I work on, conducting frailty screening is routine.	I have been trained how to conduct frailty screening.	There often is something else more important than conducting frailty screening. ^b	I have the necessary resources (including physical resources, technologies, and staff) to conduct frailty screening.	In general, I have enough time to conduct frailty screening.
	<i>M(SD)</i>	2.68(1.42)	2.74(1.27)	2.75(1.15)	2.78(1.24)	2.85(1.17)
	<i>n</i>	165	200	166	165	165
	Range	1-6	1-6	1-6	1-6	1-6

^a Means were generated from a 6-point Likert-type scale (midpoint 3.50) 1 = “Very strongly disagree” and 6 = “Very strongly agree.” Questions are ranked from 1 being the lowest mean score (greatest barrier) to 5 being the fifth lowest mean score out of all 43 Theoretical Domains Framework guided questions.

^b Reverse coded.

* $p < .05$; 95% *CI*

Supplement 1. Survey

This supplement contained the online survey and was attached separately for the journal manuscript. See Appendix F within the Thesis for the same content.

Chapter Five

Integrated Discussion

5.1 Summary of Thesis Findings

This research project provides new insights into how licensed nurses in acute care are using and perceive using frailty screening tools with older adults. The first chapter situated the research problem and was followed by a literature search in the second chapter, exploring currently known tools nurses use to screen for frailty with older adults and factors influencing the behaviour for completing these assessments. The third chapter explained the process and rationale for the research methods through a cross-sectional, descriptive, survey analysis. The data were organized into three sections: demographics, frailty screening tools used, and Theoretical Domains Framework (TDF) facilitating or barrier beliefs about using frailty screening tools. Supplemental data for the thesis is presented in appendix P with a topic-specific discussion following in appendix Q. The primary findings for this thesis are encapsulated within the fourth chapter.

The demographic data helped to firmly ground the data analyzed further by describing the registered nurses (RNs), licensed practical nurses (LPNs), and nurse practitioners (NPs) that participated in the study. There were fewer respondents than originally predicted (228 vs. 1,693), but sufficient sample size was generated to proceed with interpretation with the data in totality and by comparing three different primary practice areas in nursing. The characteristics of the survey respondents were deemed relatable to population data from Canadian Institute for Health Information within 10% for all four directly compared characteristics (with the omission of the smallest licensed nursing group the registered psychiatric nurses). Some dissimilarities existed between the demographics of the compared primary practice groups of critical care, medical and/or surgical (med/surg) and other acute care nurses. The significant ($p < .05$) differences were

in age and shift type worked most frequently, which with post hoc analysis supported that the med/surg nurses were younger and other acute care worked more day shifts.

Medians generated from the data in section ii of the survey supported that across all of the pictorially-tested frailty screening tools, they are seldomly being used. Only 64 respondents (28.1% of all participants) described what other frailty screening tools they used, from which 103 unique meaning codes were generated. Of these, only two identified tools were made to screen for frailty; The Risk Analysis Index (RAI) (Hall et al., 2017) ($n = 2$) and unit specific frailty screening ($n = 4$). There was unsolicited qualitative data provided by some respondents that included information on: when they screen for frailty, negative outcomes, the role of RNs in frailty screening, and other team involved with frailty screening. Clinical impression (100) was preferred over frailty screening tools (0) to assess for frailty screening on a 101-point sliding scale ($M = 67.1$, $SD = 25.7$). When med/surg nurses were compared to other practice areas, they were observed to use the tested frailty screening tools more in general ($B = 0.81$, $r = .31$, $p < .001$), but had no significant ($p > .05$) differences for using clinical impression ($r = .03$), or preference of frailty screening method ($r = .09$).

The top-five facilitators are within four TDF behavioural domains: Beliefs about Consequences, Emotions, Reinforcement, and (for med/surg only) Beliefs about Capabilities. The top facilitator for using frailty screening tools was the disbelief that frailty screening negatively impacts relationships with older adults ($M = 4.48$, $SD = 0.88$, $p < .05$) and was significant for all three compared practice areas ($p < .05$). The types of domains that the top-five barriers fall within are: Environmental Context and Resources, Skills, Goals (not for other acute care), and Social/Professional Role and Identity (only for other acute care). It is noteworthy that all questions within Environmental Context and Resources reached the top-five for barriers and

that it was the only domain with all questions denoted as barriers. The top barrier was the belief that conducting frailty screening was routine ($M = 2.68$, $SD = 1.42$, $p > .05$). This barrier was significant for the practice areas of critical care ($M = 2.27$, $SD = 1.22$) and other acute care ($M = 2.47$, $SD = 0.94$).

5.2 Implications for Practice

5.2.1 Linking the TDF Results to Evidence-Informed Interventions

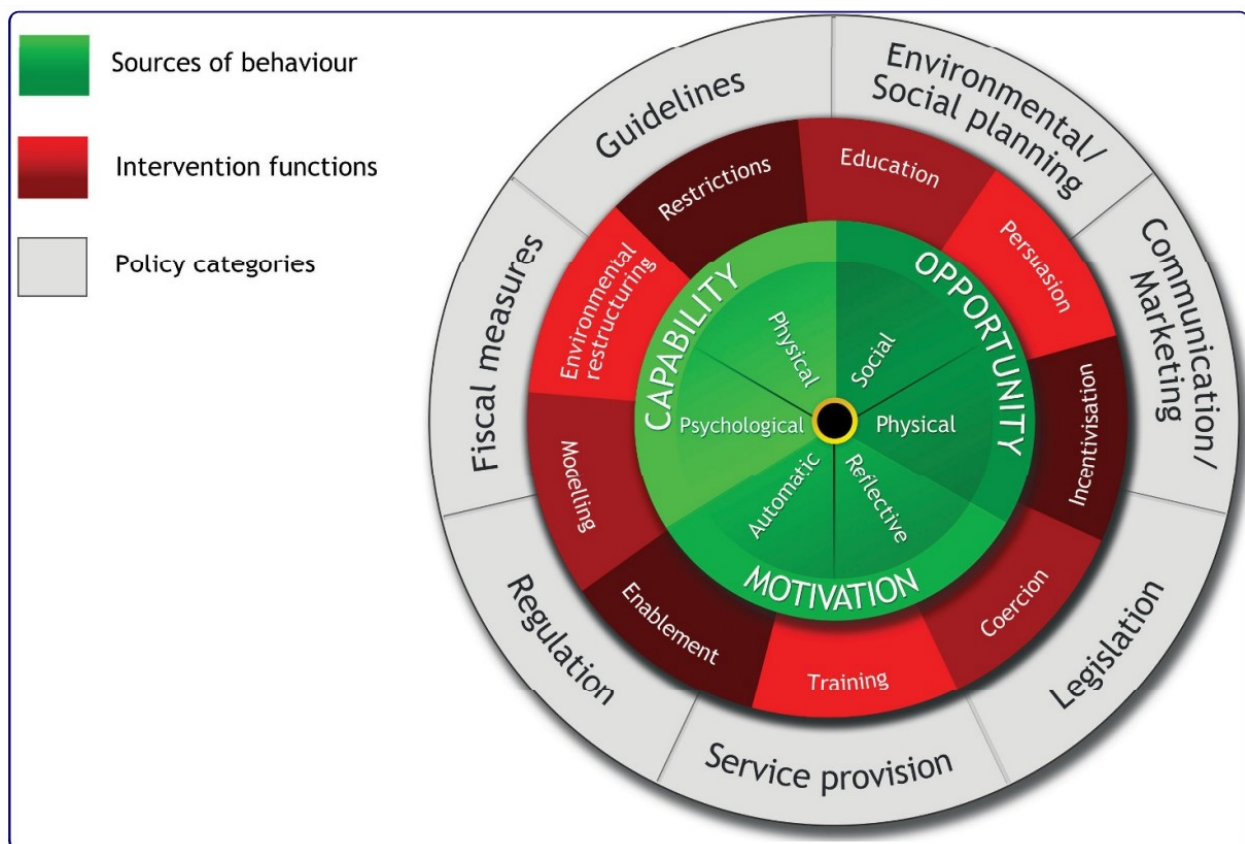
Already integrated into the nursing population of interest are two applicable frameworks that may be considered for change-management considerations. The first is a quality improvement framework put forth by the primary nursing employer in the province called the Alberta Health Services (AHS) Improvement Way (AIW) and has previously been utilized with nurses providing care to older adults (Gutscher, n.d.). This framework is results-driven with four primary steps to consider during any process change: define opportunity, build understanding, manage change, and sustain results (Gutscher, n.d.). An additional framework that has been designed specifically for advanced practice nurses (APNs) is the participatory, evidence-based, patient-focused process, for guiding the development, implementation, and evaluation of advanced practice nursing (PEPPA) framework (Bryant-Lukosius & DiCenso, 2004). The PEPPA was designed specifically for role clarity of APNs, but can be used by many health professionals seeking to facilitate process change. Both frameworks could guide administrators to utilize the findings from this thesis to anticipate needs for behaviour change and meet goals for sustainable frailty screening practices.

The natural extension for this TDF driven thesis is to use the accompanying intervention-directing Behaviour Change Wheel published by the same original author as the TDF (Michie et

al., 2011). The capability opportunity motivation - behaviour (COM-B) model is the inner ring within the Behaviour Change Wheel, with the second ring representing intervention functions and the third policy categories (Michie et al., 2011). The COM-B model is a simple four-component framework to understand sources of behaviour (Michie et al., 2011) and has been linked with the TDF domains (Atkins et al., 2017) (see Figure 3). An advantage of using the Behaviour Change Wheel implementation theory and tool is it helps to direct clinical implementation recommendations. The next section will outline intervention recommendations using this tools' explanatory power.

Figure 3

The Behaviour Change Wheel (Michie et al., 2011)



5.2.1.1 Behaviour Change Wheel Interventions for Facilitators to Frailty Screening

The top-five facilitators for the total sample were linked to the COM-B, intervention functions, and policy categories (appendix J). The COM-B categories were all within motivation, either as reflective ($n = 2$) or automatic ($n = 3$). Motivation in the COM-B model is considered the neuropathways that stimulate and influence the trajectory of behaviour, beyond mere goal setting or conscious decisions (Michie et al., 2011). Persuasion ($n = 4$) and modelling ($n = 4$) were the intervention functions that were the most frequent for the top-five facilitators. The data are representing what interventions may already be in place and are believed by nurses to be supporting their use of frailty screening tools. Communication/marketing ($n = 5$), guidelines ($n = 5$), service provision ($n = 5$), regulation ($n = 5$), and legislation ($n = 5$) were in all of the top-five policy categories. These are the types of policies that according to the Behaviour Change Wheel (Michie et al., 2014) may be currently supportive (or at least not impeding upon) using frailty screening tool utilization with older adults.

By devising guidelines that are applicable to nurses in delivering their frailty screening tool interventions to patients and clearly communicating what regulations support and guide their practice, the facilitating behaviours for using the screening tools could be reinforced. Incorporating interventions for facilitators to frailty screening would not overcome the strongest challenges, but could be beneficial to bolstering a frailty screening tool implementation. These interventions could help to build and maintain momentum called “quick-wins” in the AIW framework (Gutscher, n.d.). An example for the top facilitator (see in appendix J) is a disseminated video of a nurse administering a frailty screening tool with an older adult, who shows appreciation for the nurses’ actions and thanks them for showing their caring. This would work upon the nurses’ reflective motivation, through positive modelling and some persuasion of

the tool being a relationship builder. While these types of interventions might not directly work to overcome the barriers, they could start the positive momentum towards driving change.

5.2.1.2 Interventions for Barriers to Frailty Screening

The top-five barriers for the total sample compared similarly as the facilitator variables (appendix K). The top-five barrier TDF domains were further expanded to outline recommended behaviour change techniques (appendix L). The physical capacity to participate in the activity concerned ($n = 1$), motivation guided by reflective thought processes ($n = 1$), and physical opportunities to make the behaviour possible ($n = 3$) were the three categories in the top-five barriers to frailty screening. Training ($n = 4$) and enablement ($n = 4$) were the modes for the top-five barriers' intervention functions. These data are representing what interventions may not exist or be ineffectual and are believed to be impeding upon nurses' use of frailty screening tools. The associated modes for the policies were guidelines ($n = 5$), fiscal measures ($n = 5$), regulation ($n = 5$), legislation ($n = 5$), and service provision ($n = 5$). The existing policies influencing these categories may be impeding upon or non-existent to encourage using frailty screening tool utilization with older adults.

The associated behaviour change techniques from the Behaviour Change Wheel for the barriers to frailty screening are outlined in appendix L. Attempting to implement these change techniques without support from key stakeholders such as hospital management could fail to realize the goals to improve the care for older adults (de Vos et al., 2017). Taking the information from chapter two that identified what others have observed as barriers to frailty screening in conjunction with the results of this study could be utilized to support choices on the types of challenges to overcome. Considering possible change techniques, I will outline an example implementation program to overcome some of the barriers for frailty screening.

The first part includes creation of a new policy for a standard of practice to be provided within 24-hours of admission to the hospital (including extending emergency department (ED) stays) of all individuals 65-years and older to screen for frailty using the Clinical Frailty Scale (CFS) (embedded within the electronic medical record). This screening would then auto-generate a standard set of interventions implemented for all who score five or greater, with the option to adjust these interventions and add a geriatric team referral when also deemed appropriated based upon clinical judgement. This new policy would then need supportive training (i.e. by clinical nurse educators within nursing units) to ensure nurses have the theoretical understanding for using the CFS, as well as how new orders can be implemented with attending/consulting physicians. Another element of the training could be to utilize an online CFS training tool, such as a recently developed 30-minute program (Haddad et al., 2022). Not only are nurses educated about this new policy, but partnering health care providers and support staff on the goals of frailty screening program and anticipated benefits. This program would need ongoing surveillance, which could be accomplished by existing geriatric APN roles to monitor for use of the CFS for the target population and to ensure goals are being met (especially from the older adults' perspective). Sharing the successes of the program and where adjustments have been identified as necessary with the user nurses would help reinforce the behaviour and help improve on the utility of the tool in improving patient care.

5.2.2 Pre-Implementation Considerations

Section 5.2.1 illustrated interventions that may already be integrated within the current population (facilitating interventions) and where interventions may have the greatest success to improve nurses' screening behaviour (barrier interventions). Before implementation of a frailty

screening tool is considered, it is highly beneficial to consider the potential risks and benefits to be able to anticipate and respond to them as part of the implementation program.

5.2.2.1 What are the Risks for Frailty Screening?

Using clinical judgement alone may be incorporating unconscious age stereotypes into the frailty decision. Ageism has established negative outcomes on the physical and psychological wellness of the older adults experiencing the discrimination (Burnes et al., 2019) and is present in acute care nurses beliefs and knowledge about older adults (Scerri & Schembri, 2022). A challenge with frailty identification is it puts into words the construct behind ageism; the assumptions of age associated with weakness, neediness, and diminished capacity or potential (McNally & Lahey, 2015). If an individual is screening from a perspective of their own internalized biases, then they may not be truly screening for a multi-dimensional frailty but whether somebody fits their personal image of ‘an old person’. Although there are means to reduce these biases (Burnes et al., 2019), changing beliefs is hardly simple. Belief changes do not singularly occur upon receiving more reliable information, it a complicated inter-related process that is extremely individualized (Bromberg-Martin & Sharot, 2020). Utilizing a screening tool can provide more objectivity to the assessment and therefore reduce potential biases of ageist perspectives or presumptions.

Important to consider is once somebody has been identified as living with frailty there is a risk that labelling is also leading to additional discrimination (Muscedere et al., 2016). Registered nurses in acute care hospitals were found to use “othering,” internalized microaggression, and internalized ageism in their verbal communication when individuals were associated with functional impairment (Schnabel et al., 2021). Older adults often do not personally identify with being ‘frail’ (Van Damme et al., 2020) and when they do internalize it, it

could hamper their sense of empowerment. One study found that after experiencing a fall, older adults may become disempowered (but more receptive to receiving help) or may desire to be perceived as physically competent and not as a frail older person (therefore they would engage in riskier mobility behaviours). Diagnosing ‘frailty’ for older adults may not necessarily help them to understand their increased risks (Buhagiar & Smith, 2022) and will not necessarily improve patient outcomes with a diagnosis alone. If there is no additional follow-up interventions or care after an identification for frailty has been made, there is an increased potential for harm by assigning this ‘frail’ label. Thoughtful implementation of any frailty screening method (with a clear purpose for its use) is thus important to reduce potential harms associated with it.

Screening tools that do not cover enough breadth of frailty domains may be missing important factors relevant to the older adult’s situation. For example, health care providers and older adults both identified that a multi-domain definition of frailty best represented their perspectives when trying to define it, but that frailty tools may be missing the important factors (Van Damme et al., 2020). Another risk is when frailty screening is completed at only a singular point in time (especially during critical illness) when the assessor is scaling the patient in that moment in time without reference to the patient’s baseline. Getting assessments that are conducted multiple times and across care settings (especially with the same tool for easier interpretation) is one way to overcome this challenge or to use instruments that are designed to capture the patients’ baseline (e.g. the CFS).

Frailty screening by an inter-disciplinary team that can best interpret the different dimensions of frailty was identified by older adults as valuable to support frailty management (Van Damme et al., 2020). However, as expanded upon in chapter one, a full comprehensive geriatric assessment is costly and not practical to implement for all older adults living with frailty

in the acute care system. There are mixed results about the quality of nurses' frailty screening scores. Two different studies noted that the nurses' ratings for frailty with a CFS were more likely to underscore the patient's frailty compared to the physician (Chin et al., 2020; Shrier et al., 2021). Compared to physicians CFS ratings, intensive care unit (ICU) nurses had a moderate agreement ($\kappa = 0.59$; 95% CI, 0.44-0.75) (Pugh et al., 2019), while fair agreement was reached for both acute care respiratory nurses ($\kappa = 0.35$; CI not reported) (Chin et al., 2020) and ED nurses ($\kappa = 0.21$; 95% CI, 0.19-0.22) (Shrier et al., 2021). Whether appropriate staff training or other resources can overcome these differences in rating is a topic for further research.

5.2.2.2 What are the Benefits for Frailty Screening?

In chapter one I described how nurses are well positioned to screen for frailty with older adults using frailty screening tools in the acute care setting. While clinical impression may currently be the preference (as supported by our study), it is not without faults. This rapid clinical decision making process has been shown to be useful in time and resource limited health provision situations, but can lead to cognitive errors (Croskerry, 2002). Using clinical judgement alone may be incorporating unconscious ageist stereotypes into the frailty decision which can limit the objectivity of the assessment by the individual. The survey respondents had the greatest number of physical-domain non-frailty screening tools as their current tool to assess for frailty; this could suggest that acute care nurses in this population are primarily identifying frailty by a physical definition. How aware nurses are that there are other domains of frailty is unclear. It is possible that without evidence to guide their interpretation that a nurse using clinical impression alone could miss other relevant domains of frailty. Using a screening tool can be a simpler way to reduce bias than trying to breakdown institutionalized ageist beliefs and systems nurses are

operating within. By differentiating needs based upon frailty rather than age, it may help lead to reducing age-based discrimination biases.

Clarification of where a person is on a spectrum of frailty could help to inform and provided resources for the individuals unique needs (McNally & Lahey, 2015). This was one of the greatest advantages identified in chapter one. With frailty identification comes the potential to help improve equitable levels of care provision to the older adults most in need of limited resources. Equitable care is incorporated in the standards of practice for LPNs, and RPNs and the scope of practice for RNs (and therefore by extension NPs) in Alberta. Therefore, use of frailty screening tools can help nurses to not only work to their full scope of practice, but to provide higher quality of care to the older adults they are working with.

5.3 Future Research

Many of the study limitations described in the previous section provide stepping stones for others considering quantitatively designed TDF studies. Expansion of the questionnaire to other healthcare populations intra-provincially, cross-provincially, and to other countries would provide useful opportunities for comparison analyses. The additional qualitative data that was provided by respondents could be useful to frame other research questions. This could include extending upon why one respondent said they “sadly only” used the Braden scale and It’s Your Move non-frailty screening instruments. This was interesting to capture in this quantitatively data driven study and warrants further exploration with different research methods going forward. Given that there were many non-frailty screening tools reported as being used for frailty screening, it would be interesting to follow-up on what criteria individuals use with these instruments to identify an older adult as living with frailty or otherwise. Whether the frailty screening tools that are being utilized within the med/surg practice area is being done by

individuals, units, site-wide, or by specific regions with Alberta is unclear. The milieu that reflects different multidisciplinary teams creates complexity that could not be captured in a survey alone. The additional qualitative information provided suggested that other health care workers are engaged in frailty screening tools. Identifying the current additional health care workers (e.g. allied health practitioners and physicians) that utilize frailty screening tools in Alberta and their barriers and facilitators to use these tools would complement the information gathered for nurses. This research could help to support maximizing clinical expertise (e.g. quality screening for the lowest cost) to successfully identify older adults living with frailty in acute care. This study did not include self-reported frailty screening tools (i.e. completed by an older adult). There are frailty screening tools created for this specific purpose, some which have demonstrated the ability to successfully predict adverse outcomes based on degree of reported frailty after surgery (Roopsawang et al., 2020). This is an area for further research regarding how nurses behave with the reported results from a patient after completing a frailty screening tool in the inpatient context.

Given that this project has outlined intervention suggestions, a pilot project for a frailty screening tool with the studied population would be appropriate, which could be in the form of action research (Munten et al., 2010). An example of an action theory is provided in the next section.

5.3.1 The Normalization Process Theory

The TDF is particularly useful to identifying self-reported influences on capability, opportunity, and motivation, but could be missing intricacies of social processes that influence upon the studied behaviour (Glidewell et al., 2022). The TDF domain of environmental context and resources was supported by a panel of TDF experts to be assessed further using a middle-

range theory for organizational and systems context, such as the Normalization Process Theory (NPT) (Atkins et al., 2017). This model is useful to link to this study because one of the three core sociological problems it seeks to understand is embedding, which the authors defined as “the processes through which a practice or practices become, (or do not become), routinely incorporated in everyday work of individuals and groups” (May et al., 2009, p. 2). This model was also designed to focus on health care settings. This is particularly relevant to this study because three of the top-five barriers were within the domain of environmental context and resources and the top barrier specifically to conducting frailty screening routinely. This framework could also be utilized to evaluate a pilot project in implementing a frailty screening tool in an acute care setting to be utilized by nurses screening older adults.

Using the NPT and its sub-theory the Normalization Process Model (May et al., 2009) for research on how the social context influences utilization of frailty screening tools could be applied as a follow-up to this study. This would be useful to complement the TDF data collected as has been demonstrated in previous studies (Glidewell et al., 2022; Hunter et al., 2020; Jones et al., 2020). The NPT may have greater applicability with the new implementation and evaluation for a frailty screening tool as this study found frailty screening is currently limited in the Alberta nursing population. The NPT as an “action” theory can help to define and explain the routine embedding of a complex intervention (May et al., 2007). This theory has great potential for use in furthering the frailty screening tool usability.

5.4 Study Strengths and Limitations

5.4.1 Strengths

Strengths of this study are rooted in the available expertise that contributed to the program. It was made possible to use the Dillman's recommendation of having authority figures involved (Dillman, 2011) for the survey data collection by both the RN/NP and LPN nursing colleges collaborating with the research project. The project idea grew from identified literature gaps in understanding of how nurses use screening tools and clinical judgement to assess for frailty. The conceptualization of the research methods and creation of the survey necessitated support from all research members, and included multiple expertise realms including acute care nursing and geriatrics.

The use of an online survey platform (SurveyMonkey) that facilitated ease of question responses and has been used before by nurses in this population helped to minimize user burden. This study being conducted in the context of the COVID-19 pandemic necessitated the safest research method available; having a paperless and completely remote project prevented transmission risk to participants. The largest population of licensed nurses that work in Alberta were all reached regardless of their geographical location, making expansion of these results across the province feasible. This breadth of reach is useful for applying recommendations because Alberta employs nurses within one provincial healthcare system. Use of the TDF questionnaire improves credibility of the results to capture relevant behavioural domains influencing the use of frailty screening tools.

5.4.2 Limitations

One design challenge was the use of double-negative questions that were a part of the original TDF guided survey study (Huijg, Gebhardt, Crone, et al., 2014; Huijg, Gebhardt, Dusseldorp, et al., 2014). For example, under the domain of Emotions one question was “I feel frustrated when I cannot conduct frailty screening.” This mean score was 3.08 (SD = 1.09) indicating it was a barrier to screening for frailty with tools. Although the words “when I cannot” were bolded in the survey as recommended in the Dillman recommendations (Dillman, 2011), this use of a double negative may have influenced results. The questions within this domain before and after this question were negatively worded, creating a potential bias from misinterpreting the question’s intention.

The fact that four of the top-five facilitators were negatively coded is relevant to note. Although the total sample of nurses identified closest to “disagree” about “I feel anxious when I start to think about conducting frailty screening” the inverse that they feel confident or self-assured cannot be assumed. That nurses are more neutral or indifferent to their emotions about frailty screening may be less of a facilitator than these results are supporting. Therefore, the top-five facilitator that was positively coded “If I conduct frailty screening with older adults it will benefit public health” may have greater influence as a facilitator. Factor analysis to confirm that individual questions were truly capturing the intended TDF domains of influence was not conducted in this study, and could provide clarity to the conclusions made.

The qualitative codification process was not always clear-cut for what participants were trying to convey due to spelling mistakes and acronym use. The acronym “RAI” was interpreted to be the Risk Analysis Index (Hall et al., 2017), however the RAI may have been referring to a

different tool, including one of the interRAI standardized assessment tools such as the interRAI Resident Assessment- Home Care (RAI-HC) (Morley & Vellas, 2020). The Risk Analysis Index was created as a time-effective frailty screening tool for elective surgical patients and for a broad range of medical personnel including a “licensed practical nurse” (Hall et al., 2017). How the current population is utilizing this frailty screening tool (i.e. what surgical population) was not captured in this study.

A further limitation was the images used for the frailty screening tools. The CFS recently was upgraded in September 2020 to CFS version 2.0 (Kenneth Rockwood & Theou, 2020), creating a confounding variable given that only the original CFS picture was shown in the survey. Whether this new version is being used in the population compared to the original was not gathered in this study. The Edmonton Frail Scale (EFS) also has a similar scale called the reported EFS (Hilmer et al., 2009) that has similarities but are distinctly different frailty screening tools. In a basic web-search, the reported EFS was found with Alberta Health Services logos (the largest nursing employer), which could mean that nurses are not answering based on the original frailty screening tool. The frailty index was generated by the research team, therefore what nurses are actually using will certainly have a different appearance. The frailty phenotype is the most standard with the same five questions, but like the other tools different appearances such as within the charting system may increase recall bias and cause respondents to under-report. The other frailty screening tools relied upon respondents recalling their tools used on the unit without a visual aid, which creates greater recall bias for these responses. Respondents that reported their other frailty screening tools (which were mostly indirect or single-domain measures of frailty) and answered the TDF guided questions based on using these tools only may

have different beliefs about frailty screening practices than respondents that considered frailty-specific tools.

This survey was completed during the COVID-19 pandemic, which has shown healthcare vulnerabilities within Canada. Senior nurses in Alberta ED were found to take longer leaves and work fewer shifts related to patient acuity and personal strains (Varner, 2021). ED and ICU positions have been disproportionately affected with job vacancies, staff turnover, and filling positions with junior staff (Varner, 2021). This impact upon critical care areas may have influences upon the nursing behaviour and use of frailty screening tools. This especially may influence the domain of Environmental Context and Resources, which includes physical resources and time.

5.4.2.1 Sample Size

The survey responses were less than required to meet power goals, but despite this limitation some statistically significant differences between groups were still observed. This suggests that repeating the survey to acquire additional responses closer to the power goals could reveal additional between group differences that exist in the population (Case & Ambrosius, 2007). The potential differences between groups that were observed may also be stronger than elicited in this study (Case & Ambrosius, 2007).

The percentage of LPNs, RNs, and NPs compared to the population proportions were similar with RNs being the largest group in the sample (88.2%). Acquiring a larger sample of LPNs and NPs would be important to be able to test for between group differences. The recruitment method utilized is thought to be the primary contributor to this challenge. The NP

population is naturally small ($N = 276$) therefore more direct and reliable recruitment methods may be necessary to represent their stance. The LPNs may have a more similar response rate to the RN and NP groups if they could have been sent an email directly, but this was not allowed with the LPN college regulations. Inclusion of registered psychiatric nurses would have allowed greater understanding for the practice of all licensed nurses in Alberta as well as potentially total sample collected.

5.4.2.2 Missing Data

Missing data was a challenge in this data set due in part to attrition; this may have been related to respondent fatigue. Surveys that are overly long may increase respondent fatigue which leads to deterioration in quality of decisions, default answer choices, and skipped questions (Ben-Nun, 2008). Having 43-items for the TDF may have increased respondents' burnout. For Taylor et al. they had a 34-item 5-point Likert-type scale TDF-type survey (using an online version and hard copies) and reported manageable levels of missing data completely at random (Taylor et al., 2013). Smith et al. had 26-items in the TDF portion of their online survey (that covered ten domains) and did not discuss missing data analyses but based on their reported n had at least 8.5% of respondents have some missing data (Smith et al., 2021). Having this study's TDF survey be longer in duration may have been excessively cumbersome for respondents. While the richness in data may provide more reliable reflection of each domain's attributes, administering a longer TDF survey in a different modality may be better to acquire the data with less bias.

An additional challenge for respondents was the scale-type question. A slider scale has theoretical advantages to create closer patterns to a normal distribution, however increasing

response time and significantly increasing missing data have been observed (Chyung et al., 2018). One way to overcome this has been supported by administering the survey via an in-person method (Chyung et al., 2018).

A potential bias may have been introduced from respondents feeling that they could not answer the survey because they didn't use frailty screening tools in their practice. While the intention was that individuals would still discuss their behaviour for not using tools, some respondents may have seen this as a reason to not answer some questions. Trying to capture the reason for the non-response may be possible through changing the method of a data collection to a qualitative approach. Another option would be to add a "Don't know", "Prefer not to respond" or "Not applicable" response choice to collect more reliable data (Chyung et al., 2018).

5.5 Thesis Conclusions

A survey version of the TDF (Huijg, Gebhardt, Crone, et al., 2014; Huijg, Gebhardt, Dusseldorp, et al., 2014) was modified to successfully glean new information about the beliefs behind behaviours for using frailty screening tools by acute care nurses in Alberta with older adults. The survey was completed by 228 eligible respondents and supported that frailty screening tools are currently “rarely” utilized overall and clinical impression is currently a preferred method to assess for frailty (aim 1). Beliefs that facilitate using frailty screening tools were within the domains of: Beliefs about Consequences, Reinforcement, and Emotions. Barriers to frailty screening were within the domains of: Environmental Context and Resources, Skills, and Goals (aim 2). The sample was predominantly RNs and between group differences could not usefully be compared to the LPNs or NPs (aim 3 part 1). The nursing specialties were grouped by critical care, med/surg, and other acute care; differences were observed in frailty screening methods used and the barriers/facilitators (aim 3 part 2). Through using a robust theoretical framework to guide the research, evidence-informed intervention categories were identified with the Behaviour Change Wheel (Michie et al., 2011) that can act as a stepping stone to further research and clinical decision making. Further research using different methods, theoretical models (such as the normalization process theory), and expanding the health care members included can help to deepen the knowledge for eventual improvements in care service delivery for older adults.

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Appendix A

Table A1

Frailty Screening Tools Used by Nurses Identified in Literature Review

Name	First Author, Year, Country	Tool Description (Setting)	Number of Items, Type of Scale, and Categories	Psychometric Properties	Domains of Frailty Included (Rodríguez-Mañas et al., 2013)				Nurses Using the Tool	Time to Complete
					Physical Performance	Nutritional Status	Mental Health	Cognition		
Hospital Admission Risk Profile (HARP)	Sager, 1996 USA Hoogerduijn, 2010, Netherlands	Developed to identify older adults at risk for functional decline upon hospital admission. Risk stratifies patients into groups according to risk for functional decline. Includes a modified MMSE within the exam. (Hospital)	Three, Ordinal scale, Categories: 0 - 5 risk score (0 - 1 = low risk; 2 - 3 = intermediate risk; 4 - 5 = high risk)	VALIDITY Content validity Logistic regression, in which the decline of at least one IADL at the time of discharge was the dependent variable, was used to identify factors predicting decline in IADL function in the development cohort. AOR were significant ($p < .05$) for older age groups 75-84 and older than 85 years, preadmission IADL function being lower, abbreviated MMSE, and hospital length of stay. Construct validity From Sager et al. AUC 0.65 From Hoogerduijn et al. Low Risk AUC 0.65 Sens. 61% Spec. 68% PPV 39% NPV 84%	x			x	Not specified in original studies Nurses demonstrated use in synthesized literature (Lim et al., 2019; Warnier, Van Rossum, Velthuis, et al., 2016)	Not described

				Intermediate risk AUC 0.65 Sens. 40% Spec. 81% PPV 41% NPV 80% High risk AUC 0.60 Sens. 21% Spec. 89% PPV 38% NPV 77% AUC 0.56 Response process validity Not reported RELIABILITY Internal consistency Not reported Test-retest reliability Not reported Inter-rater reliability Not reported OTHER Not applicable						
Identification of Seniors at Risk (ISAR)	Mc.Clusker, 1999, Canada Mc.Clusker, 2000, Canada Dendukuri, 2004, Canada	Developed to identify patients in the ED at risk for adverse outcomes. Six questions that are yes or no. (Hospital	Six, Ordinal scale, 0 - 6 (< 2 = low risk, 6 = high risk)	VALIDITY Content validity Interprofessional team conducted an initial prospective cohort study during a quality improvement project in a hospital setting to identify frail older adults early in admission. Construct validity Functional decline long-term (greater than 30 days) outcomes: Sens. 92% Spec. 39% PPV 36% NPV 94%	x			x	Nurses demonstrated use (Lim et al., 2019; Muscedere et al., 2016; Puig Campmany et al., 2019)	Not described

	Moons, 2007, Belgium Geyskens, 2008, Belgium Salvi, 2009, Italy Hoogervorst, 2010, Netherlands Buurman, 2011, Netherlands Graf, 2012, Switzerland Salvi, 2012a, Italy Salvi, 2012b, Italy			AUC 0.67 ED-revisitation long-term (greater than 30 days) Sens. 56% - 84% Spec. 39% - 54% PPV 19% - 61% NPV 10% - 78% AUC 0.56 - 0.60 Hospital readmission long-term (greater than 30 days) Sens. 73% - 77% Spec. 38% - 51% PPV 36% - 44% NPV 71% - 78% AUC 0.63 - 0.68 Mortality long-term (greater than 30 days) Sens. 64% - 91% Spec. 37% - 51% PPV 4% - 18% NPV 2% - 96% AUC 0.58 - 0.74 Response process validity Not reported RELIABILITY Internal consistency Concordance Correlation Coefficient = 0.78 Test-retest reliability not performed Inter-rater reliability Not performed OTHER Not applicable						
ISAR in	Hoogervorst	Adaptation of	Four,	VALIDITY	x				Not	Not

hospitalized patients (ISAR-HP)	duijn 2012, 2014 Netherlands	the ISAR to the patients admitted to hospital. Greater weight is given to the second question about use of a walking device compared to the other three to give a total risk; if even one risk is identified the patient is considered at risk for frailty. (Hospital)	Dichotomous scale, Range 0 - 5 (score 1 or more = at risk)	Content validity Adapted from the original ISAR and adjustments made to make it shorter and more relevant for the hospital context. Construct validity The AUC of the prediction model in participants ≥ 65 was 0.72 (95% CI: 0.65–0.79), in participants aged ≥ 70 this was 0.73 (95% CI: 0.66–0.80) and in participants aged ≥ 75 it was 0.75 (95% CI: 0.66–0.83). In participants aging ≥ 65 and using threshold 2, the sensitivity was 51% and specificity was 83%. Long-term (more than 30 day) functional decline Sensitivity 85% - 89% Specificity 39% - 41% PPV 29% - 56% NPV 93% - 89% AUC 0.68 - 0.73 Long term (more than 30 day) mortality Sensitivity 81% Response process validity Not reported RELIABILITY Internal consistency Not reported Test-retest reliability Not reported Inter-rater reliability Not reported OTHER Not applicable					specified in original studies.	described
Edmonton Frail Scale	Rolfson, 2006,	EFS is a brief and user-	Eleven, Ordinal scale:	VALIDITY Content validity	x	x	x	x	Untrained	Less than

(EFS)	Canada	friendly screening interview for frailty in older adults commonly encountered by geriatricians in both the inpatient and outpatient settings Contains nine frailty domains: Cognition, General health status, Functional independence, Social support, Medication use, Nutrition, Mood, Continence, and Functional performance (Community and Hospital)	Range: 0-17 Five levels 0-5 = not frail 6-7 = vulnerable 8-9 = mild frailty 10-11 = moderate frailty 12-17 = severe frailty	Tested by a panel of geriatricians Construct validity Correlation with Barthel Index was statistically significant ($r = -0.58$, $P = 0.006$, $n = 21$), correlation with MMSE was not ($r = -0.05$, $P = 0.801$, $n = 30$) Response process validity Not reported RELIABILITY Internal consistency Cronbach's $\alpha = .62$ Test-retest reliability not reported Inter-rater reliability $k = .77$, $P = .0001$, $n = 18$ OTHER Not applicable					research assistant in original study. Nurses demonstrated (Lim et al., 2019) Muscedere et al., 2016; Uchmanowicz et al., 2019)	5min
Reported Edmonton Frail Scale (REFS)	Hilmer et al., 2009, Australia	A modification of the EFS adapted tool includes 9 frailty domains: Cognition, General health status, functional independence, social support,	Thirteen, Ordinal scale, 0-5 = not frail; 6-7 = apparently vulnerable; 8-9 = mild frailty; 10-11 = moderate frailty; 12-18 = severe	VALIDITY Content validity tested by a geriatricians' clinical impression of frailty (GCIF) Construct validity Correlation were found between REFS and GCIF ($R = .61$, $p < .01$), Charlson CI Index ($R = .51$, $p < .001$) and Katz Daily Living Scale ($R = .51$, $p < .001$).	x	x	x	x	Non-geriatricians (Lim et al., 2019)	Not described

		polypharmacy, nutrition, mood, continence, and self-reported activity level. (Hospital)	frailty. The first four domains are worth two points for degree of severity, and the following 1 for yes or no answers.	Response process validity Not reported RELIABILITY Internal consistency Cronbach's alpha = 0.68 Inter-rater reliability kappa = 0.84 Response process validity Not reported OTHER Not applicable						
Score Hospitalier d'évaluation du risque de perte d'autonomie (SHERPA)	Cornette, 2006, Belgium	Developed to identify older hospitalized patients at risk for functional decline by 3 months post-discharge. Five domains: age, impairment in pre-morbid IADL, history of fall before admission, cognitive ability and self-perceived health. (Hospital)	Five, Ordinal scale, 0 - 11,5 0-3 = no risk 3.5-4.5 = low risk 5-6 = moderate risk Above 6 = high risk	VALIDITY Content validity Not reported Construct validity Long-term functional decline Sens. 68% Spec. 71% AUC 0.73 Results showed moderate sensitivity (67.9%) and specificity (70.8%). Response process validity Not reported RELIABILITY Internal consistency demonstrated good intra-reliability with ICC 0.97. Inter-rater reliability Inter-reliability ICC 1.0. Response process validity Not reported OTHER Not applicable	x			x	Nurses (Warnier, Rossum, et al., 2016) and non-medically trained staff (Lim et al., 2019)	Not described
SPICES (Acronym)	Aronow,	An overall assessment tool	Six, dichotomous	VALIDITY Content validity	x	x		x	Original study	Not described

of skin integrity; problems eating; incontinence; confusion; evidence of falls; and sleep disturbance)	2014, USA	for older adults with yes or no questions according to the acronym (same as title). For skin integrity yes indicates a problem. (Hospital)	scale, 0 - 6 (score 2 or more = at risk for adverse outcomes during hospital admission)	To eight different variables including probability of admitted from a nursing home (n = 20, OR 1.235, CI 1.126-1.355, $p < 0.001$) and age greater than or equal to 80 (n = 89, OR 4.345, CI 2.240-8.430, $p < 0.001$). Construct Validity The correlation of SPICES to another frailty test VES-13 (n=90, OR 11.077, CI 4542-27.013, $p < 0.001$) and Charlson Comorbidity index equal or greater than 2 (n=125, OR 3.171, CI 1.600-6.283, $p = 0.001$). Short term risk for adverse hospital event OR 3.04 Readmission within 30 days (n = 38, OR 1.24, CI 0.58-2.63, $p = 0.71$) Response process validity Not reported RELIABILITY Internal consistency Not reported Test-retest reliability Not reported Inter-rater reliability Not reported OTHER Not applicable					supports registered nurses or a specially trained geriatric nurse. Nurses demonstrated use (Warnier, Rossum, et al., 2016) and non-medically trained staff (Lim et al., 2019).	bed
Frailty Index from Canadian Study of Health and Aging (FI-CSHA)	Mitnitski, 2001, Canada Rockwood, 2016, Canada	Counts the total number of different deficits across domains are tallied to create a risk index. At least 30 separate items recommended	Fourty, Continuous scale, 0-1. Higher the number the greater the frailty level. Index groups proposed for 0-0.03 (fit),	VALIDITY Content validity Created from an original 20 variable list and then expanded into total possible list of 92 yes/no questions with suspected clinical relevance and statistical properties. Generated random samples of items with different power. To do so authors checked samples of each of 60, 40, 30, and 20 items, randomly selected	x		x	x	Geriatrician in original study Possible for nurses in Hospital setting	Not described

		but 40 have since become the standard and 92 originally tested. (Community and Hospital)	0.031-.1 (less fit), .101-.2 (least fit), .201 and greater (frail).	at each age, and repeated the calculation several times. The number of re-samplings varied from 10 to 40 depending on the number of items; the lower the number of items, the greater the number of repetitions applied. The parameters of regressions produced in the random simulations were close to the values presented in the proposed equation. For example, when the index was defined from 60 randomly deficits, the researchers obtained the regression equation, $\ln(q) = -4.41 + 0.032 \cdot t$ ($r = 0.940$, with standard errors for the intercept and slope of 0.15 and 0.002, respectively), and for 40 items used for the frailty index the parameters were close to the previous values, $\ln(q) = -4.59 + 0.033 \cdot t$ ($r = 0.935$). Construct validity The parameters of gamma distribution were estimated: $k = 2.2$ and $\lambda = 10.638$ and goodness of fit was evaluated in two ways, by using the multiple correlation coefficient between the experimental and theoretical distributions ($r = 0.985$, corresponding to the 97% explained variance) and by applying the chi-squared test : $\chi^2(35) = 21.5$ which is much less than the critical value 53.5 ($p < 0.05$). Mortality highly correlated with the frailty index $r = -.23$ $p < .001$ Response process validity Not reported RELIABILITY Internal consistency Goodness of fit was assessed by the multiple correlation coefficient between					but may require geriatrician (Gibson & Crowe, 2018).	
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				the experimental data and estimated values of 0.998 corresponding to 99% of the explained variance, and (χ^2 (29) = 28.4 $p < 0.05$). Test-retest reliability Not reported Inter-rater reliability Not reported OTHER Not applicable						
Maastricht frailty screening tool for hospitalized patients (MFST-HP)	Warnier, 2016, Netherlands	A modified hospital version of the TraAG tool (acronym not explained), used in the community. Expands upon this tool which has domains of: incidental and BADL, nutrition, mobility and fall risk, incontinence, medication, vision and hearing impairment, cognition, and depressive symptoms. It adds items on delirium and pressure sores. Created as part of the initial nursing	Fifteen, Continuous scale, 0-15; every point higher indicates greater frailty risk	VALIDITY Content validity Not reported Construct Reliability Construct validity was analyzed by means of associations between several patient characteristics and MFST-HP scores. Comparing 70-75 year olds to 76 years and older MFST-HP mean score 2.87(1.96) to 3.8(1.94), $p = .04$. Charlson comorbidity index score 0-8 compared to 9 or more MFST-HP mean score 2.82(1.91) to 3.73(2.01), $p = .05$. In addition, the structure of the MFST-HP items was analyzed using an exploratory factor analysis revealing low inter-item correlations. An examination of the Eigenvalues showed six components with an Eigenvalue >1, indicating MFST-HP scores could be better used as a frailty index rather than a frailty scale. Short term mortality AUC = 0.75 long-term mortality AUC = 0.71 Response process validity Not reported RELIABILITY	x	x	x	x	Nurses demonstrated use (Warnier et al., 2020; Warnier, Van Rossum, Velthuisen, et al., 2016) and non-medically trained staff (Lim et al., 2019).	2.6(0.9)min

		assessment in the hospital setting and is structured as yes or no questions for nurses to administer to older adults. (Hospital)		Internal consistency The ICC for the intra-rater reliability for the total MFST-HP score was 0.93 (95% CI = 0.86-0.97). Test-retest reliability Not reported Inter-rater reliability The ICC for interrater reliability for the total MFST-HP score was 0.95 (95% CI = 0.90, 0.97). The ICC for interrater reliability between geriatric nurse practitioners and ward nurses was 0.89 (95% CI = 0.61-0.97). OTHER Most patients (68%) reported completing the MFST-HP was not burdensome at all and 32% reported a little burden. No patients reported the test very burdensome. Regarding length of the screening tool, 51% of patients reported it was short and 3% reported it was long.						
Think Frailty	Drummond, 2015, UK Validity testing by Taylor-Rowan, 2018	A triage tool designed for use in Healthcare Improvement Scotland (HIS) for use with patients 75 years of age and older, and for those above 65 years who were nursing home residents or admitted from a different hospital. The purpose was to expedite a CGA	Five, Dichotomous scale, 'frailty positive' with at least one indicator.	VALIDITY Content validity HIS reviewed evidence and with expert collaboration created the frailty tool. Construct Reliability Original study Sensitivity = 100% Specificity – 84.8% Validity testing study Correlation to CFS $r = 0.74, p < .01$ Sensitivity 94% Specificity 61% PPV = 77.66% (95% CI = 74.97-80.14) NPV = 87.82% (95% CI = 82.87-91.48). AUC = 0.78 Response process validity Not reported	x			x	Nurses demonstrated use (Lim et al., 2019; Warnier et al., 2020)	“Rapid”

		for those with a high risk for frailty. Questions were based upon a FRAIL acronym: Functional impairment, Resident in a care home, Altered mental state, Immobility/instability, and Likely to require support for discharge. (Hospital)		RELIABILITY Internal consistency Not reported Test-retest reliability Not reported Inter-rater reliability Not reported OTHER Not applicable						
Veiligheidsmanagementsysteem (VMS) and VMS+ tool	Veiligheidsprogramma, 2009, The Netherlands Validity study: Heim, 2014, The Netherlands	Developed to screen hospitalized patients older than 70 years for risk of functional decline by evaluating domains in: ADLs, falls risk, weight loss, and delirium. (Hospital)	Five, dichotomous scale, 3 or more of the four VMS domains indicated frailty or aged 80 years and positive for one or more domain. Fifth question is age.	VALIDITY Content validity National Dutch program enlisted experts to help reduce risk for vulnerable older adults, in part by making a screening tool. Construct Reliability To evaluate its validity, the VMS tool was tested alongside the ISAR, the 6-item Cognitive Impairment Test and the MMSE. All screening instruments were similarly predictive for adverse outcome (predictive power 0.58–0.66), but the percentage of positively screened patients (13–72%), sensitivity (24–89%) and specificity (35–91%) highly differed. RR for adverse outcomes (functional decline, death, or higher healthcare demands) including the age (+1) component were demonstrated:	x	x	x		Trained nurses administered the exam in the original study. Nurses (Lim et al., 2019; Warnier et al., 2020)	Not described

				3 month follow up: RR = 3.53 (95% CI = 2.79-4.46) Sensitivity = 68% Specificity = 74% PPV = 50% NPV = 86% AUC = 0.71 6 month follow up: RR = 3.16 (95% CI = 2.46-4.05) Sensitivity = 66% Specificity = 72% PPV = 44% NPV = 86% AUC = 0.69 Response process validity Not reported RELIABILITY Internal consistency Not reported Test-retest reliability Validation cohort were compared to the initial cohort simultaneously at the three month follow-up time. RR = 2.6 (95% CI = 2.15-3.15) Sensitivity = 61% Specificity = 75% PPV = 57% NPV = 78% AUC = 0.68 Inter-rater reliability Not reported OTHER Not applicable						
Clinical Frail Scale (CFS)	Rockwood, 2005, Canada	Categorizing based on clinical judgment	Seven originally then updated to nine, Ordinal	VALIDITY Content validity Collaboration within the Canadian Study of Health and Aging group to	x	x	x	x	Nurses can be involved in use	Rapid, <30 sec by

		knowing diagnoses, degree of comorbidity, function, and general patient information that informs about frailty. An initial score is created then a secondary multidisciplinary team reviews it. It also provides recommendations on how to score people with dementia. (Community)	scale, 1-7 or 1-9 in revised version with pictorial representation of each level. 1 = Very fit and 2 = Well 3 = Managing Well 4 = Vulnerable 5 = Mildly Frail 6 = Moderately Frail 7 = severely frail. Revision included: 8 = Very severely frail 9 = Terminally Ill.	clarify a frailty definition, a frailty index, and finally a frailty measurement based on clinical judgement. Construct Reliability Correlation between the CFS and the mathematically derived Frailty Index was high (Pearson coefficient 0.80, $p < 0.01$). In multivariable models that adjusted for age, sex and education 1-category increment of the CFS significantly increased the medium-term risks (i.e., those within about 70 months) of death (21.2%, 95% CI = 12.5%–30.6%) and entry into institutional care (23.9%, 95% CI = 8.8%–41.2%). There are many studies that have found support for CFS prediction of adverse outcomes for older adults across care areas. Response process validity Not reported RELIABILITY Internal consistency Reliability between the 2 ratings of the CSHA Clinical Frailty Scale assessments was very high (intraclass correlation coefficient 0.97, $p < 0.001$). Test-retest reliability Not reported Inter-rater reliability Not reported OTHER Not applicable					directly or as part of a multidisciplinary team (Cardona et al., 2019; Eamer et al., 2017; Gibson & Crowe, 2018; Muscedere et al., 2016; Shrapnel et al., 2019; Uchmanowicz et al., 2019)	75% of nurses (Oviedo-Briones et al., 2021)
Seven questions from the	Hébert et al., 2003,	A practically designed tool from the	Seven, dichotomous, a score greater	VALIDITY Content validity Based on a literature review of risk	x		x (judgemen	x (judgemen	Self-reported and non-	“quick” (Hoff

program of research to integrate services for the maintenance of autonomy (PRISMA-7)	Canada Validity testing in original study by the same research team (Raïche et al., 2008) and later in acute care by Hoffmann et al., 2020, Denmark	Canadian population to help identify those older adults living at risk in the community (Community)	or equal to three indicates the presence of frailty	factors for functional decline and included a disability scale called the SMAF which previously tested for validity. Then multivariate logistic regression analysis was conducted and backward elimination conducted to eliminate the variables contributing the least to the model. Construct Reliability Data from first author (Raïche et al., 2008) Created two ROC frameworks with good AUC and the 7-item questionnaire became the PRSMA-7 AUC = 0.840 (0.797-0.882) Different cut-off scores were reported, however the score with the best balance for sensitivity and specificity was highlighted by the study and what is used for this particular tool: Identified positive 35.5% Sensitivity = 78.3% Specificity = 74.7% PPV = 42.7% NPV = 93.5% In the hospital setting (Hoffmann et al., 2020) Linked the patient characteristics based on PRISMA-7 scores less than 3 and greater than or equal to 3. Found significant correlation of higher PRISMA-7 scores to: Mean number of admissions per patient $p < .001$ for 30, 90, and 180 days before current admission. Mean lengths of stay ($p < .01$) Number of GP services before admission ($p < .001$) Mortality			t based)	t based)	specialist s	mann et al., 2020)
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				30 days after discharge ($p > .05$) 90 days after discharge ($p > .05$) 180 days after discharge ($p = .003$) 360 days after discharge ($p < .001$) Minutes of supportive care received in the community prior to hospitalization practical help $p = .001$ personal care $p = .013$ Response process validity Not reported RELIABILITY Internal consistency Test-retest reliability Not reported Inter-rater reliability Not reported OTHER Not applicable						
Fatigue, Resistance, Ambulation, Illness, and Loss of weight (FRAIL) Scale	van Kan, 2008, International collaboration (USA, Canada, Europe) Validation testing information: Thompson,	Five elements based upon: self-reported fatigue, resistance (climb a single flight of stairs), ambulation (ability to walk one block), illnesses (more than 5), loss of weight (more than 5%). The focus was upon meeting all domains of frailty and	Five, Ordinal scale, Categories: 0-5. 0 = not frail 1-2 = intermediate frailty (or pre-frailty) 3 or more = frailty	VALIDITY Content validity Expert panel members recommendations Construct Reliability Ten year mortality risk with frailty HR 2.60, 95% CI = 1.78-3.80, $p < .001$ and with prefrailty HR 1.32 $p < .1$. An adjusted cutoff point of 2 or greater showed better predictive ability of ten year mortality (AUC: 0.60; 95% CI: 0.56-0.64; $P < .001$). Cut off point 3 and greater Specificity 86.8%, 95% CI = 84.0-89.2% Youden Index 0.50 Sensitivity 63.6% CI 55.3-70.8% AUC 0.75 95% CI = .71-.79 Cut off point 2 and greater	x	x			Nurses (Calvo et al., 2019; Gibson & Crowe, 2018; Karlekar et al., 2017; Sanford et al., 2020; Shoultz et al., 2019; Uchmanowicz et	Not described

	2020, Australia	keeping the scale simple. It is reliant upon self-reported experiences from the patient. (Community)		Sensitivity = 95.6% Specificity 64.1% Youden Index 0.60 AUC 0.80 Response process validity Not reported RELIABILITY Internal consistency Internal consistency was also tested by frailty scale 1 and greater, 2 and greater, and 3 and greater compared to Fried Phenotype characteristics of frailty (with 3 or greater). Sensitivity, specificity, PPV, NPV, AUC, and Youden index were supplied for all three. Sensitivity was best for the FRAIL scale 1 (98.7%, CI 95.5-99.8%) and specificity best for 3 or greater (86.8% CI= 84.0-89.2%). AUC 0.70, 0.80, and 0.75 for each ascending scale levels respectively. Test-retest reliability Not reported Inter-rater reliability Not reported OTHER Not applicable					al., 2019)	
Vulnerable Elders Survey-13 (VES-13) Frailty Tool	Saliba, 2001, USA Validation study: Kenig, 2014, Poland	A simple function based frailty screening tool designed to also be administered by nonclinical personnel within the community (original study) and evidence supported for	Thirteen, Dichotomous scale, Score range 0-13 Cut off score 3 or greater indicates frailty presence. Each of the	VALIDITY Content validity An expert panel part of the Assessing Care of Vulnerable Elders project made recommendations for inclusion material. After a literature review, the researchers developed the survey tool and tested four different models. A simple count of self-reported diagnoses/ conditions was as predictive as a more complex scheme wherein conditions were differentially weighted based on	x			x (IAD Ls)	Nurses (Vernon et al., 2019)	Less than 5 min

		use in the hospital setting too. Has four sections: the first is age, the second is overall health status, third is difficulty with physical activities, and the fourth is ability for IADL and BADL. (Community)	four categories have different maximum points; Category one asks age 1 point age 75-84, 3 points 85 or older Two score 1 point for fair or poor health in general Three: maximum 2 points if unable to do or have a lot of difficulty with the physical activities. Four: maximum 4 points with no being negative, and yes (they get help) or don't do because of their health.	the literature and bivariate chi-square values. Different cut off points were explored to yield the best balance of sensitivity and specificity. Construct Reliability Cut off point of function-based scoring system at score of 3 represented 32% of the sample. RR for functional decline or death over 2 years = 4.2 Sensitivity 0.67 Specificity 0.79 AUC = 0.78 Validation study comparing VES-13 frailty identification to a CGA. 65-79 years old: Sensitivity = 50% Specificity = 92% PPV = 87% NPV = 61% AUC = 0.71 (95% CI = 0.59-0.82, $p = 0.02$) 80 years and older: Sensitivity = 81% Specificity = 74% PPV = 74% NPV = 0% AUC = 0.40 (95% CI = 0.17-0.64, $p > 0.05$) Response process validity Not reported RELIABILITY Internal consistency Not reported Test-retest reliability Not reported Inter-rater reliability Not reported OTHER						
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				Not applicable						
Groningen Frailty Indicator	Steverink, 2001, The Netherlands Schuurmans, 2004, The Netherlands	Created to develop a short and easy to use screening instrument for level of frailty that included psychosocial indicators. Four main domains; physical (items 1-9), cognitive (item 10), social (items 11-13), and psychological (items 14-15). The questions are either yes/no questions or independent or dependent in the activity. (Community and hospital)	Fifteen, Dichotomous scale, Frailty score of 4 or higher is regarded as moderate frailty.	VALIDITY Content validity Created from literature and theory of the time 22 original items were tested in the study population. Cut off scores were determined by geriatric experts. Construct Reliability 40% of the variance was explained by one underlying component (determined by principal component analysis). Comparing respondent characteristics based on characteristic and to their mean score for the category of 75 years of age and older and the category of frailty score 4 or higher. Significant difference between these two groups ($p < .03$ at least) was determined for characteristics of: self-management ability, variety, positive frame, investment, self-efficacy, and taking the initiative. Chronological age and frailty were significantly correlated ($r = .32$, $p < .001$). Frailty was significantly and negatively related to overall self-management abilities. Response process validity Not reported RELIABILITY Internal consistency $\alpha = .76$ for 12 items of the original 22. Test-retest reliability Not reported Inter-rater reliability Not reported OTHER Not applicable	x		x	x	Nurses demonstrated use elsewhere (Muscedere et al., 2016; Uchmanowicz et al., 2019)	Short – not described further
Calgary	Freiheit	The index was	Five, Ordinal	VALIDITY	x	x	x	x	Study	10-15

Cardiac and Cognition Scale	, 2010, Canada (Alberta)	created in the population of patients 60 and older undergoing non-emergent cardiac catheterization for coronary artery disease. A portion of the index was informed by MSSA; the final model included balance, abnormal body mass index (BMI), Trails B Test, Geriatric Depression Scale, and living alone. (Hospital)	Scale, one point for increased risk on the index for each component; lowest score 0 (no frailty risk) and 3-5 were combined together for high frailty index.	Content validity Through review of frailty domains and existing criteria an index was created with practicality of the tool being strongly considered. Published and clinically used cut off scores were used to dichotomize all measures. Three executive tests were compared and it was found that the Trial-Making Test Part B outperformed the other cognitive measures. For geriatric depression measurement, two subscales were compared but were found to not improve upon predictive capacity of the full Geriatric Depression Scale. Construct Reliability A frailty index was developed with the relative magnitude of the coefficients in the final model determining the weighting of criteria. An AUC analysis of the regression model with the final criteria was compared with an AUC analysis of a model using the frailty index alone to assess its accuracy. The index was categorized based on the distribution of the data and used to predict increased ADL disability and HRQL decline. The frailty index had an AUC of 0.76 (95% CI = 0.66–0.83). Gait speed alone had an AUC of 0.60. RR for a decrease in health related quality of life were significant for scores of 1, 2, and 3 or more compared with 0 (RR=1.77, 95% CI=1.0–3.2; RR=2.69, 95% CI=1.5–4.9; and					created with assistance from trained research nurses and associates. Nurses also supported elsewhere (Uchmanowicz et al., 2019)	min
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				RR=4.16, 95% CI=2.3–7.4, respectively). Response process validity Not reported RELIABILITY Internal consistency An AUC analysis of a regression model using the categorical frailty index revealed that the index was equally as good in discrimination as the original model using the five frailty criteria separately (AUC 0.76, 95% CI=0.66–0.84). Test-retest reliability Not reported Inter-rater reliability Not reported OTHER Not applicable						
Cardiovascular Health Study (CHS) Scale, Fried Frailty Scale, Frailty Phenotype, or Phenotype 5-item scale	Fried, 2001, USA	Five elements were identified using data from a large prospective study of older adults in the community.	Five, Ordinal scale, Categories in the range of 0–5 0 = robust 1–2 pre-frail 3 or more indicates frailty	VALIDITY Content validity Started by consolidating prior research and clinical consensus and tested the hypothesized core components of frailty against a large sample of older adults Construct Reliability In those who met the criteria for frailty at baseline, mortality was sixfold higher (18%) than that for the non-frail (3%) for 3-year cumulative survival, and was over threefold higher (43% compared to 12%), compared to the non-frail group, for 7-year survival ($p < .001$). After adjustment for covariates, the	x	x (weight loss)			Demonstrated to be used by nurses (Amini et al., 2019; Cardona et al., 2019; Gibson & Crowe, 2018; Muscedere et al., 2016; Uchman	Not specified

				frailty phenotype remained an independent predictor of all adverse outcomes at both 3 and 7 years, with 7-year hazard ratios ranging from 1.23–1.79 ($p = .05$ for all, except falls, where $p = .06$). The intermediate group also significantly ($p .05$) predicted all outcomes after adjustment, but with lower strengths of association. Adjusting for covariates, those who were intermediate at baseline were at more than twice the risk of becoming frail over 3 years (or over 4 years for cohort 2), relative to those subjects with no frailty characteristics at baseline (OR = 2.63, 95% CI [1.94, 3.56]) Response process validity Not reported RELIABILITY Internal consistency Not reported Test-retest reliability Not reported Inter-rater reliability Not reported OTHER Not applicable					owicz et al., 2019)	
MacArthur Study of Successful Aging Scale (MSSA)	Sarkisian, 2008, USA	An expanded tool of the Fried Phenotype factors from the original 5 to include 5 new factors: cognitive impairment, interleukin-6, C-reactive protein,	Ten, Ordinal Scale, Categories 0-1 no frailty 2-3 intermediate frailty, 4 or more identifies frailty presence	VALIDITY Content validity Cut off points were selected for each of the five new categorical frailty variables that was predicted to result in frailty prevalence by the study authors. A principle component analysis was run and by including the new variables the explained variance increased from 48% to 56% and increased from two to four underlying structured groups from the	x	x		x	Supported to be used by nurses (Uchmanowicz et al., 2019)	Not Specified

		subjective weakness, and anorexia. (Community)		ten phenotype factors. Construct Reliability Subjects with the CHS frailty phenotype had an AOR of 4.4 (95% CI [2.1, 9.4]) of becoming disabled in 4 years and of 2.1 (95% CI [1.2, 3.8]) of dying in 9 years. Those with the expanded phenotype of frailty had an AOR of 5.9 (95% CI [3.0, 11.7]) of becoming disabled and of 2.7 (95% CI [1.6, 4.7]) of dying. In sensitivity analyses using alternative cut off points of frailty (3 or more and 5 or more), the expanded model of frailty was significantly associated with disability and mortality (AORs ranging from 1.9 to 6.0). Response process validity A series of logistic regression models was constructed to quantify the relationship between each frailty phenotype and PCA-identified subdimension and two outcomes: disability by 1995 and mortality by 2000. Models examining the subdimensions used the continuous component scores as predictors. Models were adjusted for age, sex, ethnicity, education, comorbidity, 1991 disability, and when applicable, presence of other frailty subdimensions. RELIABILITY Internal consistency Not reported Test-retest reliability Not reported Inter-rater reliability Not reported OTHER Not applicable						
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Tilburg Frailty Indicator (TFI)	Gobbens, 2010, The Netherlands	The TFI consists of 2 parts. The first part contains 10 questions on determinants of frailty and multimorbidity; the second part contains the frailty assessment of three domains: physical, psychological, and social with a total of 15 questions for this section. There are 11 yes/no questions and four yes/sometimes/no questions. There are some negatively worded questions that are identified in the coding system within the scale. (Community)	Fifteen, Dichotomous scale, 0-4 no frailty 5-15 frailty	VALIDITY Content validity The components of the TFI were selected on the basis of previous research and by two meetings with frailty experts giving their feedback on the scale. The cut off point of 5 for frailty was selected because at this point the sensitivity was good and specificity acceptable for most adverse outcomes. Construct Reliability Each of the 15 questions were compared to other measure for frailty with the same sample with correlation tests. 14 of the model questions had significant correlation to other measures of frailty at a significance at least $p = 0.02$, only the unexplained weight loss had a weak correlation and no statistical significance ($r = .19, p = .316$). Response process validity The predictive validity with respect to the Groningen activity restriction scale and reporting personal care was excellent, evidenced by AUCs larger than 0.8, whereas it was good (AUC between 0.7 and 0.8) for reporting nursing and informal care. The predictive validity was mediocre for reporting general practitioner visits and hospitalization (AUC = 0.61-0.64). RELIABILITY Internal consistency The (unstandardized) Cronbach's α was 0.73 for frailty, 0.70 for the physical domain, 0.63 for the psychological domain, and 0.34 for the social domain.	x	x	x	x	Supported to be used by nurses (Muscedere et al., 2016; Uchmanowicz et al., 2019)	14min
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				Test-retest reliability The test-retest reliability for the 1-year period was 0.79 for frailty, 0.78 for the physical domain, 0.67 for the psychological domain, and 0.76 for the social domain. It was 0.90, 0.87, 0.77, 0.86, for frailty, the physical, psychological, and social domains, respectively, for the 2-week interval after the one year follow-up. Inter-rater reliability Not reported OTHER Not applicable						
FRESH-screening instrument (not an acronym)	Kajsa, 2016, Sweden	Sought to create a clinical friendly screening instrument for use in the ED. The first four questions address mobility, fatigue, fear of falling, and dependence with shopping assistance. This shopping dependence includes a consideration for the cognitive capacity for shopping. The fifth question	Four or Five, Dichotomous scale, 0-1 = not at risk for frailty 2 or more at risk for frailty	VALIDITY Content validity The data from earlier research guided the creation of simple questions and by stakeholder involvement in creation of the questionnaire. Construct Reliability 5 item test: Sensitivity = 84% Specificity = 75% NPV = 69% PPV = 90% 4 item test: AUC = 0.86, 95% CI (0.80, 0.93) Sensitivity = 81% Specificity = 80% NPV = PPV = 92% Response process validity Not reported RELIABILITY Internal consistency	x			x	Developed originally with ED nurses with geriatric competence. Also supported to be used by nurses elsewhere (Ekerstad et al., 2018).	A few minutes

		which was excluded in part of the study testing asked about 3 or more ED visits in the last 12 months (Hospital)		Not reported Test-retest reliability Not reported Inter-rater reliability Not reported OTHER Not applicable						
Trauma Specific Frailty Index (TSFI)	Joseph, 2014, Arizona, USA	Its intention was for implementation in the ED to help with resource allocation and improve communication with families. It was built to have similar predictive abilities as the FI-CSHA with fewer questions total. (Hospital)	Fifteen, Continuous scale 0-1, The higher the number the greater the frailty level. Index groups proposed: Greater than 0.27 frail, less than or equal to 0.27 not frail	VALIDITY Content validity Performed univariate analysis to assess associate between variables in CSHA-FI controlling for age, Glasgow Coma Scale Score, and injury severity score) to discharge disposition. Categorized outcomes for each patient's discharge disposition as favourable or unfavourable. Used this information to identify the variables with the strongest association for unfavourable discharge disposition to create the TSFI Construct Reliability Analysis with cut off point at 0.27 Sensitivity = 85% Specificity = 75% AUC = 0.829 (95% CI [0.774, 0.884]) Response process validity Not reported RELIABILITY Internal consistency Not reported Test-retest reliability Not reported Inter-rater reliability Not reported OTHER Not applicable	x	x	x	x	Not specified other than ED staff members	Not measured
The	Romero	A new frailty	Fourty,	VALIDITY	x	x	x	x	Non-	Not

Survey of Health, Ageing and Retirement in Europe Frailty Index (SHARE-Flt and SHARE-Flx)	- Ortuno, 2010, and 2013, 12 European countries (Austria, Germany, Sweden, Netherlands, Spain, Italy, France, Denmark, Greece, Switzerland, Belgium and Israel).	index based upon the phenotypic model intended for community-dwelling adults 50 and older. Created a frailty index to healthcare providers with a clinical focus for providing care to the older population. The difference between SHARE-Flx and SHARE-Flt is that FLx has an additional 34 measurements previously identified by the same author (Community)	Continuous scale, Range 0-1. Higher the number the greater the frailty level. Index groups proposed Non-frail <.08, .08 ≤ prefrail < .25 Frail ≥ .25	Content validity Built from the phenotypic frailty (Fried, 2001) model. Extended the frailty definition based upon Santos-Eggimann et al., 2009 that includes psychological and cognitive domains. Separated males and females due to known differences in frailty representation. Construct Reliability Compared subjects with mortality data available to unavailable data. Imputed missing data for a sensitivity analysis. The D Factor loadings (with R² representing the communality of the indicator) were assessed for both males and females and found five variables all had a range from 0.1133-0.4109. In females, relative to the non-frail class, the unadjusted OR was 3.7 (SD = 2.7 - 5.0) in the pre-frail and 14.1 (SD = 10.4 - 19.2) in the frail. The age-adjusted OR was 2.5 (SD = 1.9 - 3.5) in the pre-frail and 6.9 (SD = 4.9 - 9.7) in the frail. In males, relative to the non-frail class, the unadjusted OR was 4.8 (SD = 3.9 - 5.9) in the pre-frail and 14.4 (SD = 11.0 - 18.9) in the frail. The age-adjusted OR was 3.8 (SD = 3.1 - 4.8) in the pre-frail and 10.0 (SD = 7.4 - 13.4) in the frail. Response process validity Developed an instrument and created a diagram representative of how the different component inter-relate. RELIABILITY Internal consistency Not reported Test-retest reliability Recalculated the unadjusted and age-adjusted OR for mortality from the					physicians (e.g. nurse, health visitor or other allied health professional)	measured
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				second wave of data and found excellent agreeance. Inter-rater reliability Not reported OTHER Also demonstrated concurrent criterion validity (beyond mortality) with indices of subjective and objective health and health care utilization factors.						
The Frailty Trait Scale (FTS)	Garcia-Garcia, 2014, Toledo, Spain	Created a new Frailty Trait Scale that has its own unique domains heavily influenced by Fried et al.'s Phenotypic Frailty model but expands the domains to include cognition and nutrition. (Community)	Twelve, Continuous scale, Range 0-100. Cut off established as equal or greater than 50 as identification of frailty. Below 50 is non-frail.	VALIDITY Content validity Started from FP, moved on to include new domains of vascular and nervous systems and nutrition based on recent research supporting these domains be included in frailty measurement. Construct Reliability First tested the FTS against biomarkers of frailty in the study population. Tested the efficacy of the scale in predicting hospitalizations and mortality, and compared to the Rockwood and Mitnitski, 2005 FI and Fried et al., 2001 Phenotypic model. Backward stepwise selection procedure was used to select covariates to keep in the final model. AUC of Fried et al's frailty phenotype and Rockwood and Mitnitski's FI were compared with the FTS's AUC using a pre-established method. Response process validity Tested the scale to the Rockwood and Mitnitski, 2005 FI and Fried et al., 2001 Phenotypic model. No significant difference ($p > .05$) found between the FI to the TFS to mortality and hospitalization prediction. AUC = 0.68 (the Fried Phenotype	x	x		x	Not specified	Not specified

				achieved 0.66, which had a significant difference $p = .0200$) for predicting hospitalizations, but no difference ($p > .05$) for mortality. RELIABILITY Internal consistency Sensitivity = .68 (95% CI, 0.60-0.74) Specificity = .72 (95% CI, 0.70-0.74) PPV = .22 (95% CI, 0.18-0.25) NPV = 0.95 (0.94-0.96) Test-retest reliability Not reported Inter-rater reliability Not reported OTHER Not applicable						
The Frailty Trait Scale Three items (FTS-3) and Five items (FTS-5)	Garcia-Garcia, 2020, Toledo, Spain	The goal was to create a valuable instrument that can be used to assess frailty in clinical settings in daily practice that are not overly time-consuming. Retrospective approach from the TSHA data. Created the 3-item form to avoid the gait-speed and hand-grip tests which are not available tests with all individuals.	Three (FTS-3) and Five (FTS-5), Continuous scale. FTS-5 range 0-50 (25 and higher recommended cutoff for determining frailty risk) and FTS-3 range 0-30 (15 and higher recommended cutoff for determining frailty risk)	VALIDITY Content validity See the FTS information. Construct Reliability Item reduction and scoring were done with an algorithm to maximize the AUC for the logistic models for each outcome of interest (mortality, hospitalization, incident disability, and frailty phenotype and Rockwood and Mitnitski 2005 FI levels). Response process validity Not reported RELIABILITY Internal consistency Lots of different cutoff sensitivity and specificity provided. Recommended for FTS-5 was 25 Death Sensitivity = 0.619 Specificity = 0.733	x			x (IAD Ls)		FTS-5 5min. Did not report FTS-3

		(Community)		FTS-3 cutoff recommendation was 15 Death sensitivity = 0.567 Specificity = 0.728 Test-retest reliability Not reported Inter-rater reliability Not reported OTHER Not applicable						
The Gérontopôle Frailty Screening Tool (GFST)	Vellas, 2013, Toulouse , France	Creates a framework to support clinical decision making for frailty identification, but is not independent from clinical judgement. (Community)	Seven, Dichotomous, Yes/No for frail	VALIDITY Content validity Builds on current evidence for the frailty domains and then links it together with clinical impression question at the end of the questionnaire. Construct Reliability Response process validity Not yet validated (may be done in another study, possibly in French-language) RELIABILITY Internal consistency Not tested Test-retest reliability Not tested Inter-rater reliability Not reported OTHER Not applicable	x	x	^a	x	General Practitioners	Not quantified but designed to be quick

Appendix B

Initial Recruitment Email

Subject: Invitation to participate in a research study to understand the barriers and facilitators to frailty screening

Dear Registered Nurse or Nurse Practitioner,

You are invited to participate in a study conducted by a Master of Science in Nursing student at the University of Ottawa, Janessa France, supervised by Dr. Chantal Backman, Associate Professor, School of Nursing. This research study is a part of her thesis requirements for the program.

The aims of the study are to (1) determine what frailty screening is being done in acute care and (2) explore the barriers and facilitators for using these tools.

Eligible participants will have (1) at least three months practice as a licensed nurse in Alberta (2) primarily work in the acute care setting and (3) provide care for older adults in their area of practice. Your participation will consist of completing an approximately 12-minute, English language web-based survey. Your contribution will add to the knowledge base on how best to care for older adults living with frailty in the hospital. This study will inform the design of a future theory-based frailty strategy for hospitals in Alberta. The University of Ottawa's Research Ethics Board has approved the ethical components of this project.

For thanks for participation, you have the option to be entered into the draw for one of three \$20 Starbucks eGift Cards.

Your participation is voluntary, there is no obligation to participate, and your participation will have no impact on your standing with the College. The information you share will remain strictly confidential and is being collected independently from your nursing college. Your identity will remain anonymous. If you have any questions about the study, you may contact the student researcher or her supervisor.

To access the survey and consent information please click on the link below:

Survey Link

Thank you,

Janessa France BHSc, BN, ACCN, RN
MScN Student
School of Nursing, Faculty of Health Sciences, University of Ottawa
XXXXXXXXXX

Chantal Backman RN, MHA, PhD
Associate Professor
School of Nursing, Faculty of Health Sciences, University of Ottawa
XXXXXXXXXX

Appendix C

First Reminder Recruitment Email

Subject Header: Reminder to participate in a research study to understand the barriers and facilitators to frailty screening

Dear Registered Nurse or Nurse Practitioner,

This is a kind reminder to please consider participation (if you have not already) in a study conducted by a Master of Science in Nursing student at the University of Ottawa, Janessa France, supervised by Dr. Chantal Backman, Associate Professor, School of Nursing. This research study is a part of her thesis requirements for the program.

The aims of the study are to (1) determine what frailty screening is being done in acute care and (2) explore the barriers and facilitators for using these tools.

Eligible participants will have (1) at least three months practice as a **registered nurse or nurse practitioner** in Alberta (2) primarily work in the acute care setting and (3) provide care for older adults in their area of practice. Your participation will consist of completing an approximately 12-minute, English language web-based survey. Your contribution will add to the knowledge base on how best to care for older adults living with frailty in the hospital. This study will inform the design of a future theory-based frailty strategy for hospitals in Alberta. The University of Ottawa's Research Ethics Board has approved the ethical components of this project.

For thanks for participation, you have the option to be entered into the draw for one of three \$20 Starbucks eGift Cards. Your participation is voluntary, there is no obligation to participate, and your participation will have no impact on your standing with the College. The information you share will remain strictly confidential and is being collected independently from your nursing college. Your identity will remain anonymous. If you have any questions about the study, you may contact the student researcher or her supervisor.

To access the survey and consent information please click on the link below:

Survey Link

Thank you,

Janessa France BHSc, BN, ACCN, RN
MScN Student
School of Nursing, Faculty of Health Sciences, University of Ottawa
XXXXXXXXXX

Chantal Backman RN, MHA, PhD
Associate Professor
School of Nursing, Faculty of Health Sciences, University of Ottawa
XXXXXXXXXX

Appendix D

Final Reminder Recruitment Email

Subject Header: Final reminder to participate in a research study to understand the barriers and facilitators to frailty screening

Dear Registered Nurse or Nurse Practitioner,

This is a kind reminder to please consider participation (if you have not already) in a study conducted by a Master of Science in Nursing student at the University of Ottawa, Janessa France, supervised by Dr. Chantal Backman, Associate Professor, School of Nursing. This research study is a part of her thesis requirements for the program and will close on the 18th of May.

The aims of the study are to (1) determine what frailty screening is being done in acute care and (2) explore the barriers and facilitators for using these tools.

Eligible participants will have (1) at least three months practice as a registered nurse or nurse practitioner in Alberta (2) primarily work in the acute care setting and (3) provide care for older adults in their area of practice. Your participation will consist of completing an approximately 12-minute, English language web-based survey. Your contribution will add to the knowledge base on how best to care for older adults living with frailty in the hospital. This study will inform the design of a future theory-based frailty strategy for hospitals in Alberta. The University of Ottawa's Research Ethics Board has approved the ethical components of this project.

For thanks for participation, you have the option to be entered into the draw for one of three \$20 Starbucks eGift Cards.

Your participation is voluntary, there is no obligation to participate, and your participation will have no impact on your standing with the College. The information you share will remain strictly confidential and is being collected independently from your nursing college. Your identity will remain anonymous. If you have any questions about the study, you may contact the student researcher or her supervisor.

To access the survey and consent information please click on the link below:

<https://www.surveymonkey.ca/r/FrailtyScreeningSurvey>

Thank you,

Janessa France BHSc, BN, ACCN, RN
MScN Student
School of Nursing, Faculty of Health Sciences, University of Ottawa
XXXXXXXXXXXXXX

Chantal Backman RN, MHA, PhD
Associate Professor
School of Nursing, Faculty of Health Sciences, University of Ottawa
XXXXXXXXXXXXXX

Appendix E

College of Licensed Practical Nurses of Alberta Recruitment Bulletin

RESEARCH STUDIES



Researchers are looking for LPN volunteers to participate in the following studies. The CLPNA is not directly involved in these studies and will not have access to any data collected. Questions should be directed to the researchers.

Understanding the Barriers and Facilitators to Frailty Screening

[**Participate**](#)

Are you an LPN practicing for at least three months in Alberta, primarily work in acute care, and provide care for older adults? This survey will take approx. 12 min to complete. For more information about the survey and consent information, click Participate.

Appendix F

Online Survey

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**Nursing Frailty Screening Survey LIVE
VERSION**

Welcome to Our Survey on Nurses' Role in Frailty Screening in Alberta Hospitals!

Please press OK to continue to eligibility questions.

* 1. Do you have at least three months practice as a fully licensed nurse in Alberta, Canada?

For example: registered nurse, licensed practical nurse, registered psychiatric nurse, or nurse practitioner

☐ Yes

☐ No

* 2. Do you primarily work in the acute care setting?

For example: hospital, emergency, urgent care, or short-term care setting?

☐ Yes

☐ No

* 3. Do you care for older adults (persons older than 64 years of age) in your area of practice?

☐ Yes

☐ No

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Nursing Frailty Screening Survey LIVE VERSION

Study Information and Consent

You are eligible to participate in this study.

Please read the study information and consent form below.

[Study information and consent form](#)

* 4. Do you agree to voluntarily participate in this study?

☐ I Agree

☐ I Disagree (I do not want to participate)

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Nursing Frailty Screening Survey LIVE VERSION

Section 1: About Your Practice

5. What type of licensed nurse are you?

- ☐ Registered Nurse (RN)
- ☐ Licensed Practical Nurse (LPN)
- ☐ Registered Psychiatric Nurse (RPN)
- ☐ Nurse Practitioner (NP)

6. How do you identify?

- ☐ Male
- ☐ Female
- ☐ You don't have an option that applies to me. I identify as

7. How old are you?

- ☐ Less than 30
- ☐ 30-39
- ☐ 40-49
- ☐ 50-59
- ☐ 60 or older

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Nursing Frailty Screening Survey LIVE VERSION

Section 1: About Your Practice (Continued)

8. What is your primary area of nursing practice?

- ☐ Emergency
- ☐ Intensive Care (includes cardiac care units)
- ☐ Operating or Recovery Room
- ☐ Psychiatry
- ☐ Gerontology
- ☐ Nephrology
- ☐ Oncology
- ☐ Palliative
- ☐ Medical and/or surgical
- ☐ Wound, ostomy and continence
- ☐ Other (please specify)

9. How many years have you been employed in your current position?

- ☐ Less than 1 year
- ☐ 1-3
- ☐ 4-6
- ☐ 7-9
- ☐ 10-14
- ☐ 15-19
- ☐ 20+

10. What are the most common shifts you work?

- ☐ Day shifts
- ☐ Evening shifts
- ☐ Night shifts
- ☐ Mixed

11. What is your current employment status?

- ☐ Full-time
- ☐ Part-time
- ☐ Casual
- ☐ Locum

12. What is your area of responsibility?

- ☐ Direct Care
- ☐ Administration
- ☐ Education
- ☐ Research
- ☐ Other (please specify)

13. What is your highest level of education attained in nursing?

- ☐ Diploma
- ☐ Bachelors
- ☐ Masters
- ☐ PhD

14. What is your highest level of education attained **not related to nursing?**

- ☐ Not Applicable
- ☐ Diploma
- ☐ Bachelors
- ☐ Masters
- ☐ PhD

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Nursing Frailty Screening Survey LIVE VERSION

Section 2: Frailty Nursing Screening

Please consider the following definition before answering the survey.

Frailty: a state of vulnerability where little stress may lead to functional impairment. It is influenced by an accumulation of multiple deficits in physical performance (including gait speed and mobility), nutritional status, mental health, and cognition (Rodríguez-Mañas et al., 2013).

Older adults are especially at risk for becoming frail (Clegg, 2013).

Nursing Frailty Screening Survey LIVE VERSION

Section 2: Frailty Nursing Screening (Continued)

Please consider this picture of the Clinical Frailty Scale (Rockwood et al., 2005) when answering your next question.

Clinical Frailty Scale*

 **1 Very Fit** – People who are robust, active, energetic and motivated. These people commonly exercise regularly. They are among the fittest for their age.

 **2 Well** – People who have **no active disease symptoms** but are less fit than category 1. Often, they exercise or are very **active occasionally**, e.g. seasonally.

 **3 Managing Well** – People whose **medical problems are well controlled**, but are **not regularly active** beyond routine walking.

 **4 Vulnerable** – While **not dependent** on others for daily help, often **symptoms limit activities**. A common complaint is being “slowed up”, and/or being tired during the day.

 **5 Mildly Frail** – These people often have **more evident slowing**, and need help in **high order IADLs** (finances, transportation, heavy housework, medications). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation and housework.

 **6 Moderately Frail** – People need help with **all outside activities** and with **keeping house**. Inside, they often have problems with stairs and need **help with bathing** and might need minimal assistance (cuing, standby) with dressing.

 **7 Severely Frail** – **Completely dependent for personal care**, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~ 6 months).

 **8 Very Severely Frail** – Completely dependent, approaching the end of life. Typically, they could not recover even from a minor illness.

 **9 Terminally Ill** - Approaching the end of life. This category applies to people with a **life expectancy <6 months**, who are **not otherwise evidently frail**.

Scoring frailty in people with dementia

The degree of frailty corresponds to the degree of dementia. Common **symptoms in mild dementia** include forgetting the details of a recent event, though still remembering the event itself, repeating the same question/story and social withdrawal.

In **moderate dementia**, recent memory is very impaired, even though they seemingly can remember their **past life events** well. They can do personal care with prompting.

In **severe dementia**, they cannot do personal care without help.

* 1. Canadian Study on Health & Aging, Revised 2008.
2. K. Rockwood et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005;173:489-495.

15. How often do you use the Clinical Frailty Scale or a similar version to detect or measure for frailty in your practice?

- ☐ Always
 ☐ Usually
 ☐ Sometimes
 ☐ Rarely
 ☐ Never

Nursing Frailty Screening Survey LIVE VERSION

Section 2: Frailty Nursing Screening (Continued)

Please consider this picture of the Edmonton Frail scale (Rolfson et al., 2006) when answering your next question.

The Edmonton Frail Scale:				Score: ____/17
Frailty domain	Item	0 point	1 point	2 points
Cognition	Please imagine that this pre-drawn circle is a clock. I would like you to place the numbers in the correct positions then place the hands to indicate a time of 'ten after eleven'	No errors	Minor spacing errors	Other errors
General health status	In the past year, how many times have you been admitted to a hospital?	0	1-2	≥2
	In general, how would you describe your health?	'Excellent', 'Very good', 'Good'	'Fair'	'Poor'
Functional independence	With how many of the following activities do you require help? (meal preparation, shopping, transportation, telephone, housekeeping, laundry, managing money, taking medications)	0-1	2-4	5-8
Social support	When you need help, can you count on someone who is willing and able to meet your needs?	Always	Sometimes	Never
Medication use	Do you use five or more different prescription medications on a regular basis?	No	Yes	
	At times, do you forget to take your prescription medications?	No	Yes	
Nutrition	Have you recently lost weight such that your clothing has become looser?	No	Yes	
Mood	Do you often feel sad or depressed?	No	Yes	
Continence	Do you have a problem with losing control of urine when you don't want to?	No	Yes	
Functional performance	I would like you to sit in this chair with your back and arms resting. Then, when I say 'GO', please stand up and walk at a safe and comfortable pace to the mark on the floor (approximately 3 m away), return to the chair and sit down'	0-10 s	11-20 s	One of >20 s patient unwilling, or requires assistance
Totals	Final score is the sum of column totals			

16. How often do you use the Edmonton Frail Scale or a similar version to detect or measure for frailty in your practice?

- ☐ Always
 ☐ Usually
 ☐ Sometimes
 ☐ Rarely
 ☐ Never

Nursing Frailty Screening Survey LIVE VERSION

Section 2: Frailty Nursing Screening (Continued)

Please consider this picture of the Frailty Phenotype (Fried et al., 2001) when answering your next question.

Characteristics of frailty	Cardiovascular health study measure
Unintentional weight loss	At the initial visit: lost >4.5 kg in the prior year; at follow-up visit: loss of 5% body weight from previous year to current weight
Grip strength	Grip strength in the lowest 20% stratified by gender and body mass index (BMI): women, (I) ≤17 kg for BMI ≤23; (II) ≤17.3 kg for BMI 23.1-26; (III) ≤18 kg for BMI 26.1-29; (IV) ≤21 kg for BMI >29; men, (I) ≤29 kg for BMI ≤24; (II) ≤30 kg for BMI 24.1-26; (III) ≤30 kg for BMI 26.1-28; (IV) ≤32 kg for BMI >28
Exhaustion	Exhaustion by self-report, based on how the patient felt the previous week: either feeling that everything the person did was an effort or feeling unable to get going
Slow gait speed	Based on measured time to walk a distance of 15 ft
Low physical activity	Lowest 20% of Kcals/week: men <383 Kcals/week; women <270 Kcals/week
Frailty is present, if ≥3 criteria are present; intermediate or pre-frail, 1 or 2 criteria present; older individuals with none of the above five criteria are classified as non-frail or fit.	

17. How often do use the Frailty Phenotype or a similar version to detect or measure for frailty in your practice?

- ☐ Always
 ☐ Usually
 ☐ Sometimes
 ☐ Rarely
 ☐ Never

Nursing Frailty Screening Survey LIVE VERSION

Section 2: Frailty Nursing Screening (Continued)

Please consider this picture of the Frailty Index (Mitnitski et al., 2001) when answering your next question.

Frailty Index

Check all that have a concern for your patient. Add up the total score and divide by 41 to get an index risk score.

- | | | |
|--|--|--|
| ☐ Delirium | ☐ Hypertension | Blood work abnormality for: |
| ☐ Sadness or depression | ☐ Cardiac risk factors | ☐ Blood glucose |
| ☐ Sleep changes | ☐ Stroke risk factors | ☐ Sodium |
| ☐ Memory impairment | ☐ Eye trouble | ☐ Potassium |
| ☐ Mood impairment | ☐ Ear trouble | ☐ Blood urea nitrogen (BUN) |
| ☐ Difficulty bathing | ☐ Chest problems | ☐ Creatinine |
| ☐ Difficulty toileting | ☐ Diabetes | ☐ Calcium |
| ☐ Difficulty dressing | ☐ Kidney disease | ☐ Phosphate |
| ☐ Urinary incontinence | ☐ Parkinson's | ☐ Thyroid stimulating hormone |
| ☐ Stool incontinence | ☐ Duration of chronic illness | ☐ B12 level |
| ☐ Tremor with rest | ☐ Impaired judgement | ☐ Folate |
| ☐ Tremor with activity | ☐ Impaired ambulation | ☐ Albumin |
| ☐ Visual impairment | ☐ Impaired coordination | ☐ Total protein |
| ☐ Hearing impairment | ☐ Aphasia | ☐ Red blood cells |

18. How often do use a Frailty Index similar to the type shown to detect or measure for frailty in your practice?

- ☐ Always
 ☐ Usually
 ☐ Sometimes
 ☐ Rarely
 ☐ Never

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Nursing Frailty Screening Survey LIVE VERSION

Section 2: Frailty Nursing Screening (Continued)

19. Do you use any other frailty screening tools in your practice?

☐ Yes

☐ No

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**Nursing Frailty Screening Survey LIVE
VERSION**

Section 2: Frailty Nursing Screening (Continued)

20. What are these frailty screening tools called?

21. How often do use these tools from question 20 to detect or measure for frailty in your practice?

☐ Always ☐ Usually ☐ Sometimes ☐ Rarely

☐ Never (I do not use a different tool)

13

Note. These questions 20 and 21 only appeared when participants answered “yes” to question 19.

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Nursing Frailty Screening Survey LIVE VERSION

Section 2: Frailty Nursing Screening (Continued)

Please consider the following questions in the context of your **primary area of nursing practice** and using frailty screening tools (for example the Clinical Frailty Scale, the Edmonton Frail Scale, the Frailty Phenotype, the Frailty Index) to assess frailty with **older adults**.

22. How often do you administer screening tools to detect frailty in your practice in general?

- ☐ Always ☐ Usually ☐ Sometimes ☐ Rarely ☐ Never

23. How often do you use your **own clinical impression** (without any measurement or screening tools) to detect frailty in your practice?

- ☐ Always ☐ Usually ☐ Sometimes ☐ Rarely ☐ Never

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Nursing Frailty Screening Survey LIVE VERSION

Section 2: Frailty Nursing Screening (Continued)

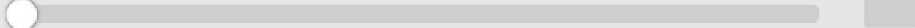
Slider Scale Question

Click and drag the white ball closest to the assessment method by the degree you find it useful. A number will appear from 0-100 in the box.

All the way right to clinical impression indicates you find this the most useful to assess frailty; a 100 will appear in the box. All the way left to screening tool indicates you find this the most useful to assess frailty; a 0 will appear in the box. Closer to the middle closer but on either side indicates a weaker preference towards one or the other. If you choose both as being equally useful, click the ball once and make the number 50 appear.

24. Which method is more useful to you for assessing frailty of older adults in your primary area of practice?

Frailty Screening Tool Equally Useful Clinical Impression



Nursing Frailty Screening Survey LIVE VERSION

Section 3: Barriers and Facilitators to Using Frailty Screening Tools

Please consider the following questions in the context of your **primary area of nursing practice** and using the **frailty screening tools** from section 2 to assess frailty with **older adults**.

25. Knowledge

	Very strongly disagree	Strongly disagree	Disagree	Agree	Strongly agree	Very strongly agree
I know the content and objectives of frailty screening.	☐	☐	☐	☐	☐	☐
I am familiar with the content and objectives of frailty screening.	☐	☐	☐	☐	☐	☐
I am aware of how to conduct frailty screening.	☐	☐	☐	☐	☐	☐

26. Skills

	Very strongly disagree	Strongly disagree	Disagree	Agree	Strongly agree	Very strongly agree
I have been trained how to conduct frailty screening.	☐	☐	☐	☐	☐	☐
I have the skills to conduct frailty screening.	☐	☐	☐	☐	☐	☐
I have conducted frailty screening.	☐	☐	☐	☐	☐	☐

Nursing Frailty Screening Survey LIVE VERSION

Section 3: Barriers and Facilitators to Using Frailty Screening Tools (Continued)

Please consider the following questions in the context of your primary area of nursing practice and using the frailty screening tools from section 2 to assess frailty with older adults.

27. Social/Professional Role and Identity

	Very strongly disagree	Strongly disagree	Disagree	Agree	Strongly agree	Very strongly agree
Conducting frailty screening in my primary area of practice is part of my work as a nurse.	☐	☐	☐	☐	☐	☐
As a nurse, it is my job to conduct frailty screening in my primary area of practice.	☐	☐	☐	☐	☐	☐
It is my responsibility as a nurse to conduct frailty screening in my primary area of practice.	☐	☐	☐	☐	☐	☐
Doing frailty screening in my primary area of practice is consistent with my nursing profession.	☐	☐	☐	☐	☐	☐

28. Beliefs about Capabilities

	Very strongly disagree	Strongly disagree	Disagree	Agree	Strongly agree	Very strongly agree
I am confident that I can conduct frailty screening, even when the patient is not motivated.	☐	☐	☐	☐	☐	☐
I am confident that I can conduct frailty screening, even when there is little time.	☐	☐	☐	☐	☐	☐
I am confident that if I was motivated and wanted to, I could conduct frailty screening.	☐	☐	☐	☐	☐	☐

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Nursing Frailty Screening Survey LIVE VERSION

Section 3: Barriers and Facilitators to Using Frailty Screening Tools (Continued)

Please consider the following questions in the context of your primary area of nursing practice and using the frailty screening tools from section 2 to assess frailty with older adults.

29. Optimism

	Very strongly disagree	Strongly disagree	Disagree	Agree	Strongly agree	Very strongly agree
When conducting frailty screening in uncertain times, I usually expect the best.	☐	☐	☐	☐	☐	☐
When conducting frailty screening, I'm always optimistic about the future.	☐	☐	☐	☐	☐	☐

30. Beliefs about Consequences

	Very strongly disagree	Strongly disagree	Disagree	Agree	Strongly agree	Very strongly agree
If I conduct frailty screening with older adults it will benefit public health.	☐	☐	☐	☐	☐	☐
If I conduct frailty screening with older adults it will have disadvantages for my relationship with these patients.	☐	☐	☐	☐	☐	☐

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Nursing Frailty Screening Survey LIVE VERSION

Section 3: Barriers and Facilitators to Using Frailty Screening Tools (Continued)

Please consider the following questions in the context of your primary area of nursing practice and using the frailty screening tools from section 2 to assess frailty with older adults.

31. Reinforcement

Very strongly disagree Strongly disagree Disagree Agree Strongly agree Very strongly agree

When I conduct frailty screening, I receive positive recognition from my patients and their families.

☐ ☐ ☐ ☐ ☐ ☐

When I conduct frailty screening, I receive positive recognition from health care professionals that are important to me.

☐ ☐ ☐ ☐ ☐ ☐

When I conduct frailty screening, I feel like I am making a difference.

☐ ☐ ☐ ☐ ☐ ☐

When I conduct frailty screening, I get criticized by health care professionals that are important to me.

☐ ☐ ☐ ☐ ☐ ☐

When I conduct frailty screening, it is discouraged by my patients and their families.

☐ ☐ ☐ ☐ ☐ ☐

32. Intentions

	Very strongly disagree	Strongly disagree	Disagree	Agree	Strongly agree	Very strongly agree
I will definitely conduct frailty screening with older adults in my next shift.	☐	☐	☐	☐	☐	☐
I intend to conduct frailty screening with older adults in my next shift.	☐	☐	☐	☐	☐	☐

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Nursing Frailty Screening Survey LIVE VERSION

Section 3: Barriers and Facilitators to Using Frailty Screening Tools (Continued)

Please consider the following questions in the context of your primary area of nursing practice and using the frailty screening tools from section 2 to assess frailty with older adults.

33. Goals

	Very strongly disagree	Strongly disagree	Disagree	Agree	Strongly agree	Very strongly agree
There often is something else more important than conducting frailty screening.	☐	☐	☐	☐	☐	☐
I am motivated to conduct frailty screening.	☐	☐	☐	☐	☐	☐
I have a clear plan on how I will conduct frailty screening.	☐	☐	☐	☐	☐	☐

34. Memory, Attention, and Decision Processes

	Very strongly disagree	Strongly disagree	Disagree	Agree	Strongly agree	Very strongly agree
When I need to concentrate to conduct frailty screening, I have no trouble focusing my attention.	☐	☐	☐	☐	☐	☐
When trying to focus my attention on conducting frailty screening, I have difficulty blocking out distracting thoughts.	☐	☐	☐	☐	☐	☐
When concentrating on conducting frailty screening, I can focus my attention regardless of what's going on around me.	☐	☐	☐	☐	☐	☐

Nursing Frailty Screening Survey LIVE VERSION

Section 3: Barriers and Facilitators to Using Frailty Screening Tools (Continued)

Please consider the following questions in the context of your primary area of nursing practice and using the frailty screening tools from section 2 to assess frailty with older adults.

35. Environmental Context and Resources

	Very strongly disagree	Strongly disagree	Disagree	Agree	Strongly agree	Very strongly agree
In general, I have enough time to conduct frailty screening.	☐	☐	☐	☐	☐	☐
The physical work environment on my unit is adequate to conduct frailty screening.	☐	☐	☐	☐	☐	☐
I have the necessary resources (including physical resources, technologies, and staff) to conduct frailty screening.	☐	☐	☐	☐	☐	☐
On the unit that I work on, conducting frailty screening is routine.	☐	☐	☐	☐	☐	☐

36. Social Influence

	Very strongly disagree	Strongly disagree	Disagree	Agree	Strongly agree	Very strongly agree
Most people who are important to me think that I should conduct frailty screening.	☐	☐	☐	☐	☐	☐
Most people whose opinion I value would approve of my conducting frailty screening.	☐	☐	☐	☐	☐	☐

Nursing Frailty Screening Survey LIVE VERSION

Section 3: Barriers and Facilitators to Using Frailty Screening Tools (Continued)

Please consider the following questions in the context of your primary area of nursing practice and using the frailty screening tools from section 2 to assess frailty with older adults.

37. Emotions

	Very strongly disagree	Strongly disagree	Disagree	Agree	Strongly agree	Very strongly agree
I feel anxious when I start to think about conducting frailty screening.	☐	☐	☐	☐	☐	☐
I feel frustrated when I cannot conduct frailty screening.	☐	☐	☐	☐	☐	☐
Conducting frailty screening for my patients is stressful to me.	☐	☐	☐	☐	☐	☐
I feel accomplished when I conduct frailty screening.	☐	☐	☐	☐	☐	☐

38. Behavioural Regulation

	Very strongly disagree	Strongly disagree	Disagree	Agree	Strongly agree	Very strongly agree
I see positive patient outcomes when I screen for frailty.	☐	☐	☐	☐	☐	☐
Screening for frailty is part of my work.	☐	☐	☐	☐	☐	☐
I have a clear plan on how I will conduct frailty screening.	☐	☐	☐	☐	☐	☐

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Nursing Frailty Screening Survey LIVE VERSION

End of Survey

You are now finished this survey. Thank you for your time and considerations answering the questions.

Please click the post-survey link to enter the draw for a Starbucks eGift Card and to receive a summary of the results from the study.

[Post-Survey Link](#)

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Email address survey for further information and Starbucks draw

Post-Survey

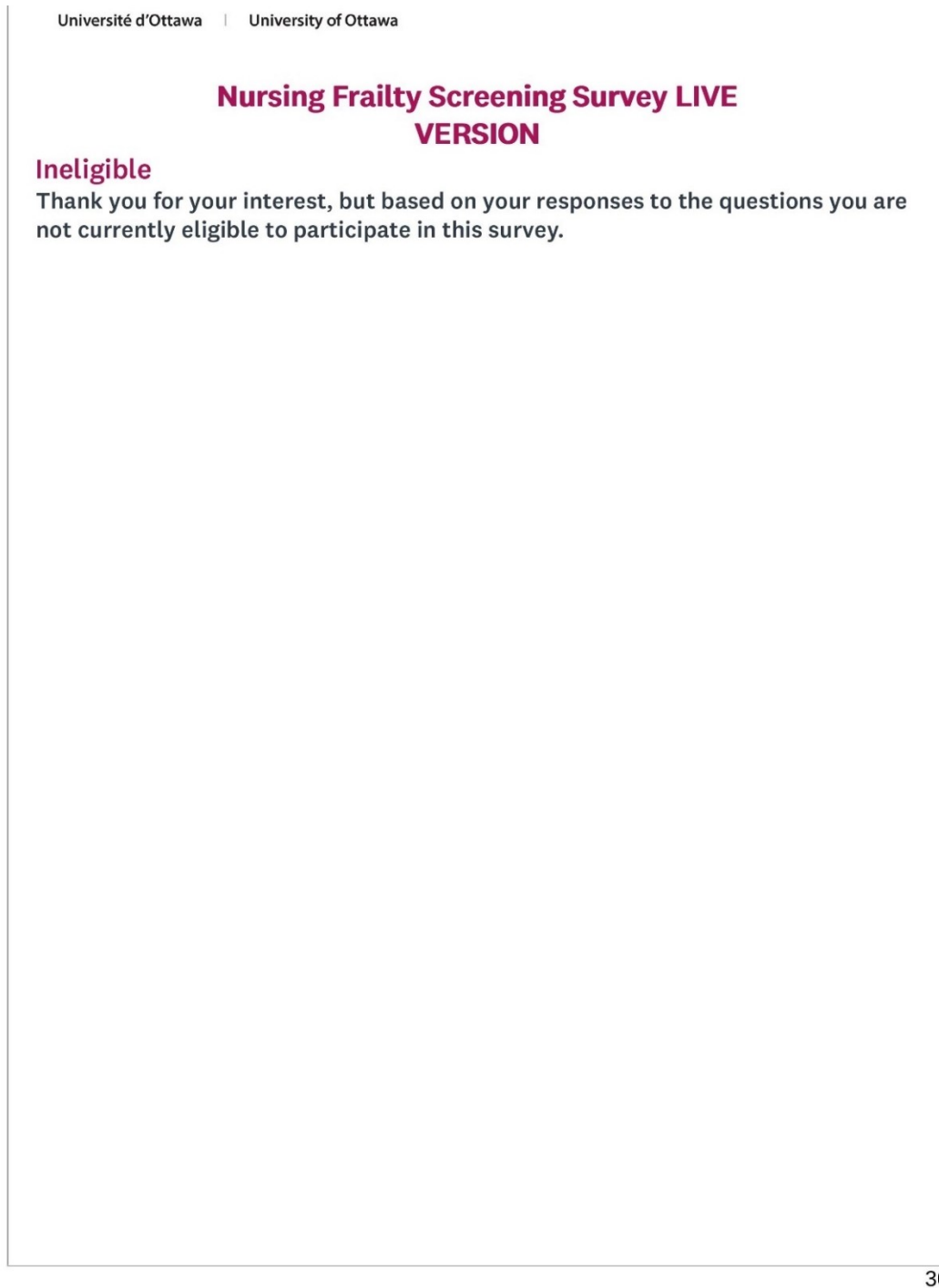
You are now finished this survey. Thank you for your time and considerations answering the questions.

1. Optional: Provide your **email address here** for a summary of the results from this study.

2. Optional: Provide your **email address here** to enter for your chance to win one of three \$20.00 Starbucks eGift Cards.

Appendix G

Ineligible Webpage



Note. This page would appear if participants answered “no” to at least one of the eligibility questions (1, 2, and/or 3) or “I Disagree (I do not want to participate)” to question 4.

Appendix H

Study Information and Consent

Title of the Study: Barriers and facilitators to nurses screening for frailty in acute care in Alberta: a survey study guided by the theoretical domains framework.

Principal Investigator:

Janessa France
Master of Science in Nursing Student
School of Nursing
University of Ottawa
Ottawa, ON

Email: XXXXXXXXXXXX

Supervisor:

Dr. Chantal Backman
Associate Professor
School of Nursing
University of Ottawa
XXXXXXXXXXXXXX

Tel: XXX-XXX-XXXX ext XXXX
Email: XXXXXXXXXXXX

Invitation to Participate: You are invited to participate in the abovementioned research study conducted by Janessa France. The project is being conducted for the purpose of Ms. France's Master's Thesis, who is being supervised by Dr. Chantal Backman.

Purpose of the Study: The purpose of this study is to describe frailty screening tools used by nurses being conducted in acute care and explore the barriers and facilitators for the use of these tools. Specific objectives are to:

- i. Determine the type and the extent of frailty screening tools provided in acute care
- ii. Describe the barriers and facilitators to nurses using frailty screening tools in acute care;
- iii. Compare the frailty screening tools used (from objective i) and barriers and facilitators between nursing licensing groups and nursing specialties (from objective ii).

Participation: If you wish to participate in this study, please complete the survey. The survey should take you approximately 12-minutes to complete and is solely in the English language. You are not required to answer questions you choose not to. Once you have completed the survey you will optionally be able to provide your email address to receive a report of the research findings and to enter a draw. The survey will be closed as of 18, May, 2021.

Benefits: You will have the option to enter a draw for one of three \$20 Starbucks eGift Cards. This study will help inform recommendations for policy and research in nursing practice and science.

Risks: Some of the questions may be considered sensitive in nature and may cause emotional or psychological discomfort. You are free to refuse to answer any questions that may cause such discomfort.

Confidentiality and Anonymity: The information that you will share will remain strictly confidential, is being collected independently from your nursing college and will be used solely

for the purposes of this research. The only people who will have access to the research data are the research team members, authorized by either Janessa France or Dr. Chantal Backman. Your answers to open-ended questions may be used verbatim in presentations and publications but neither you (nor your organization) will be identified. In order to minimize the risk of security breaches and to help ensure your confidentiality we recommend that you use standard safety measures such as signing out of your account, closing your browser and locking your screen or device when you are no longer using them or when you have completed the study. Results will be published in pooled (aggregate) format. Anonymity is guaranteed since you are not being asked to provide your name or any personal information. The collection of email addresses will be completed in a separate anonymous survey (not linked to the data) used for the optional purposes of compensation and for a copy of the study results.

Conservation of data: The electronic data will be kept on the University of Ottawa secure server for five years after completion of the study, then will be permanently deleted.

Voluntary Participation: You are under no obligation to participate and if you choose to participate you may refuse to answer questions that you do not want to answer. You will still be eligible for compensation should you choose to withdraw from the study. While you may withdraw from the study at any time, it is not feasible due to the anonymous nature of the study to withdraw your data from the study as the researchers will be unable to retrace individual datasets.

Information about the Study Results: A final report will be made available to you (optional) and to the College and Association of Registered Nurses of Alberta, College of Registered Psychiatric Nurses of Alberta, and College of Licensed Practical Nurses of Alberta. This report will not include any individual results or results that could be ascribed to any particular nurse. Your decision to participate will not be shared with your college and will not affect your employment and/or membership.

Compensation or Incentive: To thank you for your contribution to the research project, you will be given the option to enter your name in a draw to win one of three Starbucks eGift Cards valued at \$20 (Canadian Dollars). The draw is open to all research participants who enter their name in the draw, regardless of whether they decide to withdraw from further participating in the research project.

Upon completion of the study, three emails will be randomly selected amongst those who have entered and the person whose email address is drawn will be informed by email. To win the prize, the persons must correctly answer a skill testing question. If the person cannot be reached within 14 days from the date of the draw, the prize will be awarded to the next person that is randomly selected and so on until the prize has been awarded. The odds of winning a prize are dependent on the number of eligible entries received. The prize must be accepted as awarded or forfeited and cannot be redeemed for cash.

The email address that you provide when you enter the draw is collected for the purposes of contacting you if your name is selected in the draw. Your name and the contact information you have provided will be kept confidential and then destroyed once the prizes have been awarded. We reserve the right to cancel the draw or cancel the awarding of the prize if the integrity of the draw or the research or the confidentiality of participants is compromised. The draw is governed by the applicable laws of Canada.

If you have any questions or require more information about the study itself, you may contact the researcher or her supervisor at the numbers mentioned herein.

If you have any questions with regards to the ethical conduct of this study, you may contact the Protocol Officer for Ethics in Research, University of Ottawa, Tabaret Hall, 550 Cumberland Street, Room 154, Ottawa, ON K1N 6N5, tel.: (613) 562-5387 or ethics@uottawa.ca.

Please keep this form for your records.

Thank you for your time and consideration,

Janessa France BHSc, BN, ACCN, RN
MScN Student
School of Nursing, Faculty of Health Sciences, University of Ottawa
XXXXXXXXXXXXX

Chantal Backman RN, MHA, PhD
Associate Professor
School of Nursing, Faculty of Health Sciences, University of Ottawa
XXXXXXXXXXXXX

Appendix I

Supplemental Data and Discussion

Through the completion of the project, additional analyses and data were collected that were supportive to the project, but not directly incorporated into the main manuscript. This data included: expected versus actual sample size estimates, comparison of nursing sample demographics to population, additional qualitative data, the scatterplot diagrams and Durbin-Watson statistic for the linear regressions, the full 43 TDF questions results (for the total sample), and the domain-level linear regression analyses and between-group comparisons of the most-different TDF domains. These results are reported here and a small supplemental discussion summary follows.

Supplementary Results

Sample Size Estimates

The expected versus actual sample size differences are reported in Table I1. Predictions of response rate had been made based on best estimate data available. The LPN population size was predicted to be 5,521 based upon CIHI (Canadian Institute for Health Information, 2022) data as the total emailed population size ($N = 17,160$) includes all LPNs, including those that do not work in acute. Predicted 28.8% response rate from survey sent out by organization (College of Licensed Practical Nurses of Alberta, 2019). The RN original population data changed because the college could only contact RNs that agreed to participate in research and could not separate based upon area of practice ($N = 2,114$). Of these, it was estimated that 58% of RNs primarily practice in acute care (D. Flaming, personal communication, May 26, 2020). Response rate was predicted at the previous rate reported by the college for a similar study design 8.24%

(that included all specialty areas). The NP population was also a sub-set of those Alberta NPs that agree to participate in research ($N = 55$). Of these, it was estimated based on CIHI data that 42.81% would primarily practice in acute care. Response rate was predicted at 8.24%. The RN and NP samples were larger than estimated with 7.27% and 9.51% response rates respectively and LPN smaller with a 0.13% response rate.

Table I1

Population and Sample Estimates Compared to Survey Responses

License Group	Population (Emailed Individuals)	Power Analysis (95% CI)	Estimate Sample n	Actual Survey Sample n	Response Rate ^a	N Difference Estimate Verse Actual
LPN	17,160	376	1,590	23	0.13%	-1,567
NP	55	49	2	4	7.27%	2
RN	2,114	326	101	201	9.51%	100
Total	19,329	377	1,693	228	1.18%	-1,465

Note. Abbreviations: LPN, Licensed Practical Nurse; NP, Nurse Practitioner; RN, Registered

Nurse

^aResponse rate calculated from the eligible survey sample compared to the entire population that received recruitment emails.

Additional Demographic Information

The sample of nurses appeared well approximated (within 10% across all compared fields) to the Canadian Institute of Hospital Information (CIHI). The largest differences were seen in the sample participants being younger nurses (more in the age category less than 30 years) and fewer LPNs compared to the population data reported by CIHI (see Table I2). The differences between primary practice groups were compared with Fisher's Exact Test; the full results are presented in Table I3. Major differences are discussed in the manuscript.

Table I2*Demographic Characteristics of Participants and Population Data*

Characteristic	n(%)	N(%)
License Type	228(100)	27,697(100)
LPN	23(10.1)	5,521(19.9)
RN	201(88.2)	21,900(79.1)
NP	4(1.8)	276(1.0)
Primary Area of Practice	224(100)	N/A
Critical Care	90(39.5)	-
ED	64(28.1)	
ICU/CCU	26(11.4)	
Med/Surg	111(48.7)	-
General Med/Surg	102(44.7)	
Gerontology	3(1.3)	
Nephrology	3(1.3)	
Oncology	1(0.4)	
Palliative	2(0.9)	
Other Acute Care	23(10.1)	-
Psychiatry	15(6.6)	
WOC	2(0.9)	
OR and PACU	1(0.4)	
Additional Areas ^a	5(2.2)	
Gender	228(100)	27,691(100)
Male	22(9.6)	2,217(9.2)
Female	204(89.5)	25,474(90.8)
Other ^b	2(0.9)	N/A
Age	228(100)	27,988(100)
Less than 30	55(24.1)	5,584(14.6)
30-39	65(28.5)	9,478(34.1)
40-49	46(20.2)	5,903(25.5)
50-59	41(18.0)	4,492(16.9)
60 or older	21(9.2)	2,531(8.9)
Years in Current Position	226(100)	N/A
Less than 1 year	18(7.9)	
1-3	52(22.8)	
4-6	45(19.7)	
7-9	33(14.5)	
10-14	28(12.3)	
15-19	23(10.1)	
20 or more	27(11.8)	
Most Common Shift	226(100)	N/A
Days	54(23.7)	
Evenings	19(8.3)	
Nights	12(5.3)	
Mixed	141(61.8)	

Characteristic	n(%)	N(%)
Current Employment Status	226(100)	27,697(100)
Full-time	108(47.4)	11,421(48.8)
Part-time	88(38.6)	11,995(37.5)
Casual	28(12.3)	4,280(13.6)
Locum	2(0.9)	1(0.0)
Area of Responsibility	227(100)	27,670(100)
Direct Care	211(92.5)	26,799(97.1)
Administration	8(3.5)	578(2.1)
Education	8(3.5)	217(0.5)
Other	0(0)	76(0.1)
Highest Level of Education in Nursing	227(100)	N/A
Diploma	48(21.1)	
Bachelors	167(73.2)	
Masters	11(4.8)	
PhD	1(0.4)	
Highest Level of Education non-Nursing	227(100)	N/A
N/A	111(48.7)	
Diploma	53(23.2)	
Bachelors	53(23.2)	
Masters	7(3.1)	
PhD	3(1.3)	

Note. N/A represents data not available for comparison from 2020 Canadian Institute for Health Information (CIHI) data (Canadian Institute for Health Information, 2022). Emergency Department (ED), Intensive and/or Cardiac care units (ICU/CCU), Medical and/or Surgical care (Med/Surg), Wounds, Ostomy, and Continence (WOC), Operating Room and Post-Anesthetic Care Unit (OR and PACU).

^aAdditional primary practice areas were: Diagnostic Imaging (n = 1), Endoscopy (n = 1), Rehab (n = 1), IV Therapy (n = 1), and Transition Services (n = 1).

^bOther genders included Non-Binary (n = 1) and Two-Spirit (n = 1).

^cLocum was not assessed in the CIHI data set but did include an Unknown which was compared here

Table I3*Comparison of Characteristics by Primary Area of Practice (n = 224)*

Characteristic	Critical Care	Med/Surg	Other Acute Care	Total	p
License Type					.072
LPN	4	16	2	22	
RN	84	94	20	198	
NP	2	1	1	4	
Gender					.149
Male	12	8	2	22	
Female	78	102	20	200	
Other ^a	0	1	1	2	
Age					<.001
Less than 30	16	35	3	54	
30-39	28	33	4	65	
40-49	20	19	5	44	
50-59	21	16	4	41	
60 or older	5	8	7	20	
Years in Current Position					.511
0-3	32	41	7	70	
4-6	17	25	3	45	
7-9	15	13	5	33	
10-14	12	11	3	26	
15 or more	24	21	5	40	
Most Common Shift					.002
Days	12	29	12	53	
Evenings	11	7	1	19	
Nights	8	3	1	12	
Mixed	59	72	9	140	
Current Employment Status					.145
Full-time	52	44	11	107	
Part-time	28	49	11	88	
Casual	9	17	1	27	
Locum	1	1	0	2	
Area of Responsibility					.272
Direct Care	85	101	22	208	
Administration	4	3	1	8	
Education	1	7	0	8	
Highest Level of Education in Nursing					.103
Diploma	14	25	9	48	
Bachelors	71	81	12	164	
Masters	5	4	2	11	
PhD	0	1	0	1	

Characteristic	Critical Care	Med/Surg	Other Acute Care	Total	<i>p</i>
Highest Level of Education non-Nursing					.098
N/A	47	53	9	109	
Diploma	14	30	8	52	
Bachelors	27	22	4	53	
Masters	2	3	2	7	
PhD	0	3	0	3	

Note. The Fisher-Freeman-Halton Exact Test was used to test for group differences. Critical

Care includes: Emergency Department (ED) (n = 64) and Intensive and/or Cardiac care units

(ICU/CCU) (n = 26). Medical and/or Surgical care (Med/Surg) (n = 111) also includes

Gerontology (n = 3), Nephrology (n = 3), Palliative (n = 2), and Oncology (n = 1). Other Acute

Care includes: Psychiatry (n = 15), Wounds, Ostomy, and Continence (WOC) (n = 2), Operating

Room and Post-Anesthetic Care Unit (OR and PACU) (n = 1), and other self-reported areas (n =

5). Other self-reported areas were: Diagnostic Imaging (n = 1), Endoscopy (n = 1), Rehab (n =

1), IV Therapy (n = 1), and Transition Services (n = 1).

^aOther genders included Non-Binary (n = 1) and Two-Spirit (n = 1).

Additional Qualitative Data from Frailty Screening Methods

The full list of identified frailty screening tools and non-frailty screening tools identified by the nursing sample are shown in Table I4. There was additional interpretive information provided by some respondents that included information about their frailty screening use. This included: the timing of the frailty screening being at admission or triage (n = 5), pre-admission (n = 1), or when required for home care qualification (n = 1). Negative outcomes (n = 2) were expressed from it “often being missed” or from screening being limited to “sadly only Braden scale and it’s your move screening”. Another comment implied that the registered nurses’ role in their care setting did not extend to frailty screening (n = 1) while occupational therapists (n = 1)

and transition coordinator (n = 1) were additional team members specifically mentioned involved with frailty assessment tools. Existing processes were noted (n = 4) for its use in identifying frailty by “it’s in our charting system” and through “frailty modifiers” including ones that are imbedded into the specific triage program CTAS.

Table I4*Other Frailty Screening Tools Qualitative Codes*

Codes	n	(%)
Frailty Screening Tool	6	(5.8)
Unit Specific Frailty Screening	4	(3.9)
RAI ^a	2	(1.9)
Non-Frailty Tool: Single Domain	59	(57.3)
Physical Performance	33	(32.0)
Morse Fall Scale	2	(1.9)
Schmid Fall Risk	11	(10.7)
Fall Risk Screen - NS	16	(15.5)
It's Your Move	3	(2.9)
KYMITT	1	(1.0)
Nutritional Status	8	(7.8)
Malnutrition Screen - NS	7	(6.8)
Swallow Assessment - NS	1	(1.0)
Mental Health	7	(6.8)
CAM	5	(4.9)
Delirium Risk Screen - NS	2	(1.9)
Cognition	11	(10.7)
MOCA	4	(3.9)
RASS	2	(1.9)
GCS	2	(1.9)
Mental Status Exam - NS	2	(1.9)
SLUMS	1	(1.0)
Non-Frailty Tool: Multiple Domains	26	(25.2)
Braden Scale	16	(15.5)
CTAS	2	(1.9)
ADL - NS	3	(2.9)
LACE	1	(1.0)
BRASS	1	(1.0)
IADL - NS	1	(1.0)

FESE	1	(1.0)
Past Medical History - NS	1	(1.0)
No New Tool	12	(11.7)
Tool Not Recalled	6	(5.8)
Repeat Survey Tool	3	(2.9)
No Screening Tool	3	(2.9)
Total	103	(100.0)

Note. These items were generated through interpretation of a free-text response using a qualitative content analysis approach (Sandelowski, 2000). Abbreviations: Not Specific (NS), Keep Your Move In The Tube (KYMITT), Confusion Assessment Method (CAM), Montreal Cognitive Assessment (MOCA), Richmond Agitation-Sedation Scale (RASS), Glasgow Coma Scale (GCS), Saint Louis University Mental Status Examination (SLUMS), Canadian Triage and Acuity Scale (CTAS), Activities of Daily Living Assessment – not specific, length of stay / acuity of admission/ Charlson Comorbidity Index/ emergency department visits in the past 6 months (LACE), Blaylock Risk Assessment Screening Score (BRASS), Incidental Activities of Daily Living Assessment – not specific, Falls/ Entanglement/ Strangulation/ Entrapment (FESE), and RAI.

^aThe acronym RAI was not expanded by survey respondents.

Additional Quantitative Data from Theoretical Domains Framework (TDF) Questions

The entirety of the TDF 43 question results are presented in Table I5. At the domain level of behaviours that influence frailty screening there were: eight mixed, five facilitator, and one barrier. The simple linear regressions at the domain level showed that there were significant differences in the beliefs of critical care nurses for using frailty screening tools compared to other nurses (Table I6). These differences were significant ($p < .05$) for the domains of: goals, optimism, knowledge, environmental context and resources, emotions, reinforcement, beliefs about capabilities, social/professional role and identity, and behavioural regulation. These

differences were looked at more closely by the descriptive statistics presented in Table I7. There were several questions that different practice areas reflected dissimilarities in their mean scores. These differences led to some having a mean value on the opposite side of the 3.50 cut-off (compared to the other groups) to determine whether the item is a barrier or facilitator. The most drastic example was in the domain of goals for the question ‘There often is something else more important than conducting frailty screening’. The critical care nurses “strongly agreed” ($M = 2.50$, $SD = 1.03$), med/surg nurses “agreed” ($M = 2.73$, $SD = 1.12$), and other acute care nurses “disagreed” ($M = 3.75$, $SD = 1.29$). There were seven different questions where the practice areas demonstrated differences in their beliefs of using frailty screening tools, although the standard deviation did overlap the 3.50 cut-off.

Table I5*Frailty Screening Tool Theoretical Domains Framework Survey Items*

Domain and Questions	n	$M(SD)$	Range	Facilitator, Barrier, or Mixed
1. Knowledge	199-200	3.47(1.15)	1-6	M
I know the content and objectives of frailty screening.	200	3.59(1.20)	1-6	F
I am familiar with the content and objectives of frailty screening.	199	3.41(1.23)	1-6	B
I am aware of how to conduct frailty screening.	199	3.41(1.24)	1-6	B
2. Skills	199-200	3.35(1.07)	1-6	M
I have been trained how to conduct frailty screening.	200	2.74(1.27)	1-6	B
I have the skills to conduct frailty screening.	200	4.12(1.15)	1-6	F
I have conducted frailty screening.	199	3.19(1.41)	1-6	B
3. Social/Professional Role and Identity	188-189	3.75(1.13)	1-6	F
Conducting frailty screening in my primary area of practice is part of my work as a nurse.	189	3.65(1.30)	1-6	F
As a nurse, it is my job to conduct frailty screening in my primary area of practice.	189	3.77(1.27)	1-6	F

Domain and Questions	n	<i>M</i> (<i>SD</i>)	Range	Facilitator, Barrier, or Mixed
It is my responsibility as a nurse to conduct frailty screening in my primary area of practice.	188	3.79(1.25)	1-6	F
Doing frailty screening in my primary area of practice is consistent with my nursing profession.	188	3.80(1.24)	1-6	F
4. Beliefs about Capabilities	188-189	3.85(0.95)	1-6	F
I am confident that I can conduct frailty screening, even when the patient is not motivated.	189	3.83(1.03)	1-6	F
I am confident that I can conduct frailty screening, even when there is little time.	189	3.51(1.23)	1-6	F
I am confident that if I was motivated and wanted to, I could conduct frailty screening.	188	4.20(1.07)	1-6	F
5. Optimism	178-179	3.52(0.85)	1-6	M
When conducting frailty screening in uncertain times, I usually expect the best.	179	3.47(0.91)	1-6	B
When conducting frailty screening, I'm always optimistic about the future.	178	3.57(0.93)	1-6	F
6. Beliefs about Consequences	184	4.39(0.71) *	1-6	F
If I conduct frailty screening with older adults it will benefit public health.	184	4.30(1.02)	1-6	F
If I conduct frailty screening with older adults it will have disadvantages for my relationship with these patients. ^a	184	4.48(0.88) *	1-6	F
7. Reinforcement	166-168	3.95(0.70)	1-6	M
When I conduct frailty screening, I receive positive recognition from my patients and their families.	166	3.48(0.99)	1-6	B
When I conduct frailty screening, I receive positive recognition from health care professionals that are important to me.	167	3.63(1.12)	1-6	F
When I conduct frailty screening, I feel like I am making a difference.	168	3.89(1.12)	1-6	F
When I conduct frailty screening, I get criticized by health care professionals that are important to me. ^a	167	4.44(0.96)	1-6	F
When I conduct frailty screening, it is discouraged by my patients and their families. ^a	168	4.29(0.88)	1-6	F
8. Intentions	171	3.73(1.05)	1-6	F

Domain and Questions	n	<i>M</i> (<i>SD</i>)	Range	Facilitator, Barrier, or Mixed
I will definitely conduct frailty screening with older adults in my next shift.	171	3.67(1.09)	1-6	F
I intend to conduct frailty screening with older adults in my next shift.	171	3.80(1.04)	1-6	F
9. Goals	164-166	3.29(0.80)	1-6	M
There often is something else more important than conducting frailty screening. ^a	166	2.75(1.15)	1-6	B
I am motivated to conduct frailty screening.	166	3.85(1.03)	1-6	F
I have a clear plan on how I will conduct frailty screening.	164	3.26(1.14)	1-6	B
10. Memory, Attention, and Decision Processes	160	3.92(0.82)	1-6	F
When I need to concentrate to conduct frailty screening, I have no trouble focusing my attention.	160	3.86(1.07)	1-6	F
When trying to focus my attention on conducting frailty screening, I have difficulty blocking out distracting thoughts. ^a	160	4.17(0.98)	1-6	F
When concentrating on conducting frailty screening, I can focus my attention regardless of what's going on around me.	160	3.74(1.03)	1-6	F
11. Environmental Context and Resources	165	2.82(1.05)	1-6	B
In general, I have enough time to conduct frailty screening.	165	2.85(1.17)	1-6	B
The physical work environment on my unit is adequate to conduct frailty screening.	165	2.98(1.15)	1-6	B
I have the necessary resources (including physical resources, technologies, and staff) to conduct frailty screening.	165	2.78(1.24)	1-6	B
On the unit that I work on, conducting frailty screening is routine.	165	2.68(1.42)	1-6	B
12. Social Influence	161-163	3.56(0.90)	1-6	M
Most people who are important to me think that I should conduct frailty screening.	161	3.20(1.05)	1-6	B
Most people whose opinion I value would approve of my conducting frailty screening.	163	3.91(0.99)	1-6	F
13. Emotions	158-160	3.91(0.66)	1-6	M
I feel anxious when I start to think about conducting frailty screening. ^a	160	4.35(1.08)	1-6	F
I feel frustrated when I cannot conduct frailty screening.	160	3.08(1.09)	1-6	B
Conducting frailty screening for my patients is stressful to me. ^a	159	4.38(1.06)	1-6	F

Domain and Questions	n	<i>M</i> (<i>SD</i>)	Range	Facilitator, Barrier, or Mixed
I feel accomplished when I conduct frailty screening.	158	3.84(1.02)	1-6	F
14. Behavioural Regulation	156-161	3.54(0.96)	1-6	M
I see positive patient outcomes when I screen for frailty.	156	3.91(0.90)	1-6	F
Screening for frailty is part of my work.	161	3.53(1.24)	1-6	F
I have a clear plan on how I will conduct frailty screening.	159	3.23(1.23)	1-6	B

Note. Means generated from a 6-point Likert-type scale and identified as either a facilitator (F)

by being greater than 3.50 or barrier (B) by being less than 3.50. The domain means were calculated from the aggregate of each item weighted and categorized by either F, B, or mixed (M) based on the type of items.

^aReverse coded questions –these individual means are reverse-coded to match other questions to match meaningfulness as a facilitator or barrier.

**SD* that do not intersect the reference point (3.50).

Table I6*Simple Linear Regression Analysis of Primary Practice Area by Theoretical Domains**Framework Domain Means*

Domain	n	B	SE	β	t	Sig.	95% CI	
							Lower bound	Upper bound
1. Knowledge	197	0.51	0.16	0.22	3.09	.002**	0.18	0.83
2. Skills	197	0.30	0.16	0.14	1.91	.057	-0.01	0.60
3. Social/Professional Role and Identity	186	0.34	0.17	0.15	2.03	.044*	0.01	0.67
4. Beliefs about Capabilities	186	0.30	0.14	0.15	2.12	.035*	0.02	0.58
5. Optimism	177	0.40	0.13	0.23	3.13	.002**	0.15	0.66
6. Beliefs about Consequences	182	0.17	0.11	0.12	1.63	.105	-0.04	0.38
7. Reinforcement	166	0.25	0.11	0.18	2.32	.022*	0.04	0.47
8. Intentions	169	0.28	0.16	0.13	1.72	.087	-0.04	0.60
9. Goals	164	0.41	0.12	0.25	3.32	.001**	0.17	0.66
10. Memory, Attention, and Decision Processes	158	0.06	0.13	0.03	0.41	.681	-0.21	0.32
11. Environmental Context and Resources	163	0.42	0.16	0.20	2.53	.012**	0.09	0.74
12. Social Influence	161	0.25	0.14	0.14	1.75	.082	-0.03	0.54
13. Emotions	158	0.27	0.11	0.20	2.51	.013**	0.06	0.48
14. Behavioural Regulation	159	0.31	0.16	0.16	1.98	.050*	0.00	0.61

Note. Parametric statistics completed for comparing Critical Care (reference group) to Medical

and/or Surgical and Other Acute Care nursing primary areas of practice. Fourteen different

simple linear regressions were run with assumptions tested and accepted for normal distribution.

* $p < .05$; 95% CI

** $p < .05$; 95% CI; five most different TDF Domains for further analysis

Table I7*Comparing at the Item Level the Five Most Different TDF Domains According to Primary Area of Practice*

Domains	Question	<u>Critical Care</u>		<u>Med/Surg</u>		<u>Other Acute Care</u>	
		n	M(SD)	n	M(SD)	n	M(SD)
1. Goals	There often is something else more important than conducting frailty screening ^a	66	2.50(1.03)*	82	2.73(1.12)	16	3.75(1.29)* ^b
	I am motivated to conduct frailty screening	66	3.56(0.88)	82	4.09(1.12)	16	3.88(0.89)
	I have a clear plan on how I will conduct frailty screening	65	3.05(0.94)	82	3.46(1.27)	15	3.00(1.13)
2. Optimism	When conducting frailty screening in uncertain times, I usually expect the best	71	3.27(0.83)	88	3.64(0.90) ^b	18	3.44(1.20)
	When conducting frailty screening, I'm always optimistic about the future	71	3.30(0.84)	87	3.86(0.89) ^b	18	3.33(1.09)
3. Knowledge	I know the content and objectives of frailty screening	80	3.30(1.21) ^b	98	3.81(1.15)	19	3.68(1.29)
	I am familiar with the content and objectives of frailty screening	79	3.05(1.18)	98	3.68(1.23) ^b	19	3.37(1.17)
	I am aware of how to conduct frailty screening	79	3.13(1.18)	98	3.66(1.26) ^b	19	3.26(1.28)
4. Environmental Context and Resources	In general, I have enough time to conduct frailty screening	64	2.66(1.17)	82	2.95(1.20)	17	3.06(1.25)
	The physical work environment on my unit is adequate to conduct frailty screening	64	2.80(1.10)	82	3.07(1.17)	17	3.12(1.22)
	I have the necessary resources (including physical resources, technologies, and staff) to conduct frailty screening	64	2.52(1.17)	82	2.96(1.30)	17	2.82(1.07)
	On the unit that I work on, conducting frailty screening is routine	64	2.27(1.23)	82	3.00(1.53)	17	2.47(0.94)
5. Emotions	I feel anxious when I start to think about conducting frailty screening ^a	62	4.31(1.00)	80	4.39(1.16)	16	4.25(0.93)
	I feel frustrated when I cannot conduct frailty screening	62	2.76(0.90)	80	3.30(1.12)	16	3.38(1.31)
	Conducting frailty screening for my patients is stressful to me ^a	61	4.36(1.03)	80	4.39(1.10)	16	4.38(1.03)

I feel accomplished when I conduct frailty screening	60	3.63(0.86)	80	4.11(0.98)	16	3.44(1.21) ^b
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Note. The domains are ranked in order of greatest statistical difference found between comparing the critical care group to the other group in a simple linear regression analysis (Table I6).

^aReverse coded questions –these individual means are reverse-coded to match other questions to match meaningfulness as a facilitator or barrier and grouped within the domain means.

^b A group that has a mean value on the opposite side of the 3.50 cut-off to determine whether the item is a barrier or facilitator.

**SD* that do not intersect the reference point (3.50).

Supplemental Discussion Considerations

Demographic Characteristics: Between Group Differences

The differences observed between the primary area of practice in the categorical variables of age and most common shift can be theoretically explained. The Other Acute Care category included the sub-groups of Psychiatry (n = 15), Wounds, Ostomy, and Continence (n = 2), Operating Room and Post-Anesthetic Care Unit (n = 1), and other self-reported areas (n = 5) (see Table 1). These areas of specialties can primarily be associated with day-shift employment, which may skew this group to have more day shift employment compared to more traditional shift-working positions in med/surg and critical care. Critical Care nursing specialties generally require a greater depth of knowledge and often require years of nursing experience before hiring a new staff member (Varner, 2021). Fewer LPNs are hired in critical care area (due to scope differences) and will be theoretically younger as a group due to requiring two-year diploma rather than a four-year bachelors an RN requires. The other acute care sub-groups are all specialized areas of nursing that also may require more years of experience and training compared to med/surg. These relationships may explain the observed difference in age between primary care areas.

These characteristics could influence how different implementation programs are implemented. For example, with primarily day-shift employees they may take standardize time lunch breaks, which could be great opportunities for “lunch and learn” style educational sessions. Comparing this with the med/surg and critical care that is 8-12 hours around the clock employment, where most of the nurses in the sample worked a mix of days and evenings/nights there is often the need to stagger breaks with coworkers and different priorities that impede on taking a lunch break “on time”. Nurses in shift work miss meal breaks 10-11% of the time and

only 43% took uninterrupted breaks away from patient-care responsibilities in 12-hour shifts, often described from the desire to fulfill patient-care responsibilities assigned to them (Nejati et al., 2016). Therefore, these types of learning strategies may work well for the other acute care group, but different needs may exist to provide the educational material to shift workers.

Differences in Primary Practice Settings: Frailty Screening Use and Beliefs

It is interesting that in the literature search (see Chapter one) critical care nurses were the most common individuals conducting frailty screening, but in Alberta's nursing population at the time of this study it was the med/surg group. Why this disparity currently exists is predicted to be from the newness of frailty screening to Alberta. I hypothesize that in the med/surg population there are local leaders within units/sites (such as clinical nurse specialists in geriatrics) that support early application of frailty screening tools. For critical care nurses, if there isn't direct application for the tool it will likely not be utilized (triaging of time is an essential skill in this critical care area, but especially in the ED). This lack of use in triaging was previously demonstrated in the ED by Kirk et al. (2016). As there is currently no system-wide process that exists to allocate resources or change care outcomes based upon frailty screening results, it is not prioritized and therefore it is not done. Implementation of a provincial-wide program (if not, then by the primary employer of the nurses Alberta Health Service) would address this difference (see more in the primary discussion, Chapter 5).

The strongest difference in priorities across primary practice areas was demonstrated strongly in the domain of Goals question 'There often is something else more important than conducting frailty screening'. This question shows that to successfully implement a frailty screening tool into practice, for the critical care nurses and med/surg nurses, it is a barrier that

may need to be addressed to have successful implementation (see Chapter 5 for suggested implementation strategies based on an evidence-based implementation tool).

One published example of how the ED health care team operates differently in several hospitals in Alberta are their structured debriefs after resuscitation events led by RNs (Rose & Cheng, 2018). This was found to improve team preparedness for resuscitation events, increase communication, and improve cardiopulmonary resuscitation delivery (Rose & Cheng, 2018). In other EDs in Alberta, NPs provide collaborative service and can provide more supports and explanations than traditional physician-only delivery of care leading to higher patient and staff satisfaction ratings (Shand et al., 2020). These are examples of RNs and NPs contributing to a collaborative type of practice in critical care nursing that may not exist in other areas of practice. This demonstrates how different care areas are experiencing unique educational and work settings that influence barriers/facilitators to using frailty screening tools.

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Appendix J

Table J1

Top-Five Facilitators to Frailty Screening Linked to Intervention and Policy Categories

Top-Five Facilitators (Domain)	Practice Area	COM-B Category	Intervention Functions	Policy Categories
1. If I conduct frailty screening with older adults it will have disadvantages for my relationship with these patients (Beliefs about Consequences)	All	Motivation - Reflective	Education, Persuasion, and Modelling	Communication/Marketing, Guidelines, Regulation, Legislation, and Service Provision
2. When I conduct frailty screening, I get criticized by health care professionals that are important to me (Reinforcement)	All	Motivation - Automatic	Training, Incentivization, Coercion, and Environmental Restructuring	Guidelines, Fiscal Measures, Regulation, Legislation, Service Provision, Communication/Marketing, and Environmental/Social Planning
3. Conducting frailty screening for my patients is stressful to me (Emotions)	Critical care and other acute care	Motivation - Automatic	Persuasion, Incentivization, Coercion, Modelling, and Enablement	Communication/Marketing, Guidelines, Regulation, Legislation, Service Provision, Fiscal Measures, and Environmental/Social Planning
4. I feel anxious when I start to think about conducting frailty screening (Emotions)	Critical care	Motivation - Automatic	Persuasion, Incentivization, Coercion, Modelling, and Enablement	Communication/Marketing, Guidelines, Regulation, Legislation, Service Provision, Fiscal Measures, and Environmental/Social Planning
5. If I conduct frailty screening with older adults it will benefit public health (Beliefs about Consequences)	Critical care and other acute care	Motivation - Reflective	Education, Persuasion, and Modelling	Communication/Marketing, Guidelines, Regulation, Legislation, and Service Provision

Note. The three practice areas include: Critical care, medical and/or surgical, and other acute care. The domains for each of the top-five facilitators identified from this study are from the Theoretical Domains Framework (Cane et al., 2012; S. Michie et al., 2005). The capability opportunity motivation - behaviour (COM-B) model category, intervention functions, and policy categories are guided by the original publication (Michie et al., 2011) and book supplement (Michie et al., 2014).

Appendix K

Table K1

Top-Five Barriers to Frailty Screening Linked to Intervention and Policy Categories

Top-Five Barriers (Domain)	Practice Area	COM-B Category	Intervention Functions	Policy Categories
1. On the unit that I work on, conducting frailty screening is routine (Environmental Context and Resources)	All	Opportunity - Physical	Training, Restriction, Environmental Restructuring, and Enablement	Guidelines, Fiscal Measures, Regulation, Legislation, Service Provision, and Environmental/social planning
2. I have been trained how to conduct frailty screening (Skills)	All	Capability - Physical	Training	Guidelines, Fiscal Measures, Regulation, Legislation, and Service Provision
3. There often is something else more important than conducting frailty screening (Goals)	Critical Care and Med/Surg	Motivation - Reflective	Education, Persuasion, Incentivization, Coercion, Modelling, and Enablement	Communication/marketing, Guidelines, Regulation, Legislation, Service Provision, Fiscal Measures, and Environmental/Social Planning.
4. I have the necessary resources (including physical resources, technologies, and staff) to conduct frailty screening (Environmental Context and Resources)	All	Opportunity - Physical	Training, Restriction, Environmental Restructuring, and Enablement	Guidelines, Fiscal Measures, Regulation, Legislation, Service Provision, and Environmental/social planning
5. In general, I have enough time to conduct frailty screening (Environmental Context and Resources)	Critical Care and Med/Surg	Opportunity - Physical	Training, Restriction, Environmental Restructuring, and Enablement	Guidelines, Fiscal Measures, Regulation, Legislation, Service Provision, and Environmental/social planning

Note. The three practice areas include: Critical Care, Medical and/or Surgical (Med/Surg), and Other Acute Care. The domains for each of the top-five barriers identified from this study are from the Theoretical Domains Framework (Cane et al., 2012; S. Michie et al., 2005). The capability opportunity motivation - behaviour (COM-B) model category, intervention functions, and policy categories are guided by the original publication (Michie et al., 2011) and book supplement (Michie et al., 2014).

Appendix L

Table L1

Top-Five Barriers to Frailty Screening Linked to Behaviour Change Techniques

Top-Five Barriers (Domain)	Practice Area	Recommended Behaviour Change Technique
1. On the unit that I work on, conducting frailty screening is routine (Environmental Context and Resources)	All	Restructuring the physical environment, discriminative (learned) cue, prompts/cues, restructuring the social environment, and avoidance/changing exposure to cues for the behaviour
2. I have been trained how to conduct frailty screening (Skills)	All	Graded tasks, behavioural rehearsal/practice, habit reversal, body changes, and habit formation
3. There often is something else more important than conducting frailty screening (Goals)	Critical Care and Med/Surg	Goal setting (outcome), goal setting (behaviour), review of outcome goals(s), review behaviour goals, and action planning (including implementation intentions)
4. I have the necessary resources (including physical resources, technologies, and staff) to conduct frailty screening (Environmental Context and Resources)	All	Restructuring the physical environment, discriminative (learned) cue, prompts/cues, restructuring the social environment, and avoidance/changing exposure to cues for the behaviour
5. In general, I have enough time to conduct frailty screening (Environmental Context and Resources)	Critical Care and Med/Surg	Restructuring the physical environment, discriminative (learned) cue, prompts/cues, restructuring the social environment, and avoidance/changing exposure to cues for the behaviour

Note. The three practice areas include: Critical Care, Medical and/or Surgical (Med/Surg), and

Other Acute Care. The domains for each of the top-five barriers identified from this study are from the Theoretical Domains Framework (Cane et al., 2012; S. Michie et al., 2005). The capability opportunity motivation - behaviour (COM-B) model category, intervention functions, and policy categories are guided by the original publication (Michie et al., 2011) and book supplement (Michie et al., 2014).