Healthcare Provider-to-Patient Physical Activity Discussions among Patients with Atrial Fibrillation

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Preface

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Table of Contents

Acknowledgements ... *ii*
Preface ... *iii*
Table of Contents ... *iv*
List of Figures ... *vi*
List of Tables ... *vii*
List of Abbreviations ... *viii*
Thesis Abstract ... *ix*
Chapter 1: Background and Review of the Literature ... *1*
1.1 Introduction to Atrial Fibrillation ... 1
1.2 Physical Activity, Exercise and Atrial Fibrillation ... 3
1.3 Exercise Prescriptions and Atrial Fibrillation Exercise Targets ... 8
1.4 Atrial Fibrillation and Cardiovascular Rehabilitation ... 9
1.5 Physical Activity Discussion and Counselling ... 10
1.6 Sex and Gender Differences in Atrial Fibrillation, Physical Activity and Exercise ... 12
1.7 The Rationale and Statement of Problem ... 14
1.8 Research Objectives ... 16
Chapter 2 ... *18*
Study 1: Healthcare Provider and Patient Physical Activity and Exercise Discussion ... *18*
2.1 Introduction ... 20
2.2 Methods ... 23
2.3 Results ... 28
2.4 Discussion ... 38
Chapter 3 ... *45*
Study 2: The Integration of Exercise Physiology in the Management of Atrial Fibrillation by Canadian Healthcare Providers ... *45*
3.1 Introduction ... 47
3.2 Methods ... 50
3.3 Results ... 53
3.4 Discussion ... 60
Chapter 4: Conclusion ... *66*
References ... *72*
Appendix 1: Patient Questionnaire ... *84*
Appendix 2: Resistance and Flexibility Self-Report Participation from Chapter 2: Study 1 ... *94*

Appendix 3: Additional information on the other Healthcare Providers from Chapter 2: Study 1.....*95*

Appendix 4: FITT Components Reported by Patients in Chapter 2: Study 1.....*96*

Appendix 5: Healthcare Provider Survey.....*98*

Appendix 6: Nurse Practitioner and Occupational Therapist Answers from Chapter 3: Study 2.....*104*

Appendix 7: Exercise Prescription Training Methods Reported in Chapter 3: Study 2.....*105*

Appendix 8: REB Approval Letter……...106

List of Figures

1.1 Sex differences in patients with atrial fibrillation …… 13

2.1 Timeline for involvement of participants in the study ……. 24

2.2 Recruitment flow for patient appointments ……..... 29

3.1 Involvement of Canadian healthcare provider organizations in recruitment ……..……..…… 54

3.2 Self-reported exercise prescription frequency for patients with atrial fibrillation by healthcare providers …..……... 56

3.3 Identification of the 2020 Canadian Cardiovascular Society atrial fibrillation exercise targets by healthcare providers ……... 59

3.4 Healthcare provider self-report training in exercise prescription …… 60

List of Tables

1.1 Physical activity levels of patients with atrial fibrillation …….. 6

2.1 Patient demographics ……... 30

2.2 Accelerometer measured patient physical activity levels ……..…….. 31

2.3 Patient-reported and EPIC-recorded physical activity discussion occurrences ……... 32

2.4 University of Ottawa Heart Institute physician and family physician physical activity discussion occurrences ……. 32

2.5 EPIC-recorded physical activity and exercise discussion …… 33

2.6 Meeting the 2020 Canadian Cardiovascular Society atrial fibrillation exercise targets and physical activity and exercise discussion occurrences ……. 34

2.7 FITT principle components provided by University of Ottawa Heart Institute physicians and family physicians ……... 36

2.8 Sex-differences in physical activity and exercise discussion and prescription occurrence ……..... 37

3.1 Healthcare provider demographics …….. 55

3.2 Differences in exercise prescription frequency, confidence, training, and identification between healthcare provider groups ……. 58

List of Abbreviations

AF: atrial fibrillation

AFEQT: Atrial Fibrillation Effect on QualiTy of Life survey

BMI: body mass index

BP: blood pressure

CAD: coronary artery disease

CACPR: Canadian Association of Cardiovascular Prevention and Rehabilitation

CAHEA: American Medical Association's Committee on Allied Health Education and Accreditation

CCFP: certificate of added competence in sport and exercise medicine

CCS: Canadian Cardiovascular Society

CIHR: Canadian Institutes of Health Research

CR: cardiovascular rehabilitation

CSEP: Canadian Society for Exercise Physiology

EIM: Exercise is Medicine

FITT: frequency, intensity, time, and type

HCP: healthcare provider

HR: heart rate

LHIN: Local Health Integration Network

MET: metabolic equivalent

MVPA: moderate-to-vigorous physical activity

PA: physical activity

QoL: quality of life

UOHI: University of Ottawa Heart Institute

2020 CCS AF Guidelines: The 2020 Canadian Cardiovascular Society/Canadian Heart Rhythm Society Comprehensive Guidelines for the Management of Atrial Fibrillation

Thesis Abstract

Atrial fibrillation (AF), the most common cardiac arrhythmia, is associated with a poor cardiovascular disease risk profile, dramatically reduced quality of life (QoL), and a high risk of mortality. In 2020, the Canadian Cardiovascular Society (CCS) released the first exercise targets (≥200 minutes/week of moderate intensity physical activity (PA), 2-3 days/week of resistance training, and if >65 years of age, 10 minutes/day of flexibility exercise 2 days/week) for patients with AF and included exercise physiology in an integrated care model for those living with AF. Inclusion of exercise targets and exercise physiology in the guidelines may influence the PA recommendations provided by healthcare providers (HCP) and patient PA levels for people with AF. The overall purpose of this thesis was to explore the implementation of the exercise recommendations within the 2020 CCS AF guidelines. Study 1 was an observational study aimed at determining if HCPs of patients with AF are discussing PA and exercise with their patients using a self-report questionnaire and physician reports from patient medical charts. The secondary purposes were to explore potential differences in PA and exercise discussion occurrence and prescription, and whether this information is different based on patients' PA levels and sex. Of the 195 patients, 49% reported not discussing PA or exercise with their University of Ottawa Heart Institute (UOHI) physician. Of the patients who reported a PA and exercise discussion with a UOHI physician, 23% did not have a record of the discussion in their medical charts. Significantly more patients discussed PA and exercise with both their UOHI and family physicians than either of these providers alone (χ^2=21.64, p<0.001). The occurrence of a PA and exercise discussion was not associated with patients' measured PA levels. Females were provided frequency prescription (i.e., how often to exercise) more than males (χ^2=3.97, p=0.046), but no other sex differences were identified. Study 2 was a pan-Canadian observational study which used a HCP self-report survey to determine: (i) if HCPs prescribe PA and exercise for patients with AF; (ii) if HCPs believed exercise physiology should be included in AF management; (iii) which HCPs have the highest confidence in

prescribing exercise; (iv) which HCPs have exercise prescription training; and (v) if HCPs know the 2020 CCS AF exercise targets. Of the 96 responses, 87% of HCPs reported prescribing PA to their patients with AF at least some of the time. All HCPs believed exercise physiology should be included in AF management. Physicians (60%), kinesiologists (50%), and exercise physiologists (40%) reported always prescribing exercise to patients with AF, which was significantly more than registered nurses (0%; χ^2=37.37, $p<0.05$). More physicians (80%) reported being fairly confident in prescribing exercise to patients with AF than physiotherapists (7%) and registered nurses (6%; χ^2=43.14, all $p<0.05$). More exercise physiologists (95%), kinesiologists (90%), and physiotherapists (78.6%) reported being trained in exercise prescription than registered nurses (11.8%; χ^2=23.57, all $p<0.05$). Only 22.9% of HCPs knew the AF targets were from the CCS, and only 14.6% of HCPs correctly identified all three exercise targets from CCS. **Conclusion:** This thesis suggests that most HCPs are discussing or prescribing exercise to patients with AF, and that exercise physiologists, kinesiologists, and physicians were the healthcare providers most likely to prescribe exercise to their patients. Future research should focus on progressing toward an AF specific PA counseling method and disseminating the CCS AF guidelines to HCPs of patients with AF, based on the lack of identification of the 2020 CCS AF exercise targets and confidence in prescribing to patients who have AF.

Chapter 1: Background and Review of Literature

1.1 Introduction to Atrial Fibrillation

The global prevalence of atrial fibrillation (AF) is 1-2% of the general population.[1] AF afflicts approximately 447,100 adults in Canada.[2] AF is the most common cardiac arrhythmia (i.e., a rapid irregular heart rhythm) caused by electrical signal disturbances within the atria of the heart. The bundle of specialized cells that initiate the unified contraction of the heart is the sinoatrial (SA) node, also known as the heart's pacemaker. In healthy populations, the SA node is adapted to meet the body's metabolic needs and generates electrical impulses at a rate of approximately 100 beats per minute at rest.[3] In patients with AF, the cells of the atria may fire at a rate of 400-600 times per minute if left untreated.[4] During AF, the signals are fast and irregular causing the heart to contract in a non-unified manner at approximately 150 beats per minute at rest.[5]

The 2020 Canadian Cardiovascular Society (CCS)/Canadian Heart Rhythm Society Comprehensive Guidelines for the Management of Atrial Fibrillation (AF) recognizes four types of AF: (i) *paroxysmal* – continuous episodes of AF lasting 30 seconds to seven days; (ii) *persistent* – continuous AF that lasts seven or more days, but less than one year; (iii) *longstanding persistent* – continuous AF lasting one year or more and in whom rhythm control management is being pursued; and (iv) *permanent* – continuous AF for which the therapeutic decision has been made not to pursue sinus rhythm restoration.[6] In many patients, AF progresses from short self-terminating episodes to longstanding persistent AF.[6]

Symptoms of AF can include palpitations, dyspnea, dizziness, diaphoresis, nausea, fatigue, chest pain, weakness, anxiety, and depression.[6,7] The severity and frequency of these symptoms vary depending on the presence of modifiable cardiovascular disease risk factors (e.g., physical inactivity, hypertension, diabetes, dyslipidemia, obesity, smoking) associated with the development and progression of AF.[1,6,8] These risk factors are established contributors to the development and

progression of AF[1,8] because they promote structural remodelling of the heart.[8] For example, hypertension reduces atrial conduction velocity which facilitates re-entry of electrical signals.[9] Obesity may cause structural remodeling of the heart due to saturated free fatty acids reducing outward potassium currents; this is important for cardiac repolarization of atrial ion channels and, therefore, atrial electrical activity.[10]

AF is further associated with reduced functional capacity and performance, diminished quality of life (QoL), and increased risk of morbidity and mortality.[6] The treatment of AF depends on patients' risks, needs, and symptoms.[5] The current 2020 CCS Comprehensive Guidelines for the Management of AF focuses on three areas: (i) assessment of risk factors; (ii) management of arrhythmia by controlling patients' heart rate (typically controlled with medication), and rhythm control (usually achieved with medication, electrical cardioversion, or catheter ablation[6,5]); and (iii) assessment of thromboembolic risk.[6] The major goals of AF management are improvement in functional capacity and QoL; reduction of symptoms, and cardiovascular disease risk factors; and prevention of further complications, such as stroke or thromboembolism.[6] AF symptom management can be achieved with a combination of medication and lifestyle interventions.[6]

Lifestyle interventions (e.g., physical activity [PA] and exercise training, smoking cessation, healthy food choices, weight management, stress reduction, and low alcohol consumption) have been shown to improve AF symptom frequency and severity, as well as reduce the risk of AF progression.[9,11,12,13] Aerobic exercise training may simultaneously improve several cardiovascular disease risk factors including resting blood pressure (BP) and heart rate (HR), body mass index (BMI), body composition, and severity of anxiety and depressive symptoms in patients with AF.[14] Aerobic exercise training has also been shown to reduce AF occurrence. In support, 24 of 60 patients were AF free 12 months after a 6-month individualized aerobic exercise training program with thrice weekly sessions (4 sets of 4 minutes at 85-90% of heart rate reserve), and patients with AF experienced a reduction in symptom severity.[15]

1.2 Physical Activity, Exercise and Atrial Fibrillation

The World Health Organization defines PA as any bodily movement produced by skeletal muscles that requires more energy expenditure than at rest (including during leisure time, for transport or as part of employment).[16] Exercise is a sub-type of PA that is planned, structured, and repetitive, such as sport and exercise classes, with the goal of improving physical fitness.[17] Throughout this thesis PA and exercise terms are used according to the referenced definitions.

1.2.1 Benefits of Physical Activity and Exercise for Atrial Fibrillation

PA and exercise appear to reduce the risk of AF development for persons without AF. Growing evidence suggests that improvements in cardiorespiratory fitness (improved through regular moderate-to-vigorous intensity PA [MVPA] and exercise) are inversely associated with the risk of incident AF, such that greater PA participation is associated with lower AF incidence, especially among patients who are obese.[18] In adults 65 or more years of age with atherosclerosis, low levels of MVPA (<150 minutes/week) have been shown to lower the hazard ratio of AF by 23% (HR=0.77, 95% CI 0.61, 0.96), and adequate MVPA levels (150-299 minutes/week) lowered the risk of AF by 14% (HR=0.86, 95% CI 0.69, 1.06).[19] Higher levels of MVPA (>300 minutes/week) in these older adults was not associated with AF risk (HR=0.97, 95% CI 0.78, 1.20),[19] thus suggesting that PA and exercise can prevent the development of AF.

Several studies have shown that PA and exercise are beneficial for managing time spent in AF. Malmo et al. (2016) showed that time in AF decreased (from 8.1% to 4.8%) in 38% of patients with non-permanent AF following a 12-week aerobic interval training program with thrice weekly sessions (4-minute intervals at 85-95% HR peak interspersed with 3 minutes of active recovery at 60-70% of HR peak).[20] Findings from the LEGACY study, including patients with non-permeant AF, demonstrated decreased time in AF (10% or more in weight loss resulted in a 6-fold greater probability of being AF free), as well as improved rhythm maintenance and obesity after sustained long-term

weight loss (through a combination of exercise [i.e., 60 minutes of low-intensity PA per week and increasing to 200 minutes of moderate-intensity PA per week,] and nutrition [i.e., high protein and low glycemic index, calorie controlled foods and if <3% weight loss after three months then very-low calorie meal replacement sachets were given for 1-2 meals/day]).[21] This implies that regular PA and exercise for 12 weeks may influence time spent in AF.

PA and exercise have been shown to improve clinical symptoms and outcomes in patients with AF. A systematic review of five trials including 379 patients with AF showed that higher levels of PA were associated with increased exercise capacity, left ventricular ejection fraction, QoL, and reduced BMI.[22] Both the HUNT and EORP-AF studies found that patients with AF engaging in regular and intense PA had lower rates of all-cause and cardiovascular-specific mortality than patients with AF not engaging in regular and intense PA, and that any level of PA intensity was significantly associated with lower risk of death.[23,24] Emerging literature also indicates that improvements in rate control (i.e., lower resting HR), fitness (i.e., increased 6-minute walk test distance, muscular strength, power, and work), ability to carry out activities of daily living, and QoL were achieved following regular moderate-to-vigorous intensity exercise for 8-16 weeks in patients with AF.[14] Increasing PA by 24 steps per day has been associated with a 1-point decrease in symptom severity (as measured by the Atrial Fibrillation Effect on QualiTy of Life [AFEQT] survey).[25] Notably, improvements in cardiorespiratory fitness, resulting from increases in PA and exercise levels, have been shown to lower AF risk; a 1 metabolic equivalent (MET) increase in $\dot{V}O_2$ peak has been associated with a 7% lower risk of developing AF,[18] and for each 1-MET increase in cardiorespiratory fitness, there is a lower risk of all-cause mortality (HR=0.88, 95% CI 0.81-0.95), and cardiovascular mortality (HR=0.85, 95% CI 0.76-0.95) and morbidity (HR=0.88, 95% CI 0.82-0.95).[23] These results show that exercise for patients with AF can be beneficial to decrease AF incidence, time in AF, and the symptoms experienced by those with AF.

1.2.2 Physical Activity Levels of Patients with Atrial Fibrillation

The benefits of PA in preventing and managing cardiovascular disease are well established. The measurement of PA is not only required to characterize current PA levels, but also for determining the efficacy and effectiveness of interventions designed to increase PA levels.[26] PA levels can be assessed using self-report (e.g., questionnaires, logs, interviews) and device-measured (e.g., accelerometers, pedometers) tools.[26] Both of these approaches have been used in previous studies to measure the PA levels of patients with AF.

Prior studies examining the self-reported PA levels of adults with AF (see Table 1.1) show that most adults are not sufficiently physically active (i.e., not meeting PA guidelines of 150 minutes/week of MVPA when using self-report measurement), and this may, in part, be due to a lack of PA and exercise education. In a sample of 619 patients with AF living in Ontario, Canada, approximately half did not know the Canadian PA recommendations, and 59% were not spoken to about engaging in PA by a healthcare provider (HCP).[27]

Studies measuring the PA levels (i.e., meeting or not meeting PA guidelines) of patients with AF with devices show inconsistencies when compared to self-reported tools. For example, Reed et al. (2021) reported that 73% of patients with non-permanent AF were meeting and exceeding the recommended 150 minutes of weekly MVPA, respectively,[28,29] while studies using self-reported PA instruments showed approximately 30-60% of patients meet these recommendations. This discrepancy may be due to: (i) self-perception of PA (i.e., fitter individuals may over report PA more so than less fit individuals[30]); (ii) social desirability bias which has been shown to cause over-reporting of PA levels[31] (i.e., increased activity due to wearing a device); or (iii) social approval bias causing self-report PA levels to be over-estimated.[31]

Table 1.1: Physical activity levels of patients with atrial fibrillation

Author	Year	Study Tile	Country	Sample Size	AF Types	PA Summary
Self-Report						
Way et al.	2022	The Physical Activity Levels and Sitting Time of Adults Living with Atrial Fibrillation: The CHAMPLAIN-AF Study	Canada	619	All	• 46% meeting the 150 min/week PA guidelines
Garnvik et al.	2020	Physical activity, cardiorespiratory fitness, and cardiovascular outcomes in individuals with atrial fibrillation: the HUNT study	Norway	1117	All but mostly paroxysmal	• 27.4% inactive • 40% not meeting the 150 min/week PA guidelines • 32.6% meeting the 150 min/week PA guidelines
Proietti et al.	2016	Self-reported physical activity and major adverse events in patients with atrial fibrillation: a report from the EURObservational Research Programme Pilot Survey on Atrial Fibrillation (EORP-AF) General Registry	Europe	2403	All	• 39% not engaging in PA • 34.7% complete occasional PA • 21.7% regular PA • 4.7% intense PA
Ball et al.	2013	Women Versus Men with Chronic Atrial Fibrillation: Insights from the Standard Versus Atrial Fibrillation spEcific managemenT studY (SAFETY)	Australia	335	All	• 37% females meeting the 150 min/week PA guidelines • 56% male meeting the 150 min/week PA guidelines
Device-measured						
Borland et al.	2020	Exercise-based cardiac rehabilitation improves physical fitness in patients with permanent atrial fibrillation – a randomized controlled study	Sweden	96	Permanent	• 164-180 MVPA minutes/week

Semaan et al.	2020	Physical activity and atrial fibrillation: Data from wearable fitness trackers	USA	3333	All	• Significantly fewer steps (723 steps/day) than those without AF
Reed et al.	2021	An evaluation of device-measured physical activity levels of patients with nonpermanent atrial fibrillation	Canada	30	Non-permanent	• 340 ± 323 MVPA minutes/week • 73.3% meeting the 150 min/week PA guidelines • 63.3% meeting the 200 min/week PA guidelines
Reed et al.	2022	Effect of High-Intensity Interval Training in Patients with Atrial Fibrillation	Canada	86	Persistent and permanent	• 23.3% meeting the 200 min/week PA guidelines

AF: atrial fibrillation; min: minutes; MVPA: moderate-to-vigorous intensity physical activity; PA: physical activity.

1.2.3 Resistance and Flexibility Training

Currently, there is no evidence to suggest that patients with AF should not participate in resistance (i.e., muscle strengthening exercise),[32] and flexibility training. Further, no evidence suggests that the resistance and flexibility recommendations for non-AF adults (2-3 days a week of resistance training, and 2-3 days per week of flexibility training, with daily being most effective)[33] should differ for patients with AF. Resistance training has been shown to improve muscle strength in adults and physical functioning in older adults, and lower all-cause mortality by 21%.[34] Flexibility training has been shown to improve range of motion and aid in injury prevention in adults.[35] The use of flexibility training to improve physical function and supplement other forms of exercise in older adults needs further investigation due to inconclusive findings.[36] Nevertheless, no resistance, and flexibility studies have been conducted in patients with AF, so it remains unknown if there is a more effective or better suited recommendation.

1.3 Exercise Prescriptions and AF Exercise Targets

Exercise prescriptions are cost-effective as they can increase PA and exercise by 10% in relatively inactive patients, a number which recent Canadian evaluations have estimated could save approximately 2.1 billion dollars (CAD) annually in healthcare costs if adopted at the population level.[37] FITT principles (frequency, intensity, time, and type of exercise) are used by HCPs to create exercise prescriptions/recommendations, and each principle can be used to individualize the prescription needs.[33] The inclusion of exercise targets (≥200 moderate intensity minutes/week of aerobic activity, 2-3 days of resistance training, and 2 days/week of at least 10 minutes of flexibility training for those 65+ years of age), and exercise physiology as part of the CCS AF management guidelines are important steps to improve patient care with a multidisciplinary approach. However, these targets are based on limited evidence, and few studies in patients with AF have included resistance and flexibility training.[38]

Reed et al. (2022) and Reed et al. (2021) compared the PA levels of patients with AF to the 2020 CCS AF guidelines, and found that 20 of 86 (23.3%) patients with AF in Ontario, Canada, met the 200 minutes per week of moderate intensity PA following the completion of a 12 week exercise program with twice weekly sessions,[39] and 19 of 30 (63.3%) patients with AF in Nova Scotia, Canada, met the 200 minutes per week of moderate intensity PA.[29] There are challenges in assessing PA in this population (e.g., many PA surveys are based on the general public, meaning they are not validated in the AF population), and this could lead to an underestimation of associations with clinical outcomes (e.g., the association could be stronger than shown due to measurement errors).[40] Patients with AF meeting the World Health Organization and American College of Sports Medicine PA guidelines of 150 minutes/week of MVPA have similar mortality risk to inactive participants without AF; this is important since patients with AF have a higher risk of all-cause mortality than the general population.[40] Findings from the HUNT study show that more patients with paroxysmal AF, when compared to persistent or permanent AF, met the PA guidelines (150 minutes/week of MVPA), suggesting that AF

type could be an important consideration when exploring the relationship between PA and AF.[40] This could suggest that patients with persistent or permanent AF are at higher risk of all-cause mortality.

1.4 Atrial Fibrillation and Cardiovascular Rehabilitation

Referral to cardiovascular rehabilitation (CR; a secondary prevention program offered to patients with cardiovascular disease that includes exercise training, cardiovascular disease education and behavioural counselling) is not included in the CCS AF Guidelines despite its use for managing the poor physical and mental health associated with other cardiovascular conditions (e.g., coronary artery disease, heart failure, peripheral arterial disease).[38] One systematic review (n=9 exercise-based CR studies including 959 patients with AF) highlighted that CR programs for patients with AF have been shown to improve exercise capacity, QoL, cardiac function, and symptom burden (i.e., time spent in AF).[41] Similarly, in patients with AF, exercise capacity (measured as $\dot{V}O_2$peak [mean difference, MD 3.76 ml/kg/min, 95% CI 1.37-6.15] in two studies of moderate quality evidence, and six-minute walk test distance [MD 75.76 m, 95% CI 14.00 to 137.53] in four studies of low-quality evidence) increased after an eight week to 6-month exercise-based CR program when compared to no exercise.[42] Findings from Reed et al., however, showed that a standard 3-month CR program may not improve QoL in patients with persistent and permanent AF to the same extent as patients with cardiovascular disease without AF.[43,44] The lack of referral to CR programs may create barriers for patients with AF to receive specific PA and exercise prescription, to allow for modification of their PA behaviours that would improve and or manage AF symptoms, as well as their physical and mental health.

1.5 Physical Activity Discussion and Counselling

Only one study to date has explored HCP PA discussion among patients with AF. Way et al. (2022) conducted an observational cohort study of patients with AF within the Champlain Local Health Integration Network (LHIN) of Ontario seeking care at the University of Ottawa Heart Institute (UOHI) and found that most (81%) patients with AF thought that PA can be used to manage cardiovascular disease risk factors, yet 59% of these patients had not previously spoken to a HCP (medical doctors, nurses, etc.) about engaging in PA to manage their AF.[27] Way et al. also found a significant positive correlation between total MVPA minutes and patients who had: (i) spoken to a HCP about PA to manage their AF; and (ii) were aware of the 2020 Canadian Society for Exercise Physiology (CSEP) PA guidelines (150 minutes of MVPA per week), indicated that patients who received PA counselling from HCPs were more active, and aware of PA guidelines.[27] Most of these patients with AF (72%) thought PA should be part of their AF management, and 62% reported having poor or very poor confidence in performing PA. The findings of Way et al. also revealed that patients with AF thought that they should engage in PA, but were not confident in their ability to do so, and those who had discussed PA with a HCP were more likely to participate in PA. Patients in this study often felt uninformed, and unsupported regarding their AF care/management,[45] likely due not receiving information they perceive as important for their health. Way et al. emphasized the need for exercise professionals (e.g., kinesiologists, and exercise physiologists) to be incorporated into AF management to educate and support patients in incorporating MVPA in their lifestyle.[27]

HCPs may not prescribe exercise to patients, despite its inclusion in the CCS AF guidelines, for a variety of reasons and unfortunately all studies examining HCP PA discussion and counselling (to our knowledge) have focused on physicians only. The primary reported barrier for physicians in providing PA and exercise prescriptions is a lack of education.[46] As many as 94% of Canadian medical students perceive competence to prescribe PA to patients as important, but only 16% feel capable of doing so upon graduation due to limited focus on the topic within their current curriculum.[47] Among family

physicians in Nova Scotia, those who reported previous training in PA (e.g., medical rounds, webinars, conference presentations, symposiums, workshops, personal experience, academic courses, or university degree) were 22% more confident in PA counselling than physicians untrained in PA ($p=0.03$).[48] Both trained and untrained physicians had similarly low rates of exercise prescriptions (12%, $p>0.05$).[48] The importance of PA and exercise for patients with AF is being recognized by authoritative cardiovascular organizations, as evidenced by its inclusion in the CCS AF Guidelines, but little is known regarding how and if these targets are being communicated to patients.

PA counselling (i.e., structured appointment specifically for PA counsel [often using behaviour change techniques] to educate the patient on PA and generate a PA plan/prescription) is an efficient and effective strategy for increasing PA.[49] A review by Tulloch, Fortier, and Hogg investigated which primary care HCPs have been involved in PA counselling interventions, and their relative effectiveness for increasing PA levels.[50] Of the 19 identified studies, 37% of counselling interventions were conducted by physicians, 37% were conducted by allied HCPs (e.g., exercise physiologists, exercise specialists, exercise consultants, exercise development officers, health educators), and 26% were combined interventions (i.e., conducted by an allied HCP and physician counselling).[50] All counselling interventions provided some improvements in PA behaviour, but allied HCPs as adjuncts or alone provided the strongest results long-term (67% and 71% of studies, respectively, showing a positive change in PA levels after 6+ months).[50] There was a shift over time towards more counselling interventions being led by allied HCPs which may indicate a response to overcome the current limitations of physician only counselling interventions, such as lack of physician time and PA training.[50]

Over 80% of Canadians visit and prefer to receive health information directly from their family physician.[51] Of 28,340 Canadian physicians surveyed nationwide in 2007, 26.2% assessed patients' fitness through a physical exam or fitness test; 10.9% referred to other exercise professionals (types not specified) for a fitness assessment and exercise prescription; 69.8% provided verbal counseling on PA;

and 15.9% provided written prescriptions for exercise programs.[52] One qualitative focus group study of home-dwelling older adults (health conditions not reported) in the United States showed that when physicians discussed PA with their patients, they either: (i) did not provide enough information; (ii) provided mixed information; (iii) provided vague information; or (iv) did not initiate the conversation.[53] This study also reported that physicians only discussed PA as secondary care, not primary care.[53] Physicians believe PA counselling is important and that they have a role in PA promotion among their patients, yet it has been shown that approximately half of physicians in countries such as the United States do not discuss PA with their patients.[54,55] Studies assessing the patient perspective are lacking (i.e., studies directly asking the patient if PA was discussed with their HCP), and this is important because knowing what information (if any) patients received and understand during PA discussions informs HCPs and organizations on how to improve their care.

1.6 Sex and Gender Differences in Atrial Fibrillation, Physical Activity and Exercise

1.6.1 Sex Differences in Atrial Fibrillation, Physical Activity and Exercise

The Canadian Institutes of Health Research (CIHR) defines sex as a set of biological attributes (i.e., physical, and physiological features including chromosomes, gene expression, hormone concentrations/function, and reproductive anatomy) in humans and animals.[56] Sex is usually categorized as male, female, or intersex.[56] The terms “male” and “female” will be used to indicate the sex of individuals throughout this thesis. There are several well documented sex differences in patients with AF, and these are summarized in Figure 1.1.

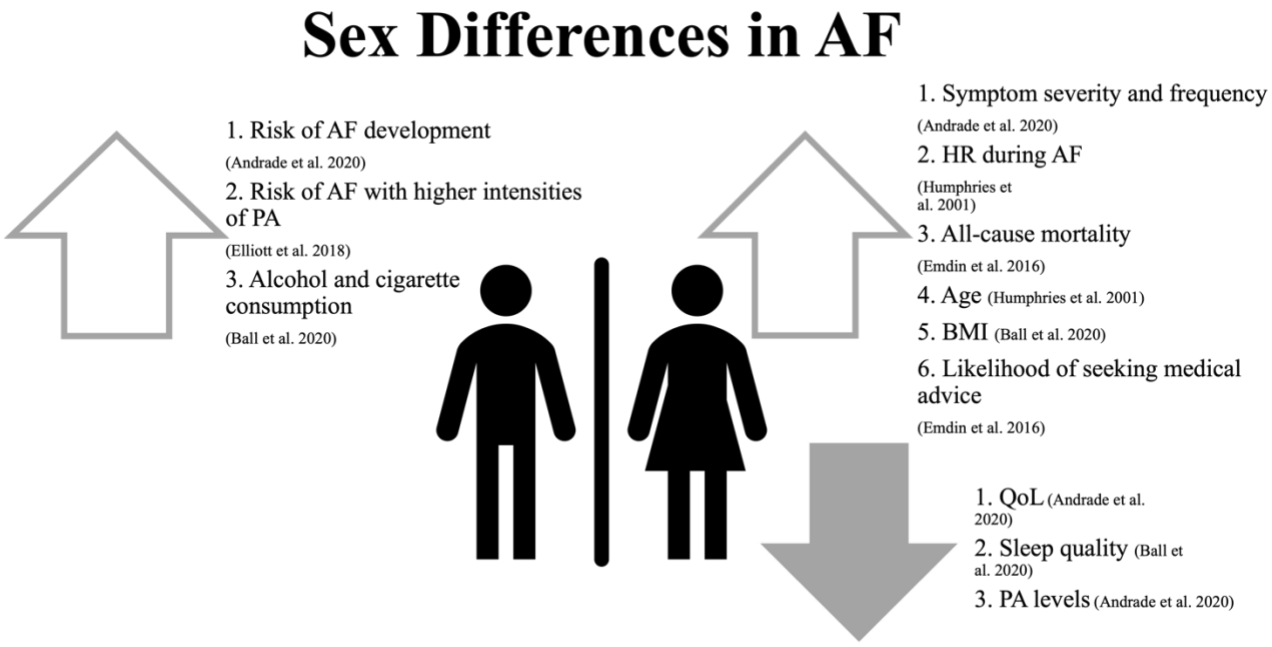

Figure 1.1: Sex differences in patients with atrial fibrillation (AF). BMI: body mass index; HR: heart rate; PA: physical activity; QoL: quality of life.

In the SAFETY trial including patients with all AF types, 36.7% of the 161 females, and 55.9% of the 174 males reported engaging in at least 150 minutes per week of moderate-intensity PA. In females with non-permanent AF who completed a 12-week CR program had significantly higher QoL and greater 6-minute walk test distance when compared with patients with AF who had not undergone CR; yet, this improvement was not observed in the male participants.[57] In females, significant differences were found between those who completed a CR program, and those who received usual care, in the Atrial Fibrillation Effect on QualiTy of Life (AFEQT) global and treatment concern scores; these differences were not observed in males.[57] Further, in the SAFETY trial, approximately 50% of females selected home-based CR (compared to 30% of males), and females had a 40% adherence rate to CR when compared to 47% of males.[57] These studies highlight the importance of examining sex-differences within PA and exercise habits, outcomes (e.g., 6-minute walk test distance), and program selection and adherence.

1.6.2 Gender Differences in Atrial Fibrillation

The CIHR defines gender as the socially constructed roles, behaviours, expressions, and identities of girls, women, boys, men, and diverse people.[56] This social construct is constantly changing as it describes the *experience* of "femaleness" and "maleness" in society.[58] Gender is comprised of four interrelated aspects: gender roles, gender identity, gender relations, and institutionalized gender.[58] Some examples of gender-related variables include household primary earner; employment status; number of hours worked per week; number of hours per week doing housework; education; and job value and quality.[59] Research regarding the role of gender in the development and management of cardiovascular disease is in its infancy, but it is known that gender-related characteristics may more thoroughly explain health status outcomes (e.g., QoL, hypertension, and angina), than sex characteristics alone.[60] Females with AF are more likely to live alone, have less education, and work in lower-skilled occupations.[61] These factors are gender-related as they impact one's interaction with society.

1.7 The Rationale and Statement of Problem

Since exercise targets have recently been provided within the CCS AF guidelines, and exercise physiology has been included as part of the multidisciplinary AF management approach, it is essential to assess if patients with AF are now being provided this information. The specific prescription provided to patients is important because it could impact motivation, confidence, participation levels, and feelings of safety. In support, in the CHAMPLAIN-AF study which included 619 patients with AF, 55% reported confidence in completing MVPA, 46% of participants engaged in at least 150 minutes of MVPA per week, and 38% reported PA would be unsafe if their heart rate is too fast.[27] Further, identifying factors that impact PA discussion (e.g., patient sex, patient PA levels, HCP knowledge, HCP training, and HCP confidence) will identify HCP differences and allow for informed improvements to be made to ensure the highest standard of care for AF management.

After determining the frequency and details (i.e., PA prescription, specific PA recommendation and referral) of PA discussions with patients, knowing which HCPs are confident recommending patients with AF on specific PA and exercise information is imperative so that HCPs of patients with AF can receive more targeted training in PA to improve patient care. If physicians are not adequately discussing PA and exercise, the healthcare system needs to better equip professionals with this information as resources for patients, which is why various HCP types that support the management of AF will be included in this thesis.

1.8 Research Objectives

Study 1 Primary Question:

1. Do HCPs (UOHI and family physicians) discuss PA and exercise with their patients who have AF?

Study 1 Secondary Questions:

1. Are there differences in discussion occurrence and prescription (i.e., FITT principles) provided between patients meeting and not meeting the CCS AF guidelines exercise targets (≥200 minutes/week of moderate PA, 2-3 days/week of resistance training and, if >65 years of age, 10 minutes/day of flexibility exercise 2 days/week)?
2. When PA and exercise are discussed, what specific prescription on PA and exercise (i.e., FITT principles or exercise targets) is provided to patients with AF by their HCPs?
3. Are there differences in HCP PA and exercise discussion and prescription (i.e., discussion occurrence and FITT principle components) among patients with AF based on patients' sex (i.e., male vs. female)?
4. Are patients with AF being referred to a cardiac rehabilitation program, a community-based exercise program (e.g., HeartWise Exercise), or an exercise specialist (e.g., kinesiologist) by their HCPs and are there differences between sexes?

Study 2 Primary Question:

1. Do HCPs (i.e., physician assistants, physiotherapists, occupational therapists, registered nurses, nurse practitioners, exercise physiologists, and kinesiologists) prescribe exercise to their patients with AF?

Study 2 Secondary Questions:

1. What is the frequency of exercise prescription to patients with AF based on HCP type?
2. Do HCPs believe exercise physiology should be included in AF management?
3. Which HCPs have the highest level of confidence in prescribing exercise to patients with AF?

4. Do HCPs have training in exercise prescription, and are there differences in training across HCP types?
5. Which HCPs can correctly identify the 2020 CCS AF exercise targets?

Chapter 2: Study 1

Healthcare Provider and Patient Physical Activity and Exercise Discussion

Abstract

Background: Physical activity (PA) has been shown to improve AF symptoms and reduce time in AF. The 2020 Canadian Cardiovascular Society (CCS)/Canadian Heart Rhythm Society Comprehensive Guidelines for the Management of Atrial Fibrillation (AF) are the first to include exercise targets (≥200 minutes/week of moderate PA, 2-3 days/week of resistance training, and if >65 years of age, 10 minutes/day of flexibility exercise 2 days/week) for patients with AF. The primary purpose of this study was to assess if HCPs of patients with AF are discussing PA and exercise with their patients, as recommended in the 2020 CCS AF guidelines. The secondary purposes were to explore potential differences in PA and exercise discussion occurrence and prescription, and whether this information is different based on patients' PA levels and sex. **Methods:** This observational study included patients with AF attending an AF management appointment at the University of Ottawa Heart Institute (UOHI). Within seven days of their appointment, patients were asked to complete a questionnaire on PA and exercise discussions they may have had (i.e., did it occur and what information [frequency, intensity, time, and type; FITT] was provided). Subsequently, patients' medical chart notes were reviewed for any record of PA or exercise discussions they may have had. After the visit, patients were also asked to wear an accelerometer for 7 days to measure PA levels. **Results:** A total of 195 patients with AF (64.6% males, 35.4% females) participated in the study and 48.5% reported not discussing PA or exercise with their UOHI physician. Of the patients who reported a PA discussion with a UOHI physician, 23.2% did not have a record of the discussion in their medical charts. Significantly more patients discussed PA with both their UOHI and family physicians than either of these providers alone (χ^2=21.64, p<0.001). The occurrence of a PA and exercise discussion was not associated with patients' measured PA levels. Females were provided frequency prescription (i.e., how often to exercise) more

than males (χ^2=3.97, p=0.046). Thirty-nine participants wore the accelerometer and completed 488.3 ± 314.1 minutes per week of MVPA. Males spent a higher percentage of time in light (p=0.049) and moderate (p=0.027) intensity PA per week, and achieved more steps per day (p=0.037) and week (p=0.037) compared to females. **Conclusion:** Approximately half of patients with AF self-reported discussing PA or exercise with their UOHI physician, and among them, female patients were more likely than male patients to be advised on a frequency to participate in exercise.

2.1 Introduction

Atrial fibrillation (AF) is a growing epidemic that afflicts approximately 447,100 Canadians,[2] and approximately 46.3 million adults worldwide.[62] AF is characterized by a rapid and irregular heartbeat.[6] The severity and frequency of symptoms (e.g., poor exercise tolerance, fatigue, palpitations)[5] vary depending on the presence of non-modifiable (e.g., age, ethnicity, and family history) and modifiable cardiovascular disease risk factors (e.g., physical inactivity, hypertension, obesity, smoking, diabetes, and dyslipidemia) associated with the development and progression of AF.[6,5,1,8] The prevalence of AF is expected to continue rising globally due to the increased prevalence of cardiovascular disease risk factors (e.g., increase in hypertension, obesity, and smoking rates) and an aging population.[63]

Regular physical activity (PA) has been shown to be inversely associated with AF incidence.[19] Participation in an exercise-based intervention over six months has been shown to reduce AF reoccurrence, and improve symptom severity among patients with AF.[15] PA has also been shown to improve health outcomes such as functional capacity, quality of life (QoL), and rate control in patients with AF who completed MVPA at least 3 days a week for 8-16 weeks.[14] Yet, the scarce PA and exercise data suggest that most patients with AF are not regularly physically active.[25] In support, patients with AF often self-report little or no PA.[23,24,61] Garvik et al. (2020; in Trøndelag, Norway) showed approximately 33% and Way et al. (2022; in Ottawa, Ontario, Canada) showed approximately 46% of patients with AF met the general PA guidelines (150 minutes of MVPA per week).[27,64] In studies using device-measured PA tools, Semaan et al. (2020; in San Francisco, California, USA) reported that patients with AF take on average 723 fewer steps per day than patients without AF.[25] Borland et al. (2020; south western Sweden) reported that patients with AF accumulate approximately 164-180 minutes of MVPA per week.[28] This implies that although PA is beneficial for reducing AF incidence, burden, and health outcomes, patients with AF may not be achieving sufficient PA levels.

The 2020 Canadian Cardiovascular Society/Canadian Heart Rhythm Society Comprehensive Guidelines for the Management of Atrial Fibrillation (2020 CCS AF Guidelines)[6] are the first in the world to provide specific exercise targets for patients with AF. These exercise targets include: (i) ≥30 or more daily minutes of moderate-intensity aerobic exercise, 3-5 days per week, with a target of ≥200 minutes weekly; (ii) resistance exercise 2-3 days per week; and (iii) flexibility exercises at least 10 minutes per day, two days per week, for people 65 years of age and older.[6] A recent study including patients in the greater Ottawa area in Canada showed that only 20 of 86 (23%) patients with AF met the 2020 CCS exercise guidelines during the last week of a 12-week exercise-based cardiovascular rehabilitation (CR) programs.[39]

The 2020 CCS AF guidelines do not advocate for specific referral to CR programming, healthcare providers (HCPs), or community-based exercise programming (such as HeartWise Exercise: a program for patients with heart diseases that has shown to be safe for persons with multiple chronic health conditions),[65] despite including the domain of exercise physiology in the multidisciplinary care team for AF management. Few studies have investigated patient-reported PA discussion or counselling that HCPs provide to patients or have assessed the details provided during discussions in any patient populations. In Quebec, Canada it was reported that 21.6% of patients with no specified health conditions received PA counselling from at least one primary HCP.[66] In Ontario, Canada, a survey of 619 patients with all AF types determined that 59% of patients reported not being spoken to about engaging in PA by a HCP.[27] No studies have investigated HCP discussion or counselling on resistance and flexibility training, but PA counselling from allied HCPs (e.g., kinesiologists, and exercise physiologists) alone or adjunct to other providers (e.g., physicians and nurse practitioners) have been shown to provide greater increases in PA levels than PA counselling from physicians only.[50] Therefore, it is possible that patients with AF are not receiving valuable PA information if they are not referred or spoke to about PA by their HCPs.

Exercise prescriptions (i.e., specific guidance/advise on PA) are a cost-effective method to increase PA in physically inactive individuals.[37] The FITT principle is typically how HCPs prescribe exercise in a specific and individualized manner. The FITT principle is comprised of four components; an exercise frequency [number of sessions per week]; intensity [exertion during exercise]; time [duration of session]; and type [mode of exercise].[33] Exercise prescriptions should be prescribed to patients by trained HCPs, such as physicians, kinesiologists, exercise physiologists, and physiotherapists. Most commonly, exercise prescriptions and interventions are expected to be written and provided by physicians, due to their status as trusted healthcare information providers and their ability to reach many patients.[50] However, interventions including other HCPs (e.g., kinesiologists, exercise physiologists) in PA counselling and exercise prescription are becoming more frequent and requested in healthcare.[50]

Sex (i.e., determined by biological characteristics[58]) and gender (i.e., socially constructed roles, identities, and behaviours[58]) differences in PA discussion, counselling, and prescription have not been explored in patients with AF. It has been shown that female patients with heart disease do not receive the same care as males (e.g., less likely to be referred for appropriate treatment and receive information on recommended therapies after hospitalizations).[67] Similarly, in adults with diabetes, females are less likely to receive treatment for risk factor control than males, particularly when treated by male HCPs.[68] Female HCPs were more likely to prescribe more intense/aggressive treatment for hyperlipidemia and hypertension than male HCPs.[68] With limited data available, it is difficult to confirm if this is consistent among patients with AF, but differences in care between male and female patients might exist in AF as previously shown in other heart diseases.

The primary purpose of this study was to determine if HCPs are discussing PA and exercise with their patients who have AF. It was hypothesized that at least 60% of HCPs will not have a discussion regarding PA and exercise with their patients with AF. Secondarily, it was explored if: (i) there were differences in discussion occurrence and prescription (i.e., FITT principle) provided

between patients meeting and not meeting the CCS AF guideline exercise targets (≥200 minutes/week of moderate-intensity PA, 2-3 days/week of resistance training and, if >65 years of age, 10 minutes/day of flexibility exercise 2 days/week); (ii) when discussed, what specific PA prescription (i.e., FITT principles, or exercise targets) was provided to patients with AF by their HCPs; (iii) there were differences in HCP PA and exercise discussion (i.e., discussion frequency and FITT principle) across patients with AF based on patients' sex (i.e., male vs. female); and (iv) patients with AF were referred to a cardiac rehabilitation program, a community-based exercise program (e.g., HeartWise Exercise), or an exercise specialist (e.g., kinesiologist) by their HCPs and were there differences between sexes.

2.2 Methods

2.2.1 Design and Setting

This single centre, observational study was conducted at the University of Ottawa Heart Institute (UOHI), a tertiary cardiovascular health centre in Ottawa, Canada. The UOHI primarily provides cardiovascular care to patients within the Champlain Local Health Integration Network in Ontario, Canada and patients within Gatineau, Quebec, Canada. The approval for this study was obtained from the Ottawa Health Science Network Research Ethics Board (OHSN-REB#: 20220251-01H) and University of Ottawa Office of Research Ethics and Integrity (H-12-22-8731).

2.2.2 Participants and Recruitment Process

Patients with all types of AF (i.e., paroxysmal, persistent, long-standing persistent, and permanent) were contacted for participation after completing a medical appointment with a physician at the UOHI. To identify these patients, daily EPIC (an online patient chart system) reports were created to identify all patients with AF who completed a medical appointment the previous day. Potentially eligible patients were contacted via telephone to assess their eligibility and interest in participating in this study. After verbal consent was obtained, the patient was enrolled in the study and sent the study

materials (questionnaire and ActiGraph accelerometer). Figure 2.1 shows the patient's timeline through the study.

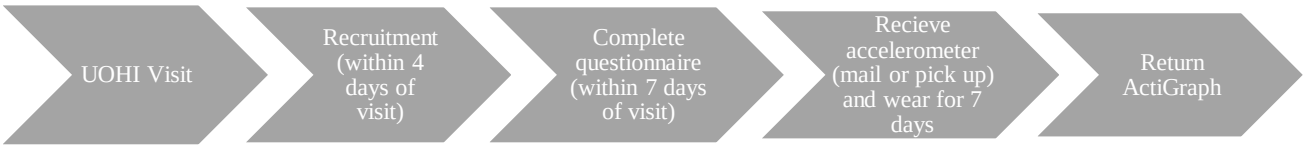

Figure 2.1: Timeline for involvement of participants in the study. UOHI: University of Ottawa Heart Institute.

2.2.3 Eligibility Criteria

Eligible participants were: (i) at least 18 years of age and diagnosed with any type of AF; (ii) able to read and write in English or French; (iii) those who had an eligible appointment (first AF diagnosis, AF consult, ablation or cardioversion consult, AF management visit, and any appointment where AF was the primary reason of visit) within the previous week; (iv) those who previously provided consent to be contacted for research purposes at the UOHI; (v) able to provide verbal consent; and (vi) without cognitive impairments that may affect their ability to recall information. Patients were excluded if: (i) they were not contacted within 4 days of their appointment (to limit recall bias); and (ii) their medical appointment included an ablation or cardioversion procedure (as unlikely PA would have been discussed due to planned treatment, and to reduce patient participation burden).

2.2.5 Questionnaire

Patients were asked to complete an online questionnaire (paper-copy available upon request) using REDCap (version 8.5.6 ©Vanderbilt University). REDCap is a secure web-based platform designed to support data-capture for research studies.[69,70] Patients were emailed the REDCap link and asked to complete it within 7 days of their appointment to minimize recall bias.[71] The questionnaire included three parts: (i) Personal Information; (ii) Physical Activity and Exercise; and (iii) Gender

Assessment. The full questionnaire is in **Appendix 1**. The questionnaire consisted of 45 questions and took approximately 20 minutes to complete. The questionnaire was pilot tested by study staff before being circulated to patients. For comparative purposes, the questionnaire asked the same questions on PA discussion and prescription from their UOHI physician, family physician, and any other HCP who may have discussed PA with them. The PA discussion and prescription questions regarding the UOHI physician were referencing their most recent visit that was within the past 7 days. There was no time frame set for questions related to family physicians or other HCPs as there was no way to verify that information, as can be done on EPIC with UOHI physicians. Participants also self-reported if they participated in resistance and flexibility training, as well as the frequency and duration of their participation.

2.2.6 Physician Appointment Notes

The physician appointment notes from the patients' visit in question were extracted from EPIC charts. Physicians providing care to patients were unaware of this study and data extraction was kept confidential among the investigative group. Notes were accessed to investigate any record of PA or exercise discussion (e.g., walking, swimming, resistance training, weight training, and fitness) by the UOHI physician.

Any record of PA and exercise discussion was then categorized based on the topics present in the notes (i.e., assessing PA levels, risk-factor modification, exercise tolerance/intolerance, weight loss, and encouragement), and reported as frequencies and proportions.

2.2.7 Accelerometer

Patients were asked to wear an ActiGraph GT3X accelerometer (ActiGraph, Pensacola, Florida) for 7 days on their right hip as soon as a device was available and received by the patient. Patients scheduled a contactless pick-up/drop-off time to receive/return their accelerometer (adhering to the

COVID restrictions and guidelines at the time) or provided an address to which the accelerometer could be dropped-off or mailed. The device is a small triaxial accelerometer, frequently used in research, and has been shown to be valid and reliable in measuring PA in adults (no significant differences between contralateral hips, $p>0.213$; decreased measurement error by 25-52% when PA was accumulated over seven days).[72] It measures activity counts, intensity levels, and energy expenditure.[73] Previously validated vector magnitude cut-points in older adults with cardiovascular disease were applied to define light (150-1799 counts/min), moderate (1800-3799 counts/min) and vigorous (≥3800 counts/min) PA.[74,75] Participants were asked to fill in a "wear-time" log on paper indicating when they put the device on and took it off for the seven days. The first day of wear time was removed and an average of the remaining days were taken for analysis of light, moderate, vigorous, and MVPA.

2.2.8 Outcomes

Primary outcome

The primary outcome was occurrence of PA discussion between patients with AF and their HCPs. Discussion occurrence was assessed in two ways: patient-reported based on the study questionnaire and obtained from the UOHI physician notes from the patients' EPIC chart.

Secondary outcomes

The secondary outcomes included PA prescription (i.e., FITT principle), PA levels, resistance training participation, flexibility training participation, and gender-related variables. Patients self-reported each FITT principle component provided by the UOHI physician, family physician or other HCP in the study questionnaire. PA levels were measured using the ActiGraph accelerometer. Resistance and flexibility participation was self-reported in the study questionnaire, and gender-related variables were measures with parts of the GENESIS-PRAXY questionnaire.

Additional outcomes

Other outcomes included demographics (e.g., sex, age), anthropometrics (e.g., body mass, height), medical information (e.g., AF type, other cardiovascular conditions, and cardiovascular disease risk factors) which were collected on the study questionnaire. Body-mass index (BMI: kg/m^2) was calculated using the self-reported body mass and height from the questionnaire. Partial postal codes from patient charts in EPIC were used to determine if patients resided in a rural or urban area (rural was defined by a community with a population <30,000 and greater than a 30 minute drive to a community with a population >30,000). Patient AF type was also extracted from patient charts.

2.2.9 Sample Size

Using PASS (Version 15.0.13 NCSS, LLC, Kaysville, Utah), a sample size of n=175 was calculated to test the primary research question, with a confidence interval of 95%, confidence interval width of 0.15, and a past reported sample proportion of 60% of patients not having discussed PA with a HCP.[27] A 10% dropout rate was included (i.e., 20 dropouts) for a final target sample size of N=195.

2.2.9 Statistical Analysis

All analyses were performed using IBM SPSS for Windows (Version 28 IBM Corp, Armonk, NY, USA). For the primary outcome, the number of participants who did or did not discuss PA and exercise with their HCP was determined from the number of 'yes'/ 'no' self-reported responses (i.e., 'Did your physician discuss physical activity or exercise with you during your most recent visit at the Ottawa Heart Institute?') and was presented as frequencies and proportions. Chi-square analyses were used to compare the number of patient-reported discussions with UOHI physicians, family physicians, and both UOHI and family physicians. EPIC chart physician notes regarding PA and exercise were calculated as frequencies and proportions of PA and exercise mentions.

For the secondary outcomes, frequencies and proportions were used to: (i) tabulate the number of patients meeting the 2020 CCS AF exercise targets who discussed PA or exercise (each of the 2020 CCS AF exercise targets [i.e., aerobic, resistance, and flexibility] were examined separately. The PA levels measured by the accelerometer were used to determine if patients were meeting the 2020 CCS AF aerobic target of ≥200 minutes of moderate-intensity PA per week. Meeting the 2020 CCS AF resistance and flexibility targets were determined by the self-reported number of days and session duration, respectively, on the questionnaire); (ii) describe the occurrence each FITT principle component of the exercise prescription provided to patients (i.e., # of 'yes'/ 'no' for each FITT principle component); (iii) describe the frequency of each FITT principle component and referrals (to CR programs, or exercise specialist).

Chi-square analyses were used to compare: (i) differences in discussion occurrence and prescription between patients meeting and not meeting the CCS AF exercise targets; (ii) the number of male and female participants who discussed PA or exercise with their HCP and/or were provided specific prescription or referral regarding the FITT principles.

2.3 Results

Recruitment occurred between June 22, 2022, and November 21, 2022, and Figure 2.2 displays the flow of patients through the study. The study included 195 participants of which 183 agreed to EPIC chart review, 127 completed the questionnaire, and 63 agreed to wear the accelerometer. The demographics of all participants are described in Table 2.1. A total of 103 participants completed the questionnaire within the 7-day study period and were included in the analysis. A total of 47 patients self-reported the same AF type that was indicated in their EPIC chart, 81 reported an AF type that differed from their chart, 76 did not know their AF type, 15 agreed that their AF type was unknown/unspecified, and 13 self-reported a less advanced AF type than their EPIC chart indicated.

Of 195 AF management appointments, 135 were check-ups/condition maintenance appointments (i.e., assessing patients' condition, adjusting medications, treatment options, etc.), and 35 specifically focused on ablation as a treatment method (i.e., visit notes indicated a substantial amount of the visit was spent discussing ablations). Significantly more check-ups/condition maintenance appointment notes mention PA counsel than the ablation consult appointments (χ^2=12.86, p=<0.001).

Of the 63 participants who agreed to wear the accelerometer, 39 (to date) completed the activity monitoring; 7 returned the device without wearing it, 12 have not returned the device, and 5 are missing. For the participants who wore the device to date, males spent a higher percentage of time in light (p=0.049) and moderate (p=0.027) intensity PA per week, and achieved more steps per day (p=0.037) and week (p=0.037) compared to females (Table 2.2).

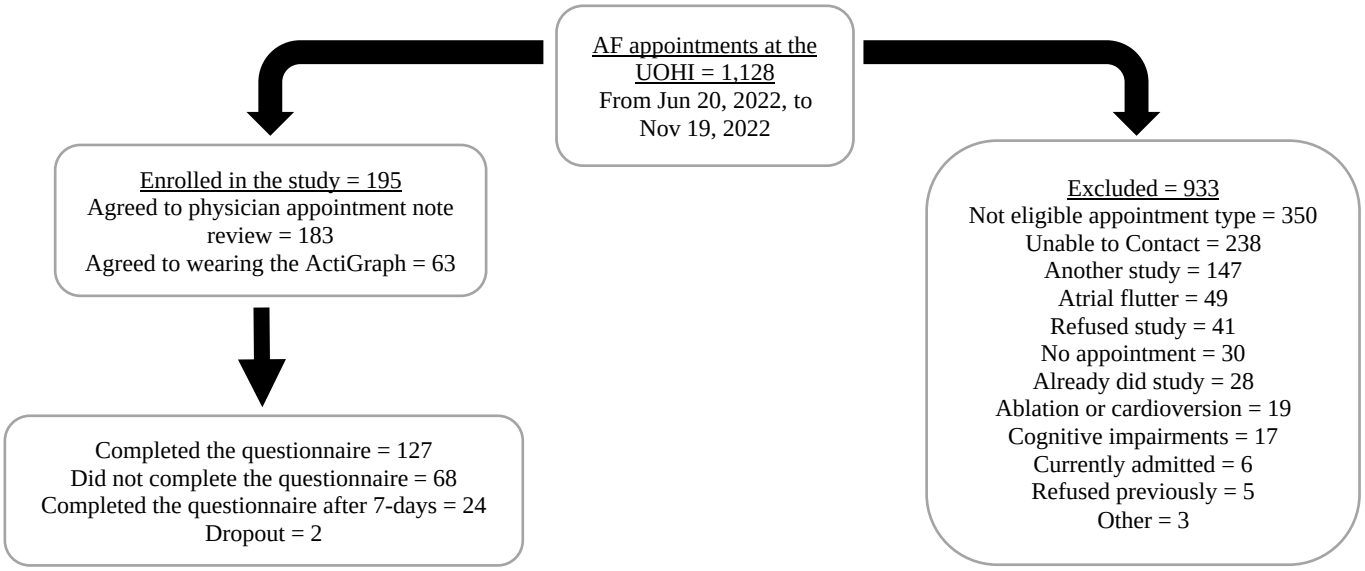

Figure 2.2 Recruitment flow for patient appointments.

Table 2.1: Patient demographics

Data Source		**All (n=195)**	**Male (n=126)**	**Females (n=69)**	**P-value**
		Mean ± SD or N (%)	**Mean ± SD or N (%)**	**Mean ± SD or N (%)**	
EPIC chart					
Age (years)		68.7 ± 11.7	67.6 ± 11.8	72.4 ± 9.7	0.080
Home setting					
	Rural	43 (22.1)	29 (23.0)	14 (20.3)	0.661
	Urban	152 (77.9)	97 (77.0)	55 (79.7)	
AF type from EPIC charts					
	Paroxysmal	111 (56.9)	65 (51.6)	46 (66.7)	0.349
	Persistent	36 (18.5)	25 (19.8)	11 (15.9)	
	Long-Standing Persistent	1 (0.5)	1 (0.8)	0 (0.0)	
	Permanent	12 (6.2)	10 (7.9)	2 (2.9)	
	Unknown	30 (15.4)	22 (17.5)	8 (11.6)	
	New/Unknown	5 (2.6)	3 (1.4)	2 (2.9)	
Self-report questionnaire		**All Mean ± SD**	**Male Mean ± SD**	**Females Mean ± SD**	**P-value**
Height (m) (n=111)		174.4 ± 10.3	179.3 ± 7.1 (n=77)	162.3 ±5.8 (n=34)	<0.001*
Body mass (kg) (n=117)		92.6 ± 30.8	99.6 ± 32.3 (n=81)	79.2 ± 32.6 (n=36)	0.007**
BMI (kg/m^2) (n=110)		52.2 ± 16.4	54.4 ± 16.7 (n=77)	48.5 ± 20.2 (n=33)	0.156
Self-report questionnaire		**All (n=127) N (%)**	**Male (n=86) N (%)**	**Females (n=41) N (%)**	**P-value**
Years with AF	0 to 1	35 (17.9)	25 (29.1)	10 (24.4)	0.087
	1 to 3	36 (18.5)	28 (32.6)	8 (19.5)	
	3 to 5	13 (6.7)	9 (10.5)	4 (9.8)	
	5 to 7	11 (5.6)	5 (5.8)	6 (14.6)	
	7 to 9	7 (3.6)	4 (4.7)	3 (7.3)	
	9+	21 (10.8)	15 (17.4)	7 (17.1)	
	don't know	3 (1.5)	0 (0.0)	3 (7.3)	
Hypertension, n (%)		72 (36.9)	45 (52.3)	27 (65.9)	0.150
Pre-diabetes, n (%)		13 (6.7)	9 (10.5)	4 (9.8)	0.902
Type 2 diabetes, n (%)		10 (5.1)	6 (7.0)	4 (9.8)	0.587
Chronic kidney disease, n (%)		5 (2.6)	3 (3.5)	2 (4.9)	0.707
High cholesterol, n (%)		44 (22.6)	29 (33.7)	15 (36.6)	0.751
Chest pain, n (%)		12 (6.2)	7 (8.1)	5 (12.2)	0.465
Overweight, n (%)		38 (19.5)	17 (19.8)	21 (51.2)	<0.001*
Sleep apnea, n (%)		33 (16.9)	24 (27.9)	9 (22.0)	0.474
COPD, n (%)		5 (2.6)	3 (3.5)	2 (4.9)	0.707
Rheumatic fever, n (%)		2 (1.0)	2 (2.3)	0 (0.0)	0.325
Anxiety, n (%)		8 (4.1)	4 (4.7)	4 (9.8)	0.268
Depression, n (%)		10 (5.1)	6 (7.0)	4 (9.8)	0.587
Angina, n (%)		5 (2.6)	2 (2.3)	3 (7.3)	0.176
Congenital heart disease, n (%)		4 (2.1)	4 (4.7)	0 (0.0)	0.161
Coronary artery disease, n (%)		8 (4.1)	6 (7.0)	2 (4.9)	0.649
Myocardial infarction, n (%)		9 (4.6)	8 (9.3)	1 (2.4)	0.159
Heart failure, n (%)		12 (6.2)	8 (9.3)	4 (9.8)	0.935
Valve disease, n (%)		9 (4.6)	3 (3.5)	6 (14.6)	0.022
Other arrhythmia, n (%)		2 (1.0)	1 (1.2)	1 (2.4)	0.664
Stroke, n (%)		6 (3.1)	4 (4.7)	2 (4.9)	0.955
Venous thrombosis, n (%)		4 (2.1)	3 (3.5)	1 (2.4)	0.752

TIA, n (%)	5 (2.6)	2 (2.3)	3 (7.3)	0.176
Aortic dissection, n (%)	1 (0.5)	1 (1.2)	0 (0.0)	0.488
Other heart disease, n (%)	6 (3.1)	5 (5.8)	1 (2.4)	0.402
Other conditions, n (%)	3 (1.5)	2 (2.3)	1 (2.4)	0.969

Urban=a community of 30,000+; *=<0.001 significance; **=0.05 significance. BMI: body mass index; COPD: chronic obstructive pulmonary disease; MVPA: moderate-to-vigorous intensity physical activity; PA: physical activity; TIA: transient ischemic attack.

Table 2.2: Accelerometer measured patient physical activity levels

Accelerometer data	**All (n=39)**	**Male (n=29)**	**Females (n=10)**	**P-value**
	Mean ± SD	**Mean ± SD**	**Mean ± SD**	
Light PA per week (min)	1844.2 ± 587.3	1868.8 ± 585.4	1772.8 ± 618.6	0.674
Light PA % per week	2.2 ± 1.7	2.5 ± 1.9	1.23 ± 0.43	0.049*
Moderate PA per week (min)	393.4 ± 266.0	430.2 ± 289.7	286.6 ± 144.0	0.143
Moderate PA % per week	0.5 ± 0.5	0.6 ± 0.6	0.2 ± 0.1	0.027*
Vigorous PA per week (min)	94.9 ± 122.2	107.1 ± 133.7	59.6 ± 74.9	0.177
Vigorous PA % per week	0.1 ± 0.2	0.2 ± 0.2	0.04 ± 0.05	0.061
MVPA per week (min)	488.3 ± 314.1	537.2 ± 339.2	346.3 ±168.6	0.098
MVPA % per week	0.3 ± 0.2	0.3 ± 0.3	0.2 ± 0.1	0.731
Steps per day	4,864 ± 2561	5,265 ± 2727	3,701± 1,590	0.037*
Steps per week	3,4051 ± 17927	3,6857 ± 19091	25,912 ± 11,134	0.037*

min: minute; MVPA: moderate-to-vigorous intensity physical activity; PA: physical activity.
*: <0.05 level of significance.

Table 2.3 describes patient-reported and EPIC-recorded discussions of PA and exercise with UOHI physicians. A similar proportion of patients reported discussing PA and exercise (50.5%) as reported not discussing PA and exercise (48.5) with their UOHI physician. EPIC-recorded PA and exercise discussions were similar proportionally to the patient-reported results. There were 99 patients who both completed the questionnaire and gave permission to view their EPIC chart. There was 23 of 99 (23.2%) patients who reported discussing PA but had no record of the conversation in their EPIC chart, and 22 of 99 (22.2%) patients who reported not having a discussion but had a record of one in their EPIC chart. Significantly more patients reported discussing PA and exercise with both their UOHI physician and their family physician when compared to either provider alone (Table 2.4).

Table 2.1: Patient-reported and EPIC-recorded PA discussion occurrences

Did the UOHI physician **discuss PA or exercise** in the most recent visit	**Patient-reported (n=103)** **N (%)**	**EPIC-recorded (n=182)** **N (%)**
Yes	52 (50.5)	86 (47.0)
No	50 (48.5)	96 (53.0)
Don't know or prefer not to answer	1 (1.0)	N/A

PA: physical activity; UOHI: University of Ottawa Heart Institute.

Table 2.4: Patient-reported UOHI physician and family physician PA discussion occurrences

Discussed PA or exercise	**Patient-reported UOHI physician (n=103) N (%)**	**Patient-reported family physician (n=102) N (%)**	**Patient-reported UOHI and family physician (n=59) N (%)**	**$\chi 2$**	**P-value**
Yes	16 (19.0) [a]	28 (35.4) [a]	36 (45.6) [b]	21.6	<0.001*
No	0 (0.0)	0 (0.0)	23 (39.0)		

*: <0.05 level of significance. PA: physical activity; UOHI: University of Ottawa Heart Institute. Different superscripts in the same row denotes values that are significantly different between groups (p<0.005).

The EPIC charts revealed 93 of 183 patients had a record of a PA and exercise discussion, but none included any components of the FITT principle. The EPIC chart PA and exercise mentions are categorized and presented in Table 2.5.

Table 2.5: EPIC-recorded PA and exercise discussion

Category	**N (%)** n=183	**Example quotations from records**
Assessed patient PA levels	25 (13.7)	"Patient remains fairly active" … "Patient is doing exercise" … "Patient walks 30 mins per day"
Mentioned risk-factor modification	24 (13.1)	"I have stressed the important role of lifestyle modification, including weight reduction, regular exercise and limiting alcohol consumption, along with optimal control of systemic hypertension and management of obstructive sleep apnea for secondary prevention of AF"
Mentioned exercise tolerance or intolerance	23 (12.6)	"Patient has SOB with ambulation and has gained weight" …" Patient exercise tolerance has improved"
Weight loss mentioned	18 (9.8)	"Patient working on their weight" … "Weight loss beneficial for AF burden"
Provided encouragement	3 (1.6)	"Encouraged patient to be more active" … "I have encouraged patient to exercise and to lose weight"
Other	3 (1.6)	"Patient is aware he needs to participate in regular exercise" …" I suggested they should get rid of the Fitbit and go for a walk" …. "Patient is remarkably better because of increased exercise and new diet. I am delighted with patient progress"

AF: atrial fibrillation; PA: physical activity; SOB: shortness of breath. Note: some patients were included in multiple categories if the chart mentioned multiple categories.

The findings regarding patients meeting each of the 2020 CCS AF exercise targets and their discussion frequency from each provider are presented in Table 2.6. There were no statistically significant differences between patients meeting and not meeting the three CCS AF exercise targets. Of the 27 participants meeting the 2020 CCS AF aerobic target, 20 reported PA counselling from at least one HCP. Of the 33 participants meeting the 2020 CCS resistance training target, and the 20 participants above 65-years of age meeting the flexibility target, all spoke to more than one HCP about

PA and exercise. Only 2 participants met all three of the 2020 CCS AF exercise targets (i.e., aerobic, resistance, and flexibility). Significantly more males than females were meeting the resistance training targets (χ^2=3.97, p=0.046). **Appendix 2** shows the frequency and proportions of patients who reported participating in resistance and flexibility training as well as the length and frequency of their participation.

Table 2.6: Meeting the 2020 CCS AF exercise targets and PA and exercise discussion occurrences

Aerobic	**Meeting target (n=14) [N (%)]**	**Not meeting target (n=11) [N (%)]**	**χ2**	**P-value**
UOHI physician discussed	4 (16.0)	3 (12.0)	0.0	1.000
Family physician discussed	7 (28.0)	8 (32.0)	2.35	0.125
Other HCP discussed	3 (12.0)	2 (8.0)	0.148	0.701
Resistance	**Meeting target (n=33) [N (%)]**	**Not meeting target (n=1) [N (%)]**	**χ2**	**P-value**
UOHI physician discussed	21 (61.8)	0 (0.0)	1.66	0.197
Family physician discussed	20 (58.8)	1 (2.9)	0.54	0.462
Other HCP discussed	11 (32.4)	1 (2.9)	1.720	0.190
Flexibility	**Meeting target (n=20) [N (%)]**	**Not meeting target (n=3) [N (%)]**	**χ2**	**P-value**
UOHI physician discussed	12 (52.2)	2 (8.7)	0.05	0.825

Family physician discussed	15 (65.2)	1 (4.3)	2.14	0.144
Other HCP discussed	8 (34.8)	2 (8.7)	0.63	0.427

HCP: healthcare provider; PA: physical activity; UOHI: University of Ottawa Heart Institute.

The number of participants who self-reported receiving a prescription for each component of the FITT principle from their UOHI physician or their family physician are reported in Table 2.7. Family physicians advised on components of the FITT principle more often when compared to both UOHI and family physicians. UOHI physicians alone advised on FITT principle components less often when compared to both UOHI and family physicians, except for intensity and referral to an exercise professional or program, which they provided more often. The proportion of FITT components provided by family physicians was higher than UOHI physicians.

Table 2.7: FITT principle components provided by UOHI physicians and family physicians

Discussed **how often** (frequency)	**UOHI physician N (%)**	**Family physician N (%)**	**Both UOHI and family physician N (%)**	**$\chi 2$**	**P-value**
Yes	6 (23.1) [a]	12 (46.2) [a]	8 (30.8) [b]	41.7	<0.001*
No	0 (0.0)	0 (0.0)	45 (100.0)		
Discussed **how hard** (intensity)	**UOHI physician N (%)**	**Family physician N (%)**	**Both UOHI and family physician N (%)**	**$\chi 2$**	**P-value**
Yes	14 (45) [a]	13 (41.9) [a]	4 (12.9) [b]	57.1	<0.001*
No	0 (0.0)	0 (0.0)	41 (100.0)		
Discussed the **amount of time**	**UOHI physician N (%)**	**Family physician N (%)**	**Both UOHI and family physician N (%)**	**$\chi 2$**	**P-value**
Yes	6 (25.0) [a]	10 (41.7) [a]	8 (33.3) [b]	41.8	<0.001*
No	0 (0.0)	0 (0.0)	49 (100.0)		
Discussed **type of PA or exercise**	**UOHI physician N (%)**	**Family physician N (%)**	**Both UOHI and family physician N (%)**	**$\chi 2$**	**P-value**
Yes	8 (21.1) [a]	21 (55.3) [a]	9 (23.7) [b]	47.7	<0.001*
No	0 (0.0)	0 (0.0)	39 (100.0)		
Referral to an exercise professional or program	**UOHI physician N (%)**	**Family physician N (%)**	**Both UOHI and family physician N (%)**	**$\chi 2$**	**P-value**
Yes	7 (77.8) [a]	2 (22.2) [a]	0 (0) [b]	47.7	<0.001*
No	0 (0.0)	0 (0.0)	69 (100.0)		

*: <0.05 level of significance. PA: physical activity; UOHI: University of Ottawa Heart Institute. Different superscripts in the same row denotes values that are significantly different between groups ($p<0.005$).

Appendix 3 provides the number of participants who self-reported receiving FITT principle components from other HCPs as well as a complete list of the other reported HCPs. **Appendix 4** provides the specific FITT components reported by patients from all HCP types in the questionnaire.

The sex differences in PA and exercise discussion occurrence, prescription (i.e., FITT principle components), and referral are presented in Table 2.8. A statistically greater number of females than males reported being advised on PA and exercise frequency by their UOHI physician, family physician, or other HCP. More females than males reported receiving a referral from their UOHI physician to an exercise professional or program.

Table 2.8: Sex-differences in PA and exercise discussion and prescription occurrence

PA Discussed	**Male**	**Females**	χ^2	**P-value**
UOHI physician EPIC chart	48 yes, 56 no	30 yes, 25 no	1.014	0.314
UOHI physician	38 yes, 32 no	13 yes, 18 no	1.311	0.252
Family physician	44 yes, 21 no	20 yes, 9 no	0.015	0.903
Other HCP	23 yes, 42 no	12 yes, 15 no	0.664	0.415
Frequency	**Male**	**Females**	χ^2	**P-value**
UOHI physician	7 yes, 28 no	7 yes, 6 no	5.256	0.022*
Family physician	11 yes, 28 no	9 yes, 4 no	6.933	0.008*
Other HCP	10 yes, 10 no	10 yes, 1 no	5.188	0.023*
Intensity	**Male**	**Females**	χ^2	**P-value**
UOHI physician	13 yes, 24 no	5 yes, 8 no	0.166	0.683
Family physician	11 yes, 29 no	6 yes, 10 no	0.541	0.462
Other HCP	13 yes, 9 no	8 yes, 3 no	0.814	0.666
Time	**Male**	**Females**	χ^2	**P-value**

UOHI physician	9 yes, 25 no	5 yes, 7 no	0.967	0.325
Family physician	11 yes, 29 no	7 yes, 8 no	1.820	0.177
Other HCP	9 yes, 11 no	6 yes, 5 no	0.259	0.611
Type	**Male**	**Females**	χ^2	**P-value**
UOHI physician	11 yes, 24 no	6 yes, 7 no	0.899	0.343
Family physician	18 yes, 25 no	12 yes, 6 no	3.124	0.770
Other HCP	13 yes, 9 no	7 yes, 4 no,	0.630	0.801
Referral	**Male**	**Females**	χ^2	**P-value**
UOHI physician	3 yes, 34 no	4 yes, 9 no	4.103	0.043*
Family physician	1 yes, 41 no	1 yes, 19 no	0.298	0.585
Other HCP	3 yes, 19 no	1 yes, 11 no	0.750	0.687

*: <0.05 level of significance. HCP: healthcare provider; PA: physical activity.

2.4 Discussion

Given the irrefutable benefits of regular PA and exercise on cardiovascular health, this study sought to determine if HCPs of patients with AF were discussing PA and exercise, as it relates to the 2020 CCS AF guidelines exercise targets. These guidelines indicate that the management of patients with AF should include a multidisciplinary healthcare team, and patients with AF should achieve at least 200 minutes weekly of moderate-intensity aerobic exercise, 2-3 days per week of resistance training, and for those 65+ years of age flexibility training at least 2 days a week for 10 minutes. To our knowledge, no other studies have reported the specific FITT principle prescription provided to patients with AF, let alone any cardiovascular population. Further, it is unknown if there are differences in PA and exercise discussion occurrence between patients who are male and female. The primary purpose of this study was to determine if HCPs are discussing PA and exercise with their patients living with AF.

Secondarily, it was examined if there were differences in PA and exercise discussion occurrence and prescription provided between patients meeting and not meeting the CCS AF guideline's exercise targets, prescription (i.e., FITT principle components) being provided, male and female patients, and referrals to CR programs, community programs or exercise professionals between sexes.

Our primary findings revealed that 50 of 103 (48.5%) patients self-reported not discussing PA and exercise with their UOHI physician, which is 11.5% less than hypothesized. Of the 183 patient records reviewed, 96 (53.0%) did not discuss PA and exercises as per the UOHI physician notes in EPIC. Further, a higher proportion of patients reported PA and exercise discussion and prescription from their family physician when compared to their UOHI physician. Yet, more patients were counselled by both providers than one alone regarding targets frequency, intensity, time, and type of PA. This is not surprising given that the family physician data, and the UOHI physician data had different reference periods (i.e., UOHI physician: 7 days, family physician: not set). We also had no method of verifying the family physician data in our EPIC records as with the UOHI physician data.

Similar to our finding that 50% of patients self-reported a PA discussion, a study of 635 overweight and obese patients in the United States indicated that 52% self-reported (via paper questionnaire) a PA discussion with their HCP.[76] It was expected that patient-reported and EPIC-recorded instances of discussion would differ due to available physician time. Physicians spend approximately 27% of their work time with patients and 49% on electronic health record and desk work; every 1-hour appointment creates nearly 2 hours of electronic health record work.[77] It is possible that not every instance of a PA and exercise discussion was recorded on the EPIC charts due to the substantial amount of time physicians spend on charting, or the need to record other topics discussed during the visit. It is also possible that physicians do not perceive PA and exercise discussion and counselling as a priority for their patient visit, their visit notes recorded in EPIC, or for the appointment type. Consultations for a catheter ablation may not be deemed an appropriate time to discuss and counsel PA and exercise (35 of 195 appointments were consultations for catheter ablation). Our study

did not show a proportional difference between patient-reported, and EPIC- recorded discussion occurrences, but the sample for patient-reports was 103 compared to 183 for EPIC charts.

Cardiovascular disease risk factors (e.g., physical inactivity, obesity, hypertension, diabetes, etc.) are associated with the development and progression of AF.[1] Patient-report and patient-charts have been shown to disagree in another study in Ontario investigating cardiovascular risk factor mentions or measurement.[78] Cardiologists with lower self-reported weekly volume of patients had significantly less cardiovascular disease risk factor information (i.e., record of obesity, hypertension, diabetes, etc.) missing from their patients' charts (when compared to patient self-reported cardiovascular disease risk factors).[78] This study also showed that less active patients who were older had fewer missing cardiovascular risk factor data in their charts, suggesting that patient charts are more complete when the patient is likely to have more risk factors and a greater overall cardiovascular disease risk.[78] We observed a disagreement in AF type reported between patient-reported and EPIC-recorded data. When comparing the self-reported patient data and the EPIC-recorded data, there were 81 occurrences of disagreement in AF type, and for 13 of the occurrences the EPIC chart had a more advanced AF type than the patient reported. Consistent with our findings, charts of patients who are overweight or obese in the United States showed that only 42% were recognized as overweight or obese, and patients were most likely to be classified as overweight or obese if they had multiple chronic conditions and more frequent physician visits.[76] This could indicate a miscommunication in the severity of AF and/or an underemphasis by physicians of risk-factor management importance to patients to prevent AF progression and aid in managing their AF.

In our study, frequency, time, and type recommendations were more frequently made by family physicians than UOHI physicians, and when provided there was a range of recommendations for all FITT principle components. Frequencies ranged from 3-7 days per week, and the intensity was mostly moderate. Nearly half the recommended PA and exercise time provided by HCPs were below the CCS AF 200-minute target per week of moderate-intensity (i.e., between 0-180 minutes per week). The most

frequent type of activity was walking and other aerobic activities such as biking, swimming, running and sports. Females were more often provided with a frequency to exercise during HCP PA discussions than males, and females also reported more referrals to CR programs, exercise professionals, or community-based programs from UOHI physicians than males. No other sex-differences in FITT components and discussion occurrence were found. It should again be noted that the questions referring to UOHI physicians and family physicians had different reference periods (i.e., UOHI physician: 7 days, family physician: not set); this could explain the observed differences. There are no studies in the available literature examining PA and exercise discussion between HCPs and patients in the same capacity as this study. This study was framed from an exercise physiologist and exercise prescription perspective and not one of PA and exercise specific counselling. These appointments were not set times for PA and exercise counselling as other studies have explored, although this may serve as a future area of investigation for patients with AF. The scope of this study was to examine if PA and exercise discussions occurred at medical appointments, which could potentially encourage patients to engage in more PA behaviours.

It has been reported in a systematic review (n=15 studies) that personalized PA advice, brief PA interventions, PA behavioural supports, and follow-up by primary care physicians improves clinical health outcomes (such as increased PA levels) in patients with chronic conditions.[79] Personalized advice, brief intervention, behavioural supports, and physician follow-up are key components of the 5 A's model for PA counseling (ask, advise, assess, assist, and arrange). Our study demonstrates that 23.4% of the UOHI physicians "Ask" (i.e., asking about PA levels, verifying safety of PA), and 17.2% "Advise" (i.e., advising patient to be more active) on PA as defined by the "5-As model".[80] There was no clear indication that the UOHI physicians "Assess" (i.e., assess patients readiness to change),"Assist" (i.e., construction of goals and or plan of action like an exercise prescription), or "Arrange" (i.e., establishment of follow-up or tracking) PA with patients who have AF. We cannot confidently determine the exact occurrence of all 5 A's within these appointments due to the possibility

that the notes could have been missing this information, and no one from the research team was present or recording patient visits. It is important to note that the 5 A's model was developed and then investigated in the primary care setting, and has not been tested using cardiologists or electrophysiologists, which could contribute to discrepancies in compliance with this model. Yet, our results are similar to that of Carroll et al. showing physicians infrequently assessing patients' readiness to change, and little to no specific mention of recommended guidelines for exercise.[81] From the patient point-of-view, our results are consistent with that of the EPIC charts in terms of the 5 A's model. The survey asked patients questions regarding the ask, assist, and arrange A's from the 5 A's model (as defined by Carroll et al. 2014)[80] and was not designed to directly measure the assess and advise from the patient point-of-view. Patients reported that 52% of HCPs asked, (15-20% reported discussing FITT), and 7% arranged.

In Quebec, Canada it was shown that inactive, moderately active, and active patients (of no specified condition in primary care) had a similar percentage of PA level assessment (approximately 51.9%) and PA counselling (approximately 21.6%) with no significant differences between these activity groups.[66] Our findings revealed a similar proportion of patients meeting versus not meeting the 2020 CCS AF exercise targets receiving PA discussions from HCPs. Patients meeting the 2020 CCS AF exercise targets reported discussing PA and exercise with at least one of their HCPs, and there were no significant differences between HCP types. Of the 14 patients meeting the aerobic target of at least 200 weekly minutes of moderate-intensity exercise, all had at least one discussion regarding PA and exercise. Of the 33 meeting the resistance target (2-3 days per week), 55 PA and exercise discussions were reported, and of the 20 meeting the flexibility target (at least 2 days per week for 10 minutes when 65+ years old), 35 PA and exercise discussions were reported.

Our accelerometer data demonstrated an average of 488 (standard deviation = 314) minutes per week of MVPA which is more than double the recommended weekly minutes of MVPA (i.e., at least 200 minutes of moderate intensity per week). Further, our PA minutes is higher than that of Reed et al.

(2021) which showed 340 minutes of MVPA per week,[29] and Borland et al. (2020) which showed 164-180 minutes of moderate-to-vigorous PA per week.[28] It is possible that the difference between Borland et al., Reed et al., and this current study is the location (Borland et al. was in south eastern Sweden, Reed et al. in Nova Scotia, Canada, and this study in Ontario, Canada), or the cut-points used for the analyses (Borland used Choi et al.; Reed et al. used Sasaki; and this study used the Mark et al. cut points for cardiovascular disease populations). Consideration of cut-points is important as those established for patients with cardiovascular disease (i.e., Mark et al.) have been show to result in significantly higher levels of PA than those for young (i.e., Sasaki et al.) or middle-aged (i.e., Santos-Lozano et al.) individuals.[75] In addition, cut-points for these young and middle-aged populations are more strongly associated with cardiovascular health indicators (e.g., BMI, waist circumference, and systolic blood pressure).[75] Our study participants had cardiovascular diseases and were older (average 68.7 years; males 67.6 years; females 72.4 years). Another potential reason for the higher minutes per week of MVPA could be the season during which data was collected (i.e., June to November).[82] Lastly, the willingness of patients to participate in wearing the accelerometer could have created a biased sample (i.e., in younger individuals it was shown that participants with healthier behaviours had more complete accelerometer data;[83] and that waist worn devices had lower compliance than wrist worn).[84]

Limitations of this study include: (i) biases from self-report surveys (i.e. nonresponse bias);[85] (ii) majority of study completion in the summer (which may have impacted recruitment rates and accelerometer data compliance due to patient vacation and travel); (iii) patient appointment numbers may be lower in the summer than the fall as seen through our patient appointment searches for recruitment; (iv) the inability to verify if family physicians or other HCPs discussed PA or exercise; (v) only a small subset of the sample wore the accelerometers with no other forms of aerobic PA measurement; (vi) a small number of female participants (69 female, 126 male); and (vii) there was no way to determine from these data if the patient or HCP initiated the PA discussion. Future research should anticipate a higher nonresponse rate in PA survey studies for patients with AF and aim to

increase the number of patients participating with measured PA (wearing the accelerometer device was optional). Device compliance might be increased with wrist worn devices,[84] as many patients declined participation due to having a Fitbit or Apple watch, or the opinion that the waist worn device was bothersome. A greater number of females participating, completing the survey (41 females and 86 males), and wearing the accelerometer (10 females to 29 males) would have allowed for an in-depth analysis of the gender-related variables and their interactions with PA discussions and PA levels in patients with AF. Based on these data from a large Canadian cardiovascular institution, future research should focus on an exercise prescription and counselling model specific for atrial fibrillation to provide more training and support for physicians, which will ensure that patients receive PA and exercise information.

In conclusion, patients with AF reported similar proportions of discussions as were recorded in their EPIC chart at the UOHI (47.0%), and more discussions with both their UOHI and family physician. When patients were meeting any of the three 2020 CCS AF targets, it is likely they had discussed PA with one or more HCPs, but they were not advised on FITT principle components (F: 19.9%, I: 18.1%, T: 18.7%, and T: 18.1% not given each component respectively). When patients did receive a prescription on FITT principle components, walking (or other aerobic activities such as biking, swimming, running and sports), at a moderate-intensity, 3-7 days a week for approximately 150 minutes per week (approximately half of responses were above 200 minutes per week and half below, but the most responses were 120-180 minutes per week) was most recommended. Females were more frequently provided with a frequency of PA and exercise recommendation by all HCPs, and a referral to CR programs or exercise professionals by UOHI physicians than males.

Chapter 3: Study 2

The Integration of Exercise Physiology in the Management of Atrial Fibrillation by Canadian Healthcare Providers

Abstract

Background: The 2020 Canadian Cardiovascular Society (CCS)/Canadian Heart Rhythm Society Comprehensive Guidelines for the Management of Atrial Fibrillation (AF) include exercise physiology as part of the multidisciplinary care plan for patients with AF but does not name specific healthcare providers (HCP) responsible for providing exercise information. The guidelines include exercise targets for patients with AF: ≥200 minutes/week of moderate-intensity physical activity (PA), 2-3 days/week of resistance training and, if >65 years of age, 10 minutes/day of flexibility exercise 2 days/week. It is unknown if this is relayed to patients or if the HCPs are aware of this information. The purpose of this study therefore was to determine: (i) if HCPs prescribe PA and exercise for patients with AF; (ii) if HCPs believe exercise physiology should be included in AF management; (iii) which HCPs have the highest confidence in prescribing exercise; (iv) which HCPs have exercise prescription training; and (v) if HCPs know the 2020 CCS AF exercise targets. **Methods:** A 15-question survey assessing exercise prescription practice, confidence, training, and knowledge of Canadian HCPs was circulated via social media and to national-level HCP organizations. HCPs included were physicians, physiotherapists, registered nurses, exercise physiologists, and kinesiologists. **Results:** Of the 96 responses 87% HCPs reported prescribing PA to their patients with AF at least some of the time. All HCPs believed that exercise physiology should be included in AF management. Physicians (60%), kinesiologists (50%), and exercise physiologists (40%) reported always prescribing exercise to patients with AF, which was significantly more than registered nurses (0%; χ^2=37.37, all $p<0.05$). More physicians (80%) reported being fairly confident in prescribing exercise to patients with AF than physiotherapists (7%) and registered nurses (6%; χ^2=43.14, all $p<0.05$). More exercise physiologists (95%), kinesiologists (90%),

and physiotherapists (78.6%) reported being trained in exercise prescription than registered nurses (11.8%; χ^2=23.57, all p<0.05). Only 22.9% of HCPs knew the AF targets were from the CCS, and only 14.6% HCPs correctly identified all three exercise targets from CCS. **Conclusion:** Most HCPs reported prescribing PA and exercise to patients with AF at least some of the time. Future work should focus on increasing awareness and training in PA prescription across Canadian healthcare providers.

3.1 Introduction

Exercise professionals, such as exercise physiologists and kinesiologists have specialized knowledge and training in physical activity (PA) and exercise for healthy and chronic disease groups (e.g., atrial fibrillation [AF], coronary artery disease [CAD], heart disease, lung conditions, etc.). Jattan and Kvern (2018), Canadian physicians, published a commentary highlighting the need for exercise professionals to be integrated within health teams.[86] These physicians recognized that accessing exercise professional services typically created additional costs to patients, as many of these services were not covered by provincial health plans.[86] Exercise is Medicine (EIM) Canada (a nationwide leader for PA promotion in chronic disease prevention and management established in 2007) has an exercise prescription tool for physicians that assists with referrals to exercise professionals.[87] Physicians can also obtain a certificate of added competence in sport and exercise medicine (CCFP), and referral to these specific CCFP trained physicians (n=288 in Canada as of 2018) are usually covered by provincial health plans. Jattan and Kvern (2018) also suggested the development of a referral system supported by government insurance plans, as they are currently implemented in the United Kingdom and New Zealand.[86]

Due to a lack of inclusion under government insurance plans and few regulatory/licencing bodies that uphold standards of practice and define practitioner scope of practice (only Ontario and British Columbia have bodies for kinesiologists and exercise physiologists, respectively, the exact role and scope of exercise professionals in healthcare can be misunderstood by other healthcare providers (HCPs). Exercise professionals are employed in many different locations (e.g., research, rehabilitation centres, fitness centres, municipalities, etc.), but these places may not be as common as family healthcare teams. This could create barriers in accessing these professionals. An interdisciplinary approach in which physicians recommend PA and provide referrals to allied health professionals is suggested.[86,88] PA counselling from an allied health professional or both exercise professional and a

physician has been shown to increase long-term PA levels.[50] Limited research has focused on the effectiveness and sustainability of incorporating exercise physiologists into primary healthcare teams (even in Ontario where kinesiologists have been regulated health professionals since 2013). In Newfoundland and Labrador the inclusion of exercise physiologists into primary healthcare teams was examined using a qualitative study where four exercise physiologists were amalgamated into a primary care referral system.[89] The common themes that were identified following the content analyses included: exercise physiologists lead advocacy for referral (i.e., communicating to the physician how they support each patient), gaps in exercise physiologist training and regulation, an unclear role for exercise professionals in healthcare and policy, and the need for organizational changes to improve the referral system (there currently isn't one) to exercise physiologists.[89] In most Canadian provinces, exercise professionals are not well integrated within the healthcare system which may subsequently impact PA and exercise being recommended to patients.

The 2020 Canadian Cardiovascular Society (CCS)/Canadian Heart Rhythm Society Comprehensive Guidelines for the Management of AF include exercise physiology as part of the multi-disciplinary care plan of patients with AF.[6] As these CCS AF guidelines are intended for physicians, it is assumed that they are responsible for the recommendations within these guidelines. Exercise prescriptions are cost-effective and have been shown to increase PA levels and exercise by 10% in relatively inactive patients, a number which recent Canadian evaluations have estimated could save approximately 2.1 billion dollars (CAD) annually in healthcare costs if adopted at the population level.[37] There currently are no studies which have assessed the effectiveness of PA and exercise prescriptions or counselling in patients who have AF. Within Canada, the Physical Activity Counselling (PAC) randomized controlled trial included primary care patients (with no specified conditions) who received PA counselling supplementation from a PA counsellor (professional type unspecified) in addition to HCP PA counselling from a physician or nurse practitioner.[90] The findings

showed a significantly higher level of PA at 13-weeks for patients with PA counseling supplementation from a PA counsellor when compared to participants with only HCP PA counselling from a physician or nurse practitioner, and higher autonomous motivation at 6-weeks.[90] The 5A's theory (i.e., a health counseling system where HCPs ask, assess, advice, assist, and arrange PA) has also shown to be effective for improving motivation and attendance in PA programs,[91] greater reductions in body mass,[91] long-term medication adherence,[92] and smoking cessation in adults.[93] This suggests that PA counselling yields more favourable PA outcomes for patients.

With the current 2020 CCS AF guidelines being the first to: (i) provide exercise targets for patients with AF (≥200 minutes/week of moderate-intensity PA, 2-3 days/week of resistance training and, if >65 years of age, 10 minutes/day of flexibility exercise 2 days/week); and (ii) include exercise physiology in their multi-disciplinary team, there is a need to explore if these targets are being incorporated into AF management. Prior to the publishing of the 2020 CCS AF guidelines, Way et al. (2022) conducted a study that found 59% of patients with AF had not previously spoken to a HCP (physicians, nurses, etc.) about engaging in PA to manage their AF. Physicians face significant barriers regarding PA counselling and exercise prescription (e.g., knowledge and time),[94] which may result in patients not receiving PA and exercise counselling. Determining which HCPs have knowledge of exercise physiology and confidence in prescribing exercise to patients with AF in Canada is important so that patients receive this vital information for their AF management.

The primary aim of this study was to determine if HCPs prescribe PA and exercise to their patients with AF. Secondarily, we examined: (i) which HCP type prescribed exercise to patients with AF more frequently; (ii) if HCPs believed exercise physiology should be included in AF management; (iii) which HCPs had the highest level of confidence in prescribing exercise to patients with AF; (iv) if HCPs had training in exercise prescription and if there were differences in training between HCP types; and (v) which HCPs were able to correctly identify the 2020 CCS AF exercise targets.

3.2 Methods

3.2.1 Study design

This observational study was conducted at the University of Ottawa Heart Institute (UOHI). Ethics approval was obtained from the Ottawa Health Science Network Research Ethics Board (OHSN-REB#20220251-01H) and University of Ottawa Office of Research Ethics and Integrity (H-12-22-8731).

3.2.2 Participants

HCPs included those who were involved in the management of patients with AF in Canada, including: physicians (e.g., family physicians, cardiologists, electrophysiologists), physician assistants, physiotherapists, occupational therapists, registered nurses, nurse practitioners, exercise physiologists, and kinesiologists.

3.2.3 Recruitment

Social media posts were created for Twitter, Facebook, Instagram, and LinkedIn asking HCPs to complete a survey. All posts included a REDCap survey link. Several national-level Canadian HCP organizations whose members may discuss and prescribe exercise to their patients were asked to distribute the advertisement which included the study purpose and REDCap link. These organizations included the Canadian College of Family Physicians, Federation of Medical Regulatory Authorities of Canada (FMRAC), Canadian Academy of Sport and Exercise Medicine (CASEM), Exercise is Medicine (EIM), CCS, Canadian Association of Cardiovascular Prevention and Rehabilitation (CACPR), Canadian Physiotherapy Association (CPA), Canadian Occupational Therapy Association (CAOT), Canadian Nurses Association (CNA), CSEP, and the Canadian Kinesiology Association (CKA).

3.2.4 Survey

The survey was open from June 21, 2022, to Dec 21, 2022. The survey included 15 questions (multiple choice and Likert scale) and an optional box for comments at the end of the survey (**Appendix 5**). The online survey was piloted by research staff and graduate students with expertise in exercise science and took approximately 5 minutes to complete.

3.2.5 Outcomes

Primary Outcome

The primary outcome was HCP prescription practices for patients with AF and was measured with a Likert scale from 1- never prescribe to 7- always prescribe. A 7-point scale was selected to provide a balance between enough points of discrimination without too many response options.

Secondary Outcomes

The secondary outcomes included the belief that exercise should be included in AF management, confidence in prescribing to patients with AF, knowledge of exercise targets for patients with AF, and training in exercise physiology. HCP belief that exercise physiology should be included in AF management was assessed with the selection of "yes" or "no" that exercise should be included in the management guidelines for patients with AF. HCP confidence in prescribing PA to patients with AF was measured with a Likert scale from 1- not at all confident to 7- completely confident. HCP knowledge of exercise for patients with AF was measured by the ability to correctly identify the 2020 CCS AF management exercise targets. HCP training in exercise physiology was measured with the selection of "yes" or "no" to having been or not been trained.

Additional Outcomes

Other outcomes to characterize respondents included HCP type, sex, partial work postal code, and work setting. HCP experience with AF patients was measured by years worked with patients who have AF.

3.2.6 Sample Size

Using PASS (Version 15.0.13 NCSS, LLC, Kaysville, Utah), a sample size of n=175 was calculated, with a confidence interval of 95%, confidence interval width of 0.15, and a past reported sample proportion of 60% of patients with AF reporting not discussing PA with their physicians.[27] Currently, there are no data on HCP-reported occurrence of PA discussion with patients who have AF. A 10% non-completion rate was included (i.e., 20 dropouts) for a final sample size of N=195, with a target of n=20 for each HCP category to ensure each group was represented and differences between groups could be determined.

3.2.7 Statistical analyses

All analyses were performed using SPSS for Windows (Version 28; IBM Corp, Armonk, NY, USA). All statistical analyses were set at the 0.05 level of significance. Frequencies and proportions were used to describe the number of HCPs who reported prescribing exercise, who believed PA and exercise should be included in AF management, and who had exercise prescription training. Chi-square analyses with post-hoc testing (Bonferroni adjustment) was used to compare exercise prescription frequency, belief PA should be included AF management, confidence in prescribing PA to patients with AF, knowledge of the 2020 CCS AF exercise targets, and exercise prescription training between the HCP types. HCP groups that had less then 5 respondents were not included in the chi-square analyses.

3.3 Results

The survey was open from June 21, 2022, to February 13, 2022, and was posted on social media approximately once a week from June 21, 2022, to Dec 21, 2022. The assistance of Canadian HCP organizations in distributing the survey is outlined in Figure 3.1. The characteristics of the 96 survey respondents are summarized in Table 3.1. Of the 96 responses, 17 were incomplete (all participants stopped at the first exercise-related question; Question 6), and therefore, were unable to be included beyond descriptive analyses. Among the 17 incomplete responses there were: 6 kinesiologists, 4 exercise physiologists, 2 physicians, 2 physiotherapists, 1 registered nurse, 1 nurse practitioner, and 1 with more than one title. Of the survey responders who selected “more than one title”, all held an exercise physiologist certification in addition to their other professional licences. No physician assistants completed the survey.

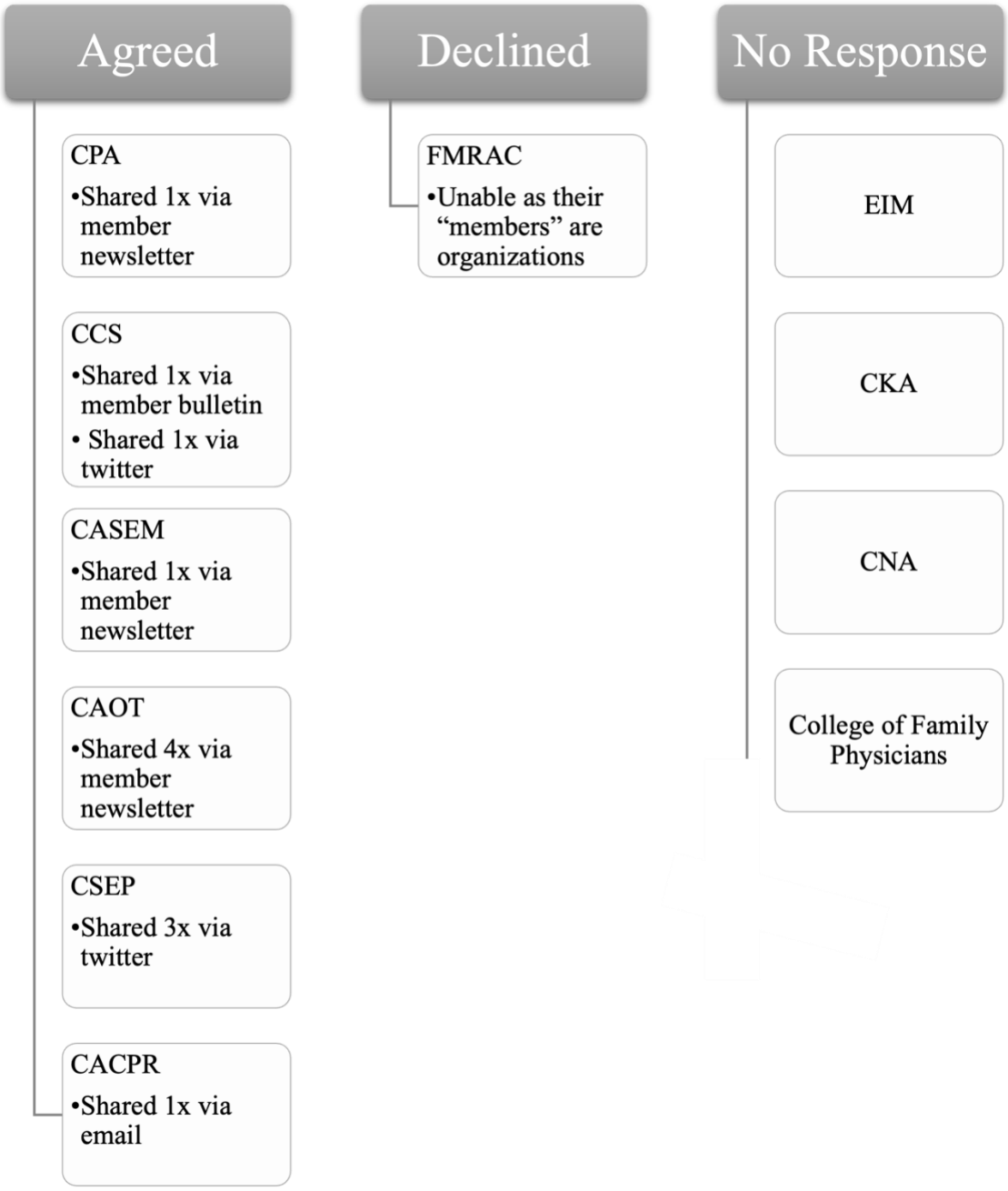

Figure 3.1 Involvement of Canadian healthcare provider organizations in recruitment. CPA: Canadian Physiotherapy Association; CCS: Canadian Cardiovascular Society; CASEM: Canadian Academy of Sport and Exercise Medicine; CAOT: Canadian Occupational Therapy Association, CSEP: Canadian Society for Exercise Physiology; CACPR: Canadian Association of Cardiovascular Prevention and Rehabilitation; FMRAC: Federation of Medical Regulatory Authorities of Canada; EIM: Exercise is Medicine Canada; CKA: Canadian Kinesiology Association; CNA: Canadian Nurses Association.

Table 3.1: HCP demographics

	EP	RN	Kin	PT	More than one title	MD	NP	OT	Total
Total	24 (25.0)	18 (18.8)	16 (16.7)	16 (16.7)	8 (8.3)	7 (7.3)	5 (5.2)	2 (2.1)	96 (100)
Sex									
Male	9 (37.5)	1 (5.6)	5 (31.3)	1 (6.3)	3 (37.5)	5 (71.4)	0 (0.0)	1 (50.0)	25 (26.0)
Female	14 (58.3)	17 (94.4)	11(68.8)	15 (93.8)	5 (62.5)	2 (28.6)	4 (80.0)	1 (50.0)	69 (71.9)
Intersex	1 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)
Unknown	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (20.0)	0 (0.0)	1 (1.0)
Province									
ON	1 (4.2)	8 (44.4)	13 (81.3)	14 (87.5)	4 (50.0)	7 (100)	5 (100)	2 (100)	53 (55.2)
BC	10 (41.7)	1 (5.6)	0 (0.0)	1 (6.3)	1 (12.5)	0 (0.0)	0 (0.0)	0 (0.0)	13 (13.5)
NB	0 (0.0)	4 (22.2)	1 (6.25)	1 (6.3)	1 (12.5)	0 (0.0)	0 (0.0)	0 (0.0)	7 (7.3)
NS	0 (0.0)	1 (5.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (3.1)
AB	9 (37.5)	3 (16.7)	0 (0.0)	0 (0.0)	1 (12.5)	0 (0.0)	0 (0.0)	0 (0.0)	13 (13.5)
MB	1 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)	1 (12.5)	0 (0.0)	0 (0.0)	0 (0.0)	2 (2.1)
SK	1 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)
YT	1 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)
QC	0 (0.0)	0 (0.0)	2 (12.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (2.1)
Missing	1 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)
Workplace Setting									
Urban	21 (87.5)	12 (66.7)	14 (87.5)	16 (16.7)	5 (62.5)	7 (100)	5 (100)	2 (100)	82 (85.4)
Rural	2 (8.3)	6 (33.3)	2 (12.5)	0 (0.0)	3 (37.5)	0 (0.0)	0 (0.0)	0 (0.0)	13 (13.5)
Missing	1 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)
Workplace									
Hospital	12 (50.0)	13 (72.2)	9 (56.3)	14 (87.5)	1 (12.5)	4 (57.1)	4 (80.0)	0 (0.0)	57 (9.4)
Outpatient	5 (20.8)	0 (0.0)	1 (6.3)	1 (6.3)	1 (12.5)	1 (14.3)	1 (20.0)	0 (0.0)	10 (10.4)
Clinic	2 (8.3)	3 (16.7)	4 (25.0)	1 (6.3)	4 (50.0)	2 (28.6)	0 (0.0)	0 (0.0)	16 (16.7)
Homecare	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (50.0)	1 (1.0)
Community Centre	4 (16.7)	0 (0.0)	1 (6.3)	0 (0.0)	1 (12.5)	0 (0.0)	0 (0.0)	1 (50.0)	7 (7.3)
Cardiac Rehab	0 (0.0)	1 (5.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)
Unspecified Rehab	0 (0.0)	1 (5.6)	1 (6.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (2.1)
Home	1 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)	1 (12.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)
Years' Experience with AF									
Never	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (12.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)
< 1	0 (0.0)	0 (0.0)	0 (0.0)	1 (6.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)
1 to 5	6 (25.0)	5 (27.8)	3 (18.8)	5 (31.3)	1 (12.5)	2 (28.6)	0 (0.0)	1 (50.0)	23 (24.0)
6 to 10	6 (25.0)	1 (5.6)	2 (12.5)	4 (25.0)	2 (25.0)	1 (14.3)	2 (40.0)	0 (0.0)	18 (18.8)
11 to 15	3 (12.5)	3 (16.7)	4 (25.0)	0 (0.0)	2 (25.0)	0 (0.0)	0 (0.0)	0 (0.0)	12 (12.5)
15 to 20	5 (20.8)	4 (22.2)	5 (31.3)	3 (18.8)	1 (12.5)	1 (14.3)	0 (0.0)	1 (50.0)	20 (20.8)

20+	3 (12.5)	5 (27.8)	2 (12.5)	3 (18.8)	1 (12.5)	3 (42.9)	3 (60.0)	0 (0.0)	20 (20.8)
Missing	1 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.0)

AB: Alberta; BC: British Columbia; EP: exercise physiologist; KIN: kinesiologist; MB: Manitoba; MD: medical doctor/physician; NB: New Brunswick; NS: Nova Scotia; NP: nurse practitioner; OT: occupational therapist; ON: Ontario; PT: physiotherapist; QC; Quebec; RN: registered nurse; SK: Saskatchewan; YT: Yukon.

A total of 69 (87%) of HCPs reported prescribing exercise to their patients with AF (Figure 3.2). Significantly fewer registered nurses reported prescribing exercise to patients with AF than physiotherapists, exercise physiologists, and kinesiologists (Table 3.2; χ^2=34.03, overall chi-square p<0.001). All (100%) HCPs believed that exercise should be included in AF management and, therefore, there were no differences between provider types.

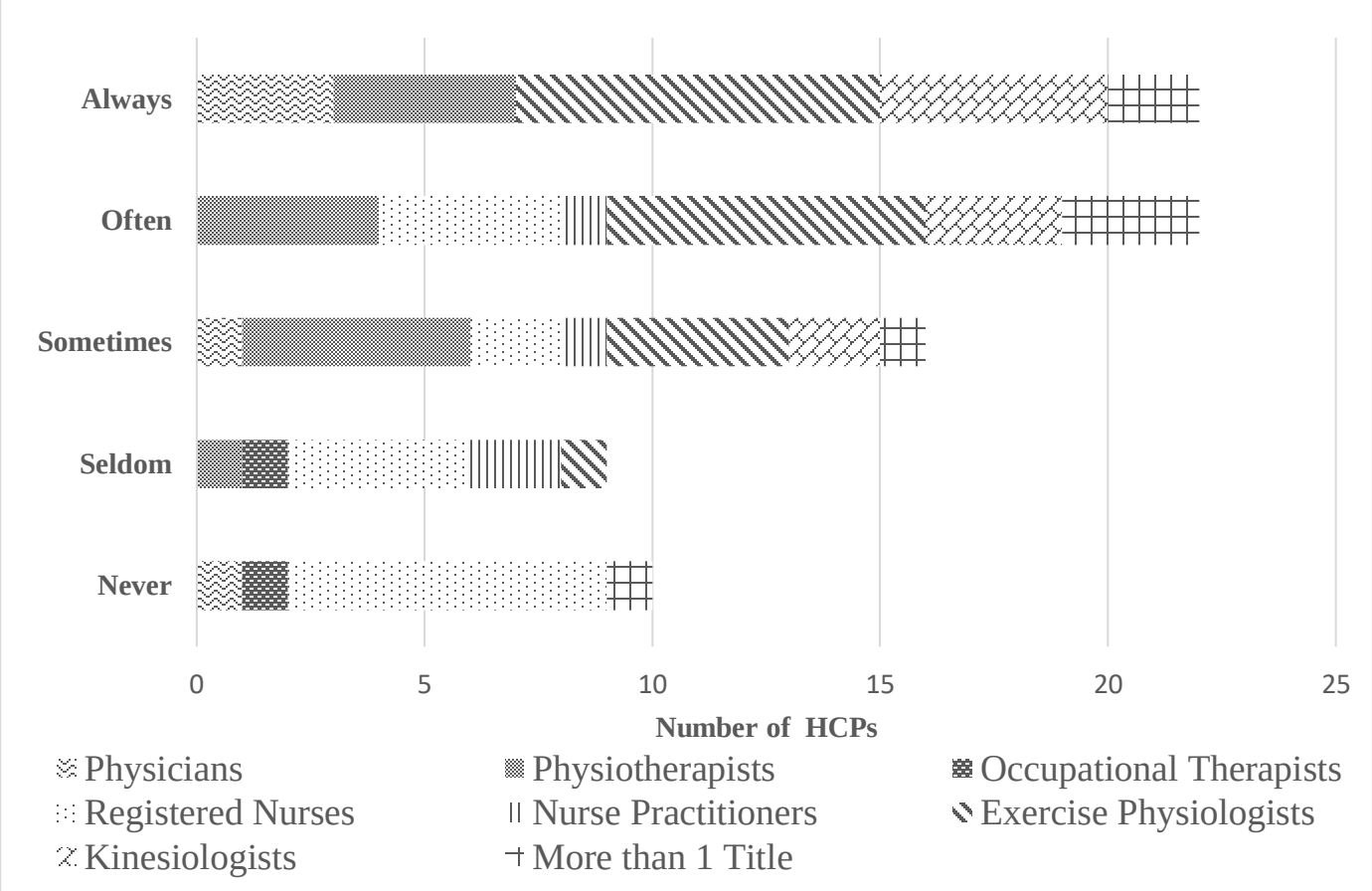

Figure 3.2: Self-reported HCP exercise prescription frequency for patients with AF. HCP, healthcare providers.

Table 3.2 displays differences between HCPs in exercise prescription frequency for patients with AF, confidence in prescribing exercise for patients with AF, identification of the 2020 CCS AF exercise targets, and exercise prescription training. Just over half (54.4%) of HCPs reported being at least slightly confident in prescribing exercise to patients with AF (Table 3.2). Significantly more physicians reported being fairly confident than physiotherapists and registered nurses (χ^2=43.14, overall chi-square p=0.002). All HCPs believed that exercise physiology should be included in the management of AF. When comparing confidence levels in prescribing exercise between AF and coronary artery disease patients (CAD), response of fairly confident and completely confident levels increased by 28.9%.

Nurses were significantly less likely than HCPs with more than one title to report ≥200 minutes as the aerobic exercise target (χ^2=38.42, p=0.042). There was no difference between HCPs in their knowledge of the CCS AF guidelines resistance (2-3 day per week) and flexibility targets (≥2 days per week) as shown in Table 3.2 (resistance: p=0.117, flexibility: p=0.262). There were 5 participants who identified the CCS as the organization for AF exercise targets, but did not identify the ≥200 minutes of aerobic activity weekly. An additional 5 participants recalled all 2020 CCS exercise targets, but did not identify the CCS as the authoritative organization. HCPs (14: 5 physiotherapists, 3 nurse practitioners, 2 with more than one title, 2 exercise physiologists, 1 registered nurse and 1 kinesiologist) correctly identified all 2020 CCS exercise targets including the CCS as the organization from which they originate. **Appendix 6** shows the nurse practitioner and occupational therapist responses, as they were not included in the analyses as there were less than five responses each. The types of exercise prescription training reported are detailed in **Appendix 7**.

Table 3.2: Differences in exercise prescription frequency, confidence, training, and identification between healthcare provider groups

Category	Scale	EP n (%)	RN n (%)	Kin n (%)	PT n (%)	More than 1 title n (%)	MD n (%)	$\chi 2$	P-value
Exercise Prescription Frequency	never	0 (0.0)[b]	7 (41.7)[a]	0 (0.0)	0 (0.0)	1 (14.3)	1 (20.0)	37.37	0.011*
	seldom	1 (5.0)	4 (23.5)	0 (0.0)	1 (7.1)	0 (0.0)	0 (0.0)		
	sometimes	4 (20.0)	2 (11.8)	2 (20.0)	5 (35.7)	1 (14.3)	1 (20.0)		
	often	7 (35.0)	4 (23.5)	3 (30.0)	4 (28.6)	3 (42.9)	0 (0.0)		
	always	8 (40.0)[a]	0 (0.0)[b]	5 (50.0)[a]	4 (28.6)	2 (28.6)	3 (60.0)[a]		
Confidence Prescribing Exercise for AF	not at all	0 (0.0)	4 (23.5)	0 (0.0)	0 (0.0)	1 (14.3)	0 (0.0)	43.14	0.002*
	slightly	1 (5.0)	6 (35.3)	0 (0.0)	3 (21.4)	0 (0.0)	0 (0.0)		
	somewhat	3 (15.0)	4 (23.5)	1 (10.0)	6 (42.9)	1 (14.3)	0 (0.0)		
	fairly	7 (35.5)	1 (5.9)[b]	5 (50.0)	1 (7.1)[b]	2 (28.6)	4 (80.0)[a]		
	completely	9 (45.0)	2 (11.8)	4 (4.0)	4 (28.6)	3 (42.9)	1 (20.0)		
Confidence Prescribing Exercise for CAD	not at all	0 (0.0)	2 (11.8)	0 (0.0)	0 (0.0)	1 (14.3)	0 (0.0)	27.49	0.122
	slightly	0 (0.0)	3 (17.6)	0 (0.0)	1 (7.1)	0 (0.0)	0 (0.0)		
	somewhat	0 (0.0)	2 (11.8)	1 (10.0)	1 (7.1)	0 (0.0)	0 (0.0)		
	fairly	8 (40.0)	7 (41.7)	2 (20.0)	5 (35.7)	1 (14.3)	4 (80.0)[a]		
	completely	12 (60.0)	3 (17.6)	7 (70.0)	7 (50.0)	5 (71.4)	1 (20.0)		
Exercise Prescription Training	yes	19 (95.0)[a,c]	2 (11.8)[b]	9 (90.0) [a,c]	11 (78.6)[c]	5 (71.4)	3 (60.0)	24.03	<0.001 *
	no	1 (5.0)	15 (88.2)	1 (10.0)	3 (21.4)	2 (28.6)	2 (40.0)		
Identification of 2020 CCS AF aerobic targets	100 minutes	0 (0.0)	1 (5.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	38.42	0.042*
	150 minutes	18 (90.0)	10 (58.8)	7 (70.0)	7 (50.0)	3 (42.9)	4 (80.0)		
	200 minutes	2 (10.0)	0 (0.0)[b]	2 (20.0)	5 (35.7)	4 (57.1)[a]	1 (20.0)		
	250 minutes	0 (0.0)	2 (11.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		
	300 minutes	0 (0.0)	0 (0.0)	1 (10.0)	1 (7.1)	0 (0.0)	0 (0.0)		
	don't know	0 (0.0)	4 (23.5)	0 (0.0)	1 (7.1)	0 (0.0)	0 (0.0)		
Identification of 2020 CCS AF resistance target	2-3 days	19 (95.0)	12 (70.6)	8 (80.0)	13 (92.9)	7 (100)	3 (60.0)	15.44	0.117
	4-5 days	1 (5.0)	1 (5.9)	2 (20.0)	0 (0.0)	0 (0.0)	1 (20.0)		
	don't know	0 (0.0)	4 (23.5)	0 (0.0)	1 (7.1)	0 (0.0)	1 (20.0)		
Identification of 2020 CCS AF flexibility target (65+)	everyday	11 (55.0)	3 (17.6)	5 (50.0)	6 (42.9)	4 (57.1)	2 (40.0)	23.57	0.262
	5 days	2 (10.0)	3 (17.6)	1 (10.0)	1 (7.1)	1 (14.3)	0 (0.0)		
	3 days	3 (15.0)	3 (17.6)	3 (30.0)	3 (21.4)	0 (0.0)	0 (0.0)		
	2 days	2 (10.0)	1 (5.9)	1 (10.0)	3 (21.4)	2 (28.6)	1 (20.0)		

don't know	2 (10.0)	7 (41.2)	0 (0.0)	1 (7.1)	0 (0.0)	2 (40.0)

EP: exercise physiologist; KIN: kinesiologist; MD: medical doctor/physician; NP: nurse practitioner; OT: occupational therapist; PT: physiotherapist; RN: registered nurse; *, <0.05 statistical significance; different superscripts in the same row denotes values that have significant differences between groups ($p<0.005$).

Of the 55 HCPs who reported that they could identify the CCS exercise targets for patients with AF, 22 did so correctly. A total of 60 HCPs could not identify the CCS as the organization that provides the AF exercise targets (Figure 3.3). A total of 51 HCPs incorrectly identified the CCS AF aerobic target of ≥200 minutes per week, and 50 of the respondents incorrectly identified 150 minutes per week.

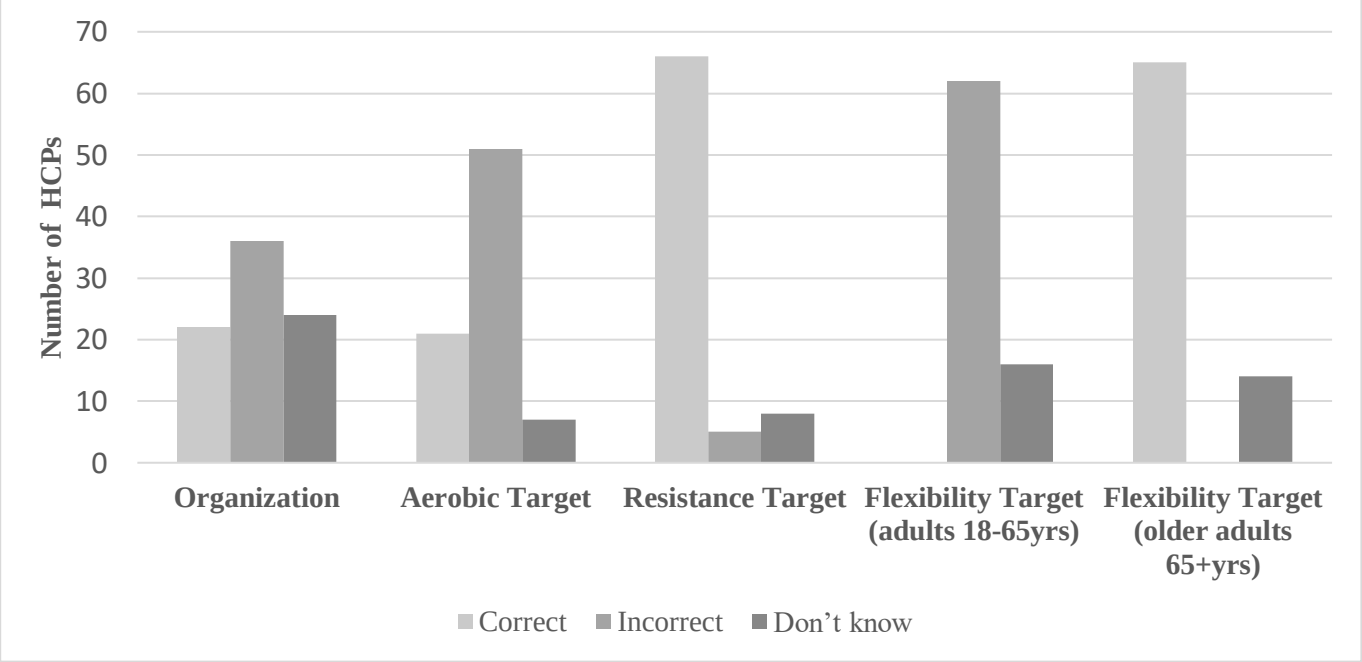

Figure 3.3: Identification of the 2020 Canadian Cardiovascular Society atrial fibrillation exercise targets by healthcare providers. HCPs, healthcare providers.

Figure 3.4 shows that 63% of HCPs reported having exercise prescription training. Registered nurses had significantly less training in exercise prescription than exercise physiologists, kinesiologists, and physicians (χ^2=34.03, overall chi-square p<0.001).

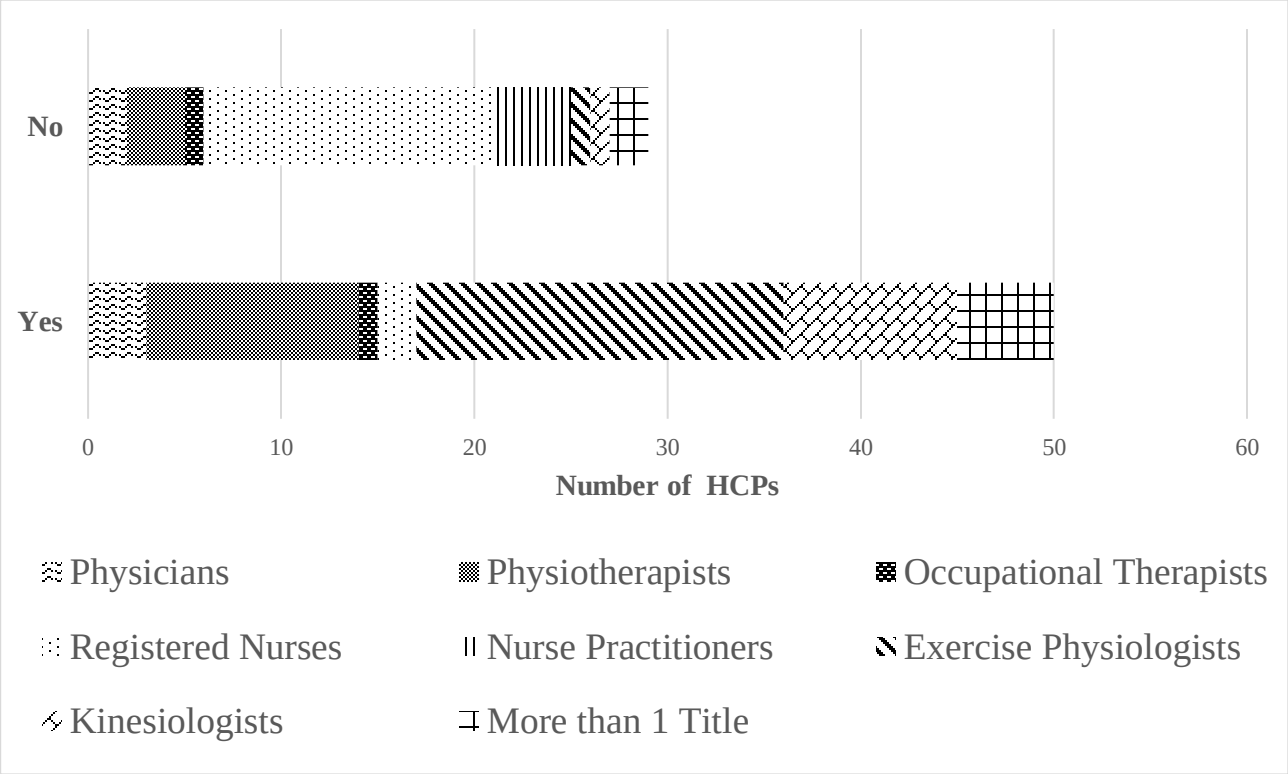

Figure 3.4: HCP self-report training in exercise prescription. HCPs, healthcare providers.

3.4 Discussion

With the inclusion of exercise targets and exercise physiology in the integrated care plan in the 2020 CCS AF guidelines, it is important to know if patients are now receiving this information. This study aimed to examine HCP exercise prescription practices for patients with AF, as well as HCP beliefs on including exercise physiology in AF management, confidence in prescribing exercise, and knowledge of exercise for patients with AF. The primary aim of this study was to determine if HCPs prescribe exercise to their patients with AF; we found that 87% of HCPs self-reported prescribing at least some of the time. We also found that a higher proportion of physicians, exercise physiologists,

and kinesiologists prescribed exercise to patients with AF than nurses. All HCPs believed that exercise physiology should be included in the management of AF. Exercise physiologists, physiotherapists, kinesiologists, and physicians seem to have higher levels of confidence in prescribing exercise to patients with AF. Physicians had more confidence in prescribing than registered nurses. Most (63%) of HCPs reported having exercise prescription training. Exercise physiologists (95%), kinesiologists (90%), and physiotherapists (78.6%) all reported being trained in exercise prescription more than registered nurses (11.8%). Only 22.9% HCPs knew the AF targets were from the CCS, and only 14.6% HCPs correctly identified all three exercise targets from CCS.

Not all HCPs have training (or equal training) in PA and exercise prescription, yet such training might increase PA and exercise prescription rates. In our study 11 of 14 physiotherapists, 19 of 20 exercise physiologists, 9 of 10 kinesiologists, and 3 of 5 physicians self-reported exercise prescription training, which show higher proportions trained than the other HCP types included. University courses and continuing education credits were the most frequently reported sources of training, followed by webinars, certifications (such as ACSM and CSEP), and conferences. In Finland (similar to the Canadian healthcare system), HCPs (physicians and nurses) trained in PA prescription for 6-months demonstrated significant improvements in their "know-how" about health-related counselling. In same study, HCPs (physicians and nurses) started using their PA and exercise prescriptions as a referral to other HCPs (exercise professionals).[95] These findings suggest that training improves PA and exercise discussions in healthcare and may facilitate more multi-disciplinary work; the latter has been shown to improve individual-level patient care[96] and lifestyle factors known to reduce cardiovascular disease risk.[97]

It is plausible that PA and exercise prescription rates are impacted by HCP confidence in prescribing PA and exercises. As shown in Nova Scotia, physicians trained in PA and exercise were 22% more confident performing PA counselling than untrained physicians,[48] indicating that more

training may result in greater confidence in prescribing PA. In a pan-Canadian study, it was found that exercise professionals (i.e., kinesiologists, physiotherapists, and personal trainers) (92 ± 11%) were more confident in providing PA information than physicians (52 ± 25%; $p<0.001$) and nurses (56 ± 24%; $p<0.001$).[98] This suggests that confidence in prescribing PA and exercise can be improved by training and knowledge, which could explain why exercise physiologists and kinesiologists are among the HCP groups reporting higher prescription rates in this study.

HCP knowledge and awareness of guidelines might also impact PA and exercise prescription. Most HCPs in our study were able to correctly identify the 2020 CCS AF flexibility (82.5%) and resistance targets (83.5%), but not the aerobic (26.5%). This is likely due to the 2020 CCS target being ≥200 minutes whereas the recommended CSEP and World Health Organization guidelines for adults and older adults are ≥150 minutes. Less than half (27.8%) of HCPs could identify the CCS as the organization for these exercise targets for those with AF. Exercise physiologists had the most correct answers when identifying the 2020 CCS AF resistance and flexibility exercise targets, but not the aerobic target. Similar to our results, a study of Canadian medical students showed that only 52% could recall the CSEP PA recommendations, despite 70% claiming to know them.[99] Among 529 Brazilian physicians and nurses it was found that 93% were unfamiliar with the current PA recommendations (≥150 minutes/week).[100] The prevalence of regular PA counseling among Brazilian physicians and nurses was 68.9% (with physicians providing counselling more frequently than nurses in the previous 6 months, $p<0.005$).[100] This suggests that not all HCPs are able to identify the guidelines/targets which could impair their ability to prescribe PA and exercise. The inability to identify these targets could also indicate a lack of dissemination or knowledge translation of the guidelines to the HCPs of patients with AF.

HCP beliefs regarding PA and exercise counselling might be barriers that results in absence of PA and exercise counselling from care. Similar to our results that 59% of HCPs often or always

prescribe PA, an observational study including 1,251 primary care providers of patients at risk of cardiovascular disease showed that 57% discussed PA with their most at risk patients.[101] Reported barriers to PA counselling included beliefs about its effectiveness, which was significantly associated with counseling and referral occurrences.[54] All HCPs in our study believed exercise physiology should be included in AF management, and similarly, a systematic review of 19 articles showed that HCPs in primary care believe PA counselling is important and that they have a role in promoting PA.[102] Most HCPs in this systematic review were uncertain about the effectiveness of counselling, and feel uncomfortable providing detailed advice, citing a lack of time, training, and reimbursement as barriers.[102] EIM 1-day workshops for physicians might address some of these barriers as they have been shown to increase physician confidence, knowledge, and PA counselling behaviours of physicians in prescribing PA and exercise.[103] Yet, in Nova Scotia, physicians trained and untrained in PA, had similar exercise prescription rates (12%; $p<0.05$), and reported time and perceived patient interest as their barriers to prescribing.[48] It is therefore unclear if addressing barriers to PA counselling for HCPs will ultimately improve the rate of counselling occurrence.

Despite the acknowledged barriers physicians face with PA prescriptions, they have been shown to be an asset to health clinics in the United States and cause little to no increase in visit length. In the Activity Counseling Trial (ACT) which included HCPs of healthy Americans, it was found that 83% of HCPs spent less than 5-6 minutes providing PA advice, 83% indicated that participation in the study was an asset to their clinics, 63% reported their PA advice resulted in little to no increase in the length of an office visit, and 46% spent 3-4 minutes providing PA advice.[104] It was suggested that training on PA guidelines and application of PA assessment instruments might increase PA counselling if sufficient time is afforded during patient consultations in primary care.[100] This could suggest that physicians may not be prioritizing PA and exercise discussion. It is difficult to determine if lack of prioritization is due to insufficient training in PA and exercise, but it is plausible.

Our study included a wide range of HCPs whose roles may include discussing and recommending PA and exercise. No responses from physician assistants and few from nurse practitioners were collected, so it is difficult to determine how they compare to other HCPs in Canada. In Arizona, USA, it was found that physicians assistants and nurse practitioners reported being knowledgeable and confident in providing PA counselling in primary care (to patients of no specified conditions), and that they routinely counsel patients on PA (94% of nurse practitioners, 76% of physician assistants; $p<0.007$).[105] In Canada more studies are required, but it should be considered there are not as many physician assistants in Canada (n=800, of which 500 reside in Ontario)[106] as in the USA (approximately 140,000 accordingly to reports from the Bureau of Labor Statistics). Our expected response rate from physician assistants was likely overly optimistic and it is possible that other recruitment methods might have produced more responses from physician assistants and nurses in Canada.

This study has several limitations that warrant mention. First, there are limitations to online recruitment, such as convenience sampling from only reaching those with social media and an inability to track non-responders. This recruitment approach was used as it was the most feasible method with the available time and resources to achieve nationwide responses. Second, most respondents of this survey followed the recruitment email send on behalf of the Canadian Association of Cardiovascular Prevention and Rehabilitation (CACPR) to its members, which could have led to confusion identifying the AF exercise target organization or caused a potential bias by targeting a HCP population that might be more familiar with PA and AF. CCS guidelines are more targeted at physicians for overall disease management (e.g., medications, procedures), whereas CACPR guidelines are targeted at HCPs involved in prevention and rehabilitation which often includes lifestyle changes (such as increasing PA levels). Third, there was a lack of equal representation among HCP groups and no physician assistants completed the survey. Finally, the generalizability of this study is limited by the few number of HCP

types who completed the survey. The scope of each professional and their ability to know all guidelines on all topics (e.g., physical activity, medications, treatments, etc.) for all conditions which they provide care (e.g., AF, heart failure, coronary artery disease) may have affected the respondents' ability to recall the exercise targets. Further, many respondents were exercise physiologists and/or kinesiologists which likely inflated the overall percent of HCPs who prescribed exercise to patients. It is also possible that the respondents had a vested interest in the topic, which could be why they chose to participate, and therefore could have more training in exercise then would be considered the 'norm'. This study could have been strengthened by including a HCP sex-difference analyses with the responses, if there had been a more equal distribution of HCPs in each group.

In conclusion, this study demonstrated that 87% of HCPs self-reported prescribing PA at least some of the time. Physicians, exercise physiologists, and kinesiologists prescribed PA more frequently to patients with AF. All HCPs believed that exercise should be included in AF management. Exercise physiologists, physicians, and kinesiologists reported more confidence and training in exercise prescription. Future research should focus on the dissemination of the CCS AF guidelines. Specifically, defining the roles of each HCP and establishing a PA and exercise referral network for patients with AF, creating an AF specific PA counseling or prescription method, and determining physician sex-differences in PA and exercise counseling for AF and other conditions.

Chapter 4: Conclusion

The 2020 Canadian Cardiovascular Society (CCS)/Canadian Heart Rhythm Society Comprehensive Guidelines for the Management of Atrial Fibrillation (AF) recognizes the importance of exercise physiology in AF management, as demonstrated by the inclusion of exercise targets for patients and including exercise physiology as part of the interdisciplinary care approach. This thesis aimed to explore the implementation of the exercise recommendations within the 2020 CCS AF guidelines, by surveying (i) patients regarding PA discussion at their AF management visits at a large Canadian cardiovascular centre, and (ii) HCPs regarding their PA prescription practices, beliefs, confidence, knowledge, and training in exercise physiology. It was expected that (i) the patient-reported and EPIC-recorded data would reveal if HCPs were discussing PA and exercise by providing the exercise targets within the 2020 CCS AF guidelines, and (ii) the pan-Canadian survey would establish if HCPs knew these exercise targets and are confident with PA and exercise prescription for patients with AF.

Study 1 found that 48.5% of patients self-reported not discussing PA and exercise with their HCP at the UOHI, and significantly more patients discussed PA with both their UOHI and family physicians than either of these providers alone. Secondarily, in patients meeting the aerobic target of ≥200 minutes, resistance target of 2-3 days per week, or the flexibility target of at least 2 days per week for 10 mins when 65+ years old, at least one PA and exercise discussions was likely to be reported, indicating those meeting guidelines are discussing PA and or exercise with their HCPs. Frequency, time, and type recommendations were more frequently provided by family physicians than UOHI physicians, and when provided, there was a range of responses (most common *frequencies* reported ranged between 3-7 days per week; *intensity* recommended was mostly moderate; about half the *time* recommendations were below the target minutes per week of MVPA; and the most common *type* of activity was walking). Females more often than males were recommended a frequency to exercise, and

a referral to exercise professionals or programs from UOHI physicians, but no sex-difference was found for family physicians or other HCPs who discussed PA and exercise.

Study 2 found that 87% of HCPs self-reported prescribing at least some of the time. Physicians (60%), kinesiologists (50%), and exercise physiologists (40%) reported a higher frequency of PA prescriptions than registered nurses. All HCPs believed that exercise physiology should be included in AF management. More physicians (80%) reported being fairly confident prescribing exercise to patients with AF than physiotherapists (7%) and registered nurses (6%). Exercise physiologists (95%), kinesiologists (90%), and physiotherapists (78.6%) all reported being trained in exercise prescription more than registered nurses (11.8%). Only 22 of 96 HCPs knew the AF targets were from the CCS, and only 14 HCPs correctly identified all three exercise targets from CCS.

This thesis demonstrates that more HCPs (87%; study 2) reported prescribing PA and exercise to patients with AF than the number of patients (52%; study 1) who reported having discussed or being provided with an exercise prescription (FITT principle) by their HCPs. This discrepancy could be due to the different HCP types included in study 2 when compared to study 1, or the larger sample of study 1 compared to study 2 (study 1: 127 completed; study 2: 96 completed). It could also be due to social-desirability bias with the HCP survey leading to over reporting, a biased sample (the respondents may be more interested or invested in the topic), or unclear messaging from HCP to patients. HCPs may have discussed PA and exercise, but patients forgot or did not fully comprehend the information. Further, we were unable to verify responses referring to family physicians in Study 1 given the study design and no access to medical records outside of the UOHI. This thesis also highlights the low levels of referral to exercise professionals or programs, inconsistent exercise prescription details (FITT principles), and a lack of knowledge regarding the appropriate prescription to provide to patients with AF. This stresses the importance of greater dissemination of the 2020 CCS AF guidelines to HCPs who care for patients with AF. Patients meeting any of the AF exercise targets are likely to have discussed

PA and exercise with a HCP, again emphasizing the importance of HCPs discussing PA and relaying the most current exercise targets for patients with AF.

These data collected as part of this thesis suggests that at the UOHI, patients are asked about their PA levels or advised on modifying their risk-factors more frequently than they are being provided a PA or exercise prescription. A previous study reports that patients perceive a PA and or exercise prescription as more serious than a HCP merely asking about their PA levels or answering their questions on PA.[107] Patients have expressed that receiving exercise counselling and follow-up are important aspects of PA and exercise prescriptions (as they report interest in increasing their PA, but do not think they are able to do so completely on their own).[107] Without follow-up from a HCP (which patients have perceived as a lack of HCP interest) patients report being less likely to continue with the PA prescription long term.[107] HCPs regularly asking patients with AF if they are reaching the 2020 CCS AF targets could be an appropriate gateway into a PA and exercise discussion while simultaneously displaying interest in the patients commitment to PA and exercise. It could also provide an opportunity for referral to exercise professionals should the patient need more in-depth information or specific help adapting exercises and reaching the exercise targets.

This thesis suggests that exercise physiologists, physicians, and kinesiologists self-report more confidence and training in exercise prescriptions than other healthcare providers. HCP confidence in exercise prescription has been shown to improve through training,[103] and may also be influenced by their personal health behaviours (e.g., HCPs who have lower BMI or higher PA levels are more likely to prescribe).[108] In Nova Scotia, physicians in primary care trained in exercise prescription reported higher confidence in prescribing than un-trained physicians.[48] A study of Canadian medical students reveled that the students engaging in strenuous PA was a strong predictor of frequency of PA recommendations to patients.[99] Training and confidence could be why exercise physiologists, physicians, and kinesiologists more frequently prescribed than the other HCPs in our studies.

This thesis also suggests that exercise physiologists, physicians, and kinesiologists self-report more frequently giving exercise prescriptions than other healthcare providers. Both studies in this thesis demonstrate similar rates of discussion and prescription from physicians and HCPs. The prescription rates of exercise physiologists and kinesiologist were not directly measured in the first study due to them not always being employed within the Canadian cardiovascular centre setting. Not being employed within the cardiovascular care setting could lead to the low referral rates (e.g., harder for physicians to find them and therefore to refer to them). Patients report difficulty making first contact with an exercise counsellor, and if there is not a direct referral/collaboration from the prescriber, the patient is less likely to seek help.[107] No study to our knowledge has determined reasons for low referral rates to exercise professionals or programs and if physicians have difficulty finding professionals or programs to refer to. However, it has been shown by Ryan et al.[89] that there is a lack of understanding among physicians on the roles of an exercise professional is the Canadian healthcare system. In a study of 1251 primary care providers of patients at risk-of cardiovascular disease, 14% referred to behaviour-change counselling, and 8% both referred and discussed PA with their patients.[101] This demonstrates that the current system (primarily physicians discussing PA) requires improvements and based on the findings of this thesis more accessible exercise physiologists and kinesiologist may be a logical and appropriate solution.

Much confusion arises when it comes to the roles of exercise professionals, their education or regulation, and exactly what they offer to the Canadian healthcare system,[89] despite the growing literature suggesting it is time for more structured and consistent integration. Part of the confusion could be the varying titles exercise professionals hold within research and healthcare teams (e.g., health counselor, exercise therapist, exercise physiologist, kinesiologist, health educator, exercise specialist, etc.), and the vast array of certifications one can obtain, which makes it more difficult to determine the differences between them. Other countries have started to integrate these health professionals in

primary care teams,[86] and research in Canada has shown their inclusion in exercise counseling and prescription significantly increases PA levels of patients in primary care.[109] Strides for a healthcare system that includes exercise professionals under government plans and creates access to these services consistently in primary and secondary care is needed. It has been suggested that the exercise physiologist education be extended into a professional degree model (similar to a medical school approach) to define and create a higher standard of training and make exercise physiologists better practitioners with clearer roles, and education expectations.[110] This could alleviate the concern that kinesiologists might not be ready to provide PA counselling given the minimal cognitive and behaviour change theory they are taught in undergraduate degrees.[111] The Canadian Association of Cardiac Prevention and Rehabilitation (CACPR) has tried to define the roles of physical activity and exercise professionals in CR programs (i.e., Health Educator – to assist, coordinate and conduct patient and family education as it relates to behaviour change to enhance cardiovascular health, and Exercise Therapist – to develop exercise prescriptions and programs, and provide exercise session, motivational support, risk-factor management support, and exercise testing).[112] Nonetheless, exercise professionals, regardless of title, are all trained professionals steadily told through their certifying bodies to stay within the scope of each certification that they hold and refer to other health professions as needed. Exercise professionals have a passion for movement, but also a desire to help others improve their health. This is the goal of all HCPs.

From these thesis studies it remains unclear: (i) if there are HCP sex-differences in PA and exercise prescriptions for AF patients; (ii) the frequency of all A's of the 5 A's model being completed by HCPs of AF patients; (iii) if HCPs in Canadian cardiovascular centres are trained in the 5'As model; (iv) and why some HCPs are prescribing PA and exercise and others are not. This should be considered in future research, as well as focusing on: (i) a comprehensive AF-specific PA counselling model (for all HCPs, including training on the model); (ii) improving uptake of PA and exercise training by all

HCPs (e.g., training on prescriptions and counselling models) (iii) creating a sound interdisciplinary health approach for patients with AF; (iv) forming well-defined referral practices for AF patients; (v) and improving awareness and dissemination of the current 2020 CCS AF guideline exercise targets to HCPs. Integrating a model considering these issues might address the lack of knowledge HCPs have of the exercise targets within the 2020 CCS AF guidelines and improve future PA and exercise guideline awareness and dissemination, which in turn could increase implementation by HCPs and improve the care that patients receive.

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Appendix 1: Patient Questionnaire

Healthcare Provider-to-Patient Guidance and Discussion Regarding Physical Activity Questionnaire

Thank you for agreeing to take the survey and participate in our research study. We would like to remind you that your participation is voluntary, and you are not obligated to answer questions that make you uncomfortable. We appreciate your time and answers.

The main purpose of this study is to evaluate the clinician-to-patient guidance and discussions regarding physical activity and exercise. We are also interested in seeing if patient physical activity levels, patient sex and patient gender impact the frequency and/or content of clinician-to-patient guidance and discussions regarding physical activity and exercise.

Instructions

For questions with a check box, please tick the most appropriate response that applies to you. There are no right or wrong answers. We only want your opinion.

For questions that read "*must provide value", an answer must be provided, or the survey will not let you continue.

PLEASE NOTE: the questionnaire must be completed in one sitting, otherwise all data will be lost. If you change your mind about participating while completing the questionnaire, exit program.

If you have any questions, technical issues, or concerns with the survey please contact Katie Comeau at _____@ottawaheart.ca or 613-696-7000 ext. _____.

If you have any questions regarding your rights as a participant, you can contact the Research Ethics Board at rebadministration@ohri.ca (reference REB#20220151-01H).

Thank you in advance for your participation.

1. Please provide the **Study ID** you were provided within the email with the link to this survey.
   _____

2. Which type of atrial fibrillation have you been diagnosed with?
   a. Paroxysmal
   b. Persistent
   c. Long-standing Persistent
   d. Permanent
   e. Prefer not to answer
   f. I don't know

3. How long ago were you diagnosed with atrial fibrillation?
   a. 0-1 year
   b. 1-3 years
   c. 3-5 years

d. 5-7 years
e. 7-9 years
f. 9+ years
g. Prefer not to answer
h. I don't know

4. Please indicate if you have been diagnosed with any of the following cardiovascular conditions in addition to your atrial fibrillation. Please check all that apply.
   - □ Angina
   - □ Congenital Heart Disease
   - □ Coronary Artery Disease
   - □ Heart Attack
   - □ Heart Failure
   - □ Valve Disease
   - □ Rheumatic Heart disease
   - □ Stroke
   - □ Venous Thromboembolism (blood clots in leg, groin, or arm)
   - □ Transient Ischemic Attack (mini stroke)
   - □ Spontaneous Coronary Artery Dissection (SCAD)
   - □ Aortic Dissection
   - □ Other

   If other, please specify below:
_____

5. Please indicate if you have been diagnosed with any of the following conditions. Please check all that apply.
   - □ High Blood Pressure
   - □ High Blood Sugar/pre-diabetes
   - □ Type 1 Diabetes
   - □ Type 2 Diabetes
   - □ Chronic Kidney Disease
   - □ High Cholesterol
   - □ Chest Pain
   - □ Overweight/Obese
   - □ Sleep Apnea
   - □ Chronic Obstructive Pulmonary Disease (COPD)
   - □ Rheumatic Fever
   - □ Anxiety
   - □ Depression
   - □ Other

   If other, please specify below:
   _____

6. What is your current body mass? Please indicate in kilograms (kg):

_____kg

□ Prefer not to answer

7. What is your height? Please indicate in centimeters (cm):
   _____ cm

   □ Prefer not to answer

8. What is your marital status?
   a. Single
   b. Married or equivalent (i.e., common law)
   c. Separated or equivalent
   d. Widowed
   e. Prefer not to answer

Physical Activity and Exercise

Physical Activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure. Examples: walking to work, household chores, yard work.
Exercise is a subcategory of physical activity that is planned, structured, repetitive with the objective of improving one or more components of physical fitness. Examples: regular exercise classes, weight training, aerobics classes, high-intensity interval training

The below section is directly related to your most recent visit at the University of Ottawa Heart Institute and is asking about discussions you may have had with your physician there.

9. Did your physician discuss physical activity or exercise with you during your most recent visit at the Ottawa Heart Institute?
   a. Yes
   b. No
   c. Prefer not to answer

If yes, please answer 10-15. **If No or Prefer not to answer, please skip to 16**

10. Did your physician at the Ottawa Heart Institute provide recommendations on the **amount of time** per day or per week you should participate in physical activity or exercise?
    a. Yes
    b. No
    c. Prefer not to answer
    d. Don't remember

    If yes, how much time? (in minutes) _____per day or per week

11. Did your physician at the Ottawa Heart Institute provide recommendations on **the type** of physical activity or exercise you should participate in?
    a. Yes
    b. No
    c. Prefer not to answer

d. Don't remember

If yes, which types? i) walking ii) cycling iii) dancing iv) swimming v) resistance training vi) running vii) other _____

12. Did your physician at the Ottawa Heart Institute provide recommendations on **how often** you should participate in physical activity or exercise?
    a. Yes
    b. No
    c. Prefer not to answer
    d. Don't remember

    If yes, how often? _____days/ week

13. Did your physician at the Ottawa Heart Institute provide recommendations on **how hard** (or intense) your physical activity or exercise should be? (e.g., light-easy, moderate-challenging but not hard, vigorous-hard)
    a. Yes
    b. No
    c. Prefer not to answer
    d. Don't remember
    e.

    If yes, how intense? i) low ii) moderate iii) vigorous iv) other

    If other, please specify:_____

14. Did your physician at the Ottawa Heart Institute refer you to an exercise specialist, cardiac rehabilitation program or community-based exercise program? (e.g., HeartWise, Kinesiologist, group classes at a fitness centre)
    a. Yes
    b. No
    c. Prefer not to answer
    d. Don't remember

    If yes, which program or specialist? _____

15. Did your **family** physician discuss physical activity or exercise with you at any time in the past?
    a. Yes
    b. No
    c. Prefer not to answer
    d. I don't have a family physician

    If yes, please answer 16-20. **If No or Prefer not to answer, please skip to 21**

16. Did your **family** physician provide recommendations on the **amount of time** per day or per week you should participate in physical activity or exercise?
    a. Yes
    b. No

c. Prefer not to answer
d. Don't remember

If yes, how much time? (in minutes) _____per day or per week

17. Did your **family** physician provide recommendations on **the type** of physical activity or exercise you should participate in?
    a. Yes
    b. No
    c. Prefer not to answer
    d. Don't remember

    If yes, which types? i) walking ii) cycling iii) dancing iv) swimming v) resistance training vi) running vii) other _____

18. Did your **family** physician provide recommendations on **how often** you should participate in physical activity or exercise?
    a. Yes
    b. No
    c. Prefer not to answer
    d. Don't remember

    If yes, how often? _____ days/ week

19. Did your **family** physician provide recommendations on **how hard** (or intense) your physical activity or exercise should be? (e.g., light-easy, moderate-challenging but not hard, vigorous-hard)
    a. Yes
    b. No
    c. Prefer not to answer
    d. Don't remember

    If yes, how intense? i) low ii) moderate iii) vigorous iv) other

    If other, please specify:_____

20. Did your **family** physician refer you to an exercise specialist, cardiac rehabilitation program or community-based exercise program? (e.g., HeartWise, Kinesiologist, group classes at a fitness centre)
    e. Yes
    f. No
    g. Prefer not to answer
    h. Don't remember

    If yes, which program or specialist? _____

21. Did any other healthcare provider, besides your physician at the University of Ottawa Heart Institute physician, discuss physical activity with you at any time in the past?
    a. Yes

i) Nurse ii) Physiotherapist iii) Occupational Therapist iv) Kinesiologist v) Other _____ v) Don't know vi) have not seen any other providers

b. No
c. Prefer not to answer

If yes, please answer 22-26. **If No or Prefer not to answer, please skip to Question 27**

22. Did your healthcare provider give recommendations on the **amount of time** per day or per week you should participate in physical activity or exercise?
    a. Yes
    b. No
    c. Prefer not to answer
    d. Don't remember

    If yes, how much time? (in minutes) _____per day or per week

23. Did your healthcare provider give recommendations on **the type** of physical activity or exercise you should participate in?
    a. Yes
    b. No
    c. Prefer not to answer
    d. Don't remember

    If yes, which types? i) walking ii) cycling iii) dancing iv) swimming v) resistance training vi) running vii) other _____

24. Did your healthcare provider give recommendations on **how often** you should participate in physical activity or exercise?
    a. Yes
    b. No
    c. Prefer not to answer
    d. Don't remember

    If yes, how often? _____ days/ week

25. Did your healthcare provider give recommendations on **how hard** (or intense) your physical activity or exercise should be? (e.g., light-easy, moderate-challenging but not hard, vigorous-hard)
    a. Yes
    b. No
    c. Prefer not to answer
    d. Don't remember

    If yes, how intense? i) low ii) moderate iii) vigorous iv) other
    If other, please specify:_____

26. Did your healthcare provider refer you to an exercise specialist, cardiac rehabilitation program or community-based exercise program? (e.g., HeartWise, Kinesiologist, group classes at a fitness centre)
    a. Yes

b. No
c. Prefer not to answer
d. Don't remember

If yes, which program or specialist? _____

Resistance and Flexibility Training

27. Do you participate in resistance/strength training? (e.g., resistance bands, body weight strengthening exercises, weight machines, dumbbells/kettlebells)
    a. Yes
    b. No

    If yes: How many days a week? _____

    And how long are your sessions? i) 10 minutes or less ii) 11-20 minutes iii) 21-30 minutes iv) 31-40 minutes v) 41-50 minutes vi) 51- 60 minutes vii) 61 or more minutes

28. Do you participate in flexibility training? (e.g., stretching and yoga)
    a. Yes
    b. No

    If yes: How many days a week? _____

    And how long are your sessions? i) 10 minutes or less ii) 11-20 minutes iii) 21-30 minutes iv) 31-40 minutes v) 41-50 minutes vi) 51- 60 minutes vii) 61 or more minutes

<u>Gender-Related Variables</u>

We would like to see if these variables below, that have been shown to be related with gender, have an impact on your physical activity and exercise discussions with healthcare professionals.

29. What is your biological sex?
    a. Male
    b. Female
    c. Intersex
    d. Prefer not to answer

30. What is your gender identity?
    a. Man
    b. Woman
    c. Other
    d. Prefer not to answer

    If other, please specify _____

31. What is your ethnicity?
    a. North American Aboriginal
    b. Other North American
    c. European

d. French
e. Caribbean
f. Latin, Central and South American
g. African
h. Central Asian and Middle Eastern
i. South Asian
j. South East Asian
k. Oceanic
l. Prefer not to answer

32. What is the highest level of education that you completed?
    a. No degree, certificate, or diploma
    b. Completed High School
    c. Some college/university
    d. Completed post secondary school (college/university)
    e. Completed registered apprenticeship/or other trades certificate

33. Which statements describe your current work situation? (Please check all that apply)
    a. Currently working
    b. Student
    c. Homemaker
    d. Volunteer
    e. Unemployed, looking for work
    f. Unemployed, not looking for work
    g. On leave of absence
    h. Retired or disabled due to a disease
    i. Other (specify): _____

34. What is your current position? (If no position or prefer not to answer please leave blank)
    _____
    □ Prefer not to answer

35. How many hours per week do you usually work in your position, including paid and unpaid overtime hours? (If no position or prefer not to answer please leave blank)
    _____ Hours per week

36. What is your mode of transport to work?
    a. Car, truck, or van
    b. Public transport
    c. Walked
    d. Bicycle
    e. Other method
    f. I work from home

37. Average daily commute time?
    a. Less than 15 minutes
    b. 15 to 29 minutes
    c. 30 to 44 minutes

d. 45 to 59 minutes
e. 60 minutes and over
f. I don't commute to work

38. Do you live with anyone who requires additional care, like a child or sick/elderly partner/parent?
    a. Yes
    b. No

39. For the children or other people living with you, to what level are you directly responsible for caring for them? (circle one number)

no responsibility						total responsibility	NA
0	1	2	3	4	5	6	

40. On average, how many hours a week do you usually spend doing housework (e.g., cleaning, cooking, washing, etc.)? _____

41. Are you the primary person responsible for doing housework in your home?
    a. Yes
    b. No

42. About tobacco use: Are you a current tobacco smoker
    a. Daily
    b. Less than daily
    c. non-smoker

43. Is there someone available to you whom you can count on to listen when you need to talk?
    a. Yes
    b. No

44. Are you the primary earner in your house?
    d. Yes
    e. No

45. What range is your gross personal income?
    a. Less than 15,000
    b. 15,000 to 29,999
    c. 30,000 to 49,999
    d. 50,000 to 69,999
    e. 70,000 to 99,999
    f. 100,000 to 150,000
    g. 150,00 to 200,000
    h. Do not know
    i. Prefer not to answer

Thank you for completing the survey and participating in our study!

If you have any feedback that you would like to share about your experience in the study to help us improve, please leave it below.

_____

_____

If you have any feedback for the physicians at the University of Ottawa Heart Institute to help improve their delivery of care to better meet your needs, please leave it below. Feedback will be provided to physicians in generic terms and will not include your identity.

_____

Appendix 2: Resistance and Flexibility Self-Report Participation from Chapter 2: Study 1

Activity	Resistance	Flexibility
Do you participate in…		
Yes, n (%)	36 (20.8)	30 (17.3)
No, n (%)	63 (36.8)	69 (40.4)
Length of session in minutes (if patient participates)		
10 or less, n (%)	1 (0.6)	6 (3.5)
11-20, n (%)	8 (4.6)	9 (5.3)
21-30, n (%)	7 (4.0)	7 (4.0)
31-40, n (%)	5 (2.9)	4 (2.3)
41-50, n (%)	5 (2.9)	0 (0.0)
51-60, n (%)	7 (4.0)	4 (2.3)
60+, n (%)	2 (1.2)	0 (0.0)
Frequency of patient participation in days per week		
1 or less, n (%)	3 (6.8)	2 (6.3)
2-3, n (%)	23 (52.3)	17 (53.1)
4-5, n (%)	13 (29.5)	5 (15.6)
6-7, n (%)	5 (11.4)	8 (25.0)

Appendix 3: Additional information on the other HCPs from Chapter 2: Study 1

FITT Principle Components	Yes [N (%)]	No [N (%)]	Prefer not to answer or I don't remember [N (%)]
Discussed how often (frequency)	21 (12.3)	11 (6.4)	3 (1.8)
Discussed how hard (intensity)	22 (12.9)	12 (7.0)	2 (1.2)
Discussed time	16 (9.4)	16 (9.4)	3 (1.8)
Discussed type	21 (12.3)	13 (7.6)	2 (1.2)

Other HCP type	Frequency Reported (n)
Nurse	7
Physiotherapist	12
Occupational Therapist	3
Kinesiologist	1
Bariatric Specialist	1
Weight Loss Clinic	1
Cardiologist	3
Chiropractor	1
Nutritionist	1
Cholesterol Specialist	1
Family doctor	3
I don’t know	1
I have not seen any others	1

Appendix 4: FITT Components Reported by Patients in Chapter 2: Study 1

FITT Component		UOHI physician (N)	Family physician (N)	Other HCP (N)
Frequency (days)	0	0	1	0
	3	3	4	4
	4	1	1	3
	5	2	4	4
	6	1	2	2
	7	6	8	7
Intensity		2 low	4 low	5 low
		10 moderate	9 moderate	18 moderate
		4 whatever is comfortable	2 enough to raise heart rate	1 vigorous
		1 low-moderate	1 moderate with short	1 vigorous in short bouts
		1 3-4mph	vigorous	1 let your body tell you
			1 no intervals	when to stop
			2 gave a specific beats per minute target	
Time (minutes)	None	1	0	0
	<90	0	2	2
	90	1	2	1
	120-180	3	7	5
	200	2	1	0
	210	4	4	3
	250	0	2	1
	400	0	0	1
	420	0	0	2
	720	1	0	0
Type		17 walk	28 walk	18 walk
		3 bike	8 bike	5 bike

	2 swim 1 chores 1 resistance training 1 golf 1 hike	6 swim 1 chores 1 cardio 1 ski 1 yoga 1 kayak 2 resistance training 1 exercise class 1 what you're already doing	3 swim 11 run 1 chores 1 tennis 1 ski 1 stretch 1 leg exercise 1 back exercise 1 rehab exercise 7 resistance training 3 aerobics 1 balance and coordination
Referral	2 cardiovascular rehab 1 heartwise exercise 1 Montfort Orleans HUB 1 Centre de l estrie 1 weight loss clinic	1 physiotherapy	3 cardiovascular rehab 1 heartwise exercise 1 physiotherapy

HCP: healthcare provider; UOHI: University of Ottawa Heart Institute.

Appendix 5: HCP Survey

Exercise Physiology in the Canadian Healthcare System Survey

Principal Investigator: Dr. Jennifer Reed, RKin, PhD OHSN-REB Number: 20220151-01H

INTRODUCTION/DISCLAIMER

You are being asked to participate because you are a healthcare provider within Canada that works with patients that have atrial fibrillation. The main purpose of this study is to assess exercise physiology knowledge and confidence in providing exercise recommendation/prescriptions to patients with atrial fibrillation among the various healthcare providers in Canada.

There are no conflicts of interest to declare related to this study.

WHAT WILL HAPPEN DURING THIS STUDY?

Your participation in this study will require the completion of a survey. The survey asks questions about your exercise physiology knowledge and confidence in recommending/prescribing physical activity to patients with atrial fibrillation. This should take approximately 5-10minutes of your time.

The information you provide is for research purposes only.

VOLUNTARY PARTICIPATION AND WITHDRAWAL:

You do not have to be in this study if you do not want to be. You can choose to end your participation in this research (called withdrawal) at any time without having to provide a reason. This means you can simply close the browser at any time. The survey is anonymous and will not impact your employment.

RISKS AND/OR BENEFITS

Participation involves minimal risk to you. Some of the questions may make you feel uncomfortable.

You may not receive direct benefit from participating in this study. We hope the information learned from this study will help the care of individuals with atrial fibrillation in the future.

PRIVACY/CONFIDENTIATLITY:
The survey is anonymous which means that your answers will not be linked to you in any way.

Communication via e-mail is not absolutely secure if you have questions regarding the study. We do not recommend that you communicate sensitive personal information via e-mail.

If the results of this study are published, your identity will remain anonymous. It is expected that the information collected during this study will be published and presented to the scientific community at meetings and in journals.

COST AND/OR PAYMENT:

You will not be paid for being in this study, nor will there be any cost to you.

RIGHTS OF PARTICIPANTS

You have the right to be informed of the results of this study once the entire study is complete. If you would like to be informed of the results of this study, please let the research team know.

Your rights to privacy are legally protected by federal and provincial laws that require safeguards to ensure that your privacy is respected.

QUESTIONS:

If you have any questions or concerns about taking part in this study, you may contact the co-investigator Katie Comeau at 613-646-7000 ext. _____ or _____@ottawaheart.ca

If you have questions about your rights as a participant or about ethical issues related to this study, you can talk to someone who is not involved in the study at all. Please contact The Ottawa Health Science Network Research Ethics Board, Chairperson at 613-798-5555 extension 16719.

CONSENT
By completing survey your consent to participate is implied. Thank you for participation. We appreciate your time and answers.

PLEASE NOTE: This questionnaire must be completed in one sitting, otherwise all data will be lost. If you change your mind about participating while completing the questionnaire, exit the program.

If you have any questions regarding your rights as a participant, you can contact the Research Ethics Board at rebadministration@ohri.ca (REB#20220151-01H).

Thank you in advance for your participation.

Healthcare Professional Details

1. What type of health care professional are you?

a) Physician

b) Physician Assistant

c) Registered Physiotherapist

d) Registered Occupational Therapist

e) Registered Nurse

f) Nurse Practitioner

g) Certified Exercise Physiologist

h) Registered or Certified Kinesiologist

i) None

j) I hold more than one of these titles

_____

2. Sex
    a. Male
    b. Female
    c. Intersex
    d. Prefer not to answer
3. What postal code do you practice in?

    _____

4. Workplace setting (e.g., hospital, clinic, fitness centre)

    _____

Atrial Fibrillation (AF) Experience

5. How many years have you been involved in patient care for people with atrial fibrillation?
    a. Never
    b. < 1 year
    c. 1 to 5 years
    d. 6 to 10 years
    e. 11 to 15 years
    f. 15 to 20 years
    g. 20+ years

Knowledge of Exercise for AF

6. Do you know what exercise guidelines to provide for patients with AF?
    a. Yes If yes: (i) Canadian Cardiovascular Society - CCS (ii) Canadian Society of Exercise Physiology - CSEP (iii) American College of Sports Medicine - ACSM (iv) Canadian Association of Cardiac Prevention and Rehabilitation - CACPR (v) other _____
    b. No
7. How much moderate to vigorous physical activity is recommended for patients with AF (18+ years) per week?
    a. <100 minutes
    b. 100 minutes
    c. 150 minutes
    d. 200 minutes
    e. 250 minutes
    f. 300 minutes
    g. I don't know
8. How often should patients with AF (18+ years) engage in resistance training per week?
    a. never
    b. 1 day
    c. 2-3 days
    d. 4-5 days
    e. 6-7 days
    f. I don't know
9. How often should adult (18-64 years) patients with AF engage in flexibility training per week?

a. 5 days

b. 4 days

c. 3 days,

d. 2 days

e. 1 days

f. I don't know

10. How often should older adults (65+ years) patients with AF engage in flexibility training per week?

a. everyday

b. 5 days

c. 4 days

d. 3 days

e. 2 days

f. I don't know

11. Do you think physical activity or exercise should be a part of a management plan for a patient with atrial fibrillation?

a. Yes

b. No

c. I don't know

Exercise Physiology Training and Confidence in Exercise Prescriptions

12. Have you received any formal training on exercise prescriptions? (e.g., webinar, conference, continuing education credits, certification, university/college courses, etc.)

a. Yes If yes, what type and when _____

b. No

13. How often do you prescribe physical activity or exercise to patients with atrial fibrillation?

Never	Seldom	Sometimes	Often	Always
1	2	3	4	5

14. How confident are you recommending or prescribing exercise to patients with AF?

Not at all Confident			Moderately Confident			Completely Confident
1	2	3	4	5	6	7

15. Do you feel confident recommending or prescribing exercise to patients with other cardiovascular conditions/diseases such as coronary artery disease?

Not at all Confident			Moderately Confident			Completely Confident
1	2	3	4	5	6	7

Thank you very much for completing the survey! If you have any comments or notes, please use the test box below.

Appendix 6: Nurse Practitioner and Occupational Therapist Answers from Chapter 3: Study 2

Category	Scale	Nurse practitioner (N%) n=4	Occupational therapist (N%) n=2
Exercise Prescription Frequency	never	0	1
	seldom	2	1
	sometimes	1	0
	often	1	0
	always	0	0
Confidence Prescribing Exercise for AF	not at all	1	1
	slightly	0	0
	somewhat	3	1
	fairly	0	0
	completely	0	0
Identification of 2020 CCS AF aerobic targets	100 minutes	0	0
	150 minutes	0	1
	200 minutes	3	0
	250 minutes	0	0
	300 minutes	0	0
	I don't know	1	1
Identification of 2020 CCS AF resistance target	2-3 days	3	1
	4-5 days	0	0
	I don't know	1	1
Identification of 2020 CCS AF flexibility target (65+)	everyday	0	0
	5 days	0	0
	3 days	3	0
	2 days	1	1
	I don't know	1	1
Exercise Prescription Training	yes	0	1
	no	4	1

Appendix 7: Exercise Prescription Training Methods Reported in Chapter 3: Study 2

Frequencies of exercise prescription training reported

University Courses – 17

Services from cardiologists – 1

Conferences – 6

Continuing education credits – 7

Certifications (e.g., CSEP, ACSM) – 9

Webinars – 7

All the above examples from survey "(e.g., webinar, conference, continuing education credits, certification, university/college courses, etc.)" - 4

ACSM and CACPR were the most named conferences

ACSM and CSEP were most named certifications

Chi-square analysis ($\chi^2 = 30.8$, $p<0.001$) revealed the physiotherapists gave significantly more training examples than registered nurses, and exercise physiologist gave significantly more training examples than physiotherapists and registered nurses. In addition, significantly more registered nurses did not provide a training example than physiotherapists, exercise physiologists and kinesiologists.

Appendix 8: REB approval letter

Ottawa Health Science Network Research Ethics Board (OHSN-REB) / Conseil d'éthique de la recherche du réseau de science de la santé d'Ottawa (CÉR-RSSO)

Date:	May 19, 2022
Principal Investigator:	Dr. Jennifer Reed, UOHI/OHIRC
Protocol ID:	20220151-01H
Study Title:	Healthcare Provider-Patient Discussions and Guidance on Physical Activity and Exercise among Patients with Atrial Fibrillation: A Master's Thesis
Submission Type:	Initial Application
Review Type:	Delegated
Date of Approval:	May 16, 2022
Study Approval Expiry Date:	May 16, 2023

Dear Dr. Reed,

An **Institutional approval (UOHI) letter is required prior to the conduct of the study** at this site. The institutional approval letter is an indication that you have satisfied ethics, contracts, departmental notifications, as applicable.

Thank you for submitting the above referenced study. The Ottawa Health Science Network Research Ethics Board (OHSN-REB) has reviewed the application and granted approval for your study. This approval is granted until the expiration date noted above. This research study is to be conducted by the investigator noted above.

The **OHSN-REB ethics approval** is applicable only for the University of Ottawa Heart Institute.

Please upload the corresponding PI/Study Team translated French documents before forty (40) days from the date of this approval letter. Upon receipt, they will be sent to OHRI French Translation Services for verification of accuracy as per OHSN-REB SOP Addendum #701.

Documents Approved:

Document Name	Document Version Date
English Actigraph Information Sheet, version 1	April 2, 2022
English Actigraph Wear Time Diary, no version date	
English Patient Email with Survey Link, version 1	May 9, 2022
English Patient Information Sheet	May 9, 2022
English Patient Survey	May 9, 2022
English Patient Verbal Consent Script	May 9, 2022
English-only HCP Social Media Script, version 1	May 9, 2022
English-only HCP Survey with Implied Consent	May 9, 2022
English-only Healthcare Provider Organization - Template Recruitment Email/Newsletter, no version date	
French Actigraph Information Sheet, version 1	June 14, 2019
TALK-AF Protocol	May 9, 2022

No deviations from, or changes to, the protocol should be initiated without prior written approval of an appropriate amendment from the OHSN-REB, except when necessary to eliminate immediate hazard(s) to study participants.

REB members involved in the research project do not participate in the review, discussion or decision.

If the study is to continue beyond the expiry date noted above, a Continuing Review Form must be received by the OHSN-REB on or prior to the full board submission deadline date of the meeting scheduled to occur a minimum of 30 days prior to the study expiry date. If the study has been completed by the expiry noted above, a Study Closure Report must be received by the OHSN-REB.

The OHSN-REB operates in compliance with, and is constituted in accordance with, the requirements of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2); International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use; Integrated Addendum to ICH E6 (R1): Guideline for Good Clinical Practice E6 (R2); Part C, Division 5 of the Food and Drug Regulations; or with the definition in the Interim Order Respecting Clinical Trials for Medical Devices and Drugs Relating to COVID-19; Part 4 of the Natural Health Products Regulations; Part 3 of the Medical Devices Regulations; and the provisions of the Ontario Personal Health Information Protection Act (PHIPA 2004) and its applicable regulations. OHSN-REB is qualified through the CTO REB Qualification Program and is registered with the U.S. Department of Health and Human Services (DHHS) Office for Human Research Protection (OHRP).