Abstract

Objective: To investigate the feasibility of an educational workshop with the provision of practical tools to change the proportion of family physicians in our sample who provided their patients with written physical activity prescriptions.

Design: A pre-post study.

Setting: Abbotsford and Mission, British Columbia.

Participants: 25 family physicians registered with the Abbotsford or Mission Divisions of Family Practice.

Intervention: A three-hour educational workshop for family physicians combined with practical tools to facilitate physical activity prescription. The educational content of the workshop included 1) assessing patients’ physical activity levels, 2) using motivational interviewing techniques to encourage physical activity, and 3) providing written physical activity prescriptions when appropriate. Tools to facilitate physician behaviour changes included a 1) ‘physical activity vital sign’, a measure of patient self-reported physical activity, and 2) copies of the “Exercise Prescription and Referral Tool” designed by the Exercise is Medicine Canadian Taskforce, a written prescription pad for physicians to provide physical activity prescriptions to their patients. Participating physicians completed a bespoke questionnaire before and four weeks after their attendance at the workshop.

Outcome Measures: The feasibility of the intervention was ascertained by assessing changes in the proportion of family physicians who reported providing written physical activity prescriptions.
at four week follow up, compared to baseline. Exploratory outcomes included changes in physicians’ 1) other physical activity prescription behaviours, 2) the perceived importance of various barriers to physical activity prescription, 3) knowledge and confidence regarding physical activity prescription, 4) knowledge of the Canadian Physical Activity Guidelines and 5) self-reported physical activity levels. McNemar’s test evaluated changes in proportions before and after the workshop, while Wilcoxon signed-rank tests evaluated changes in Likert data.

Results: Twenty five family physicians completed the baseline questionnaire and attended the workshop, with 100% follow up response rate. The proportion of family physicians who reported providing written physical activity prescriptions in their clinical practice increased from 10 (40%) at baseline to 17 (68%) four weeks after the intervention.

Conclusion: Educational workshops combined with practical tools appear to be a feasible method to encourage the use of written physical activity prescriptions among family physicians in this setting.
Preface

I composed this thesis in its entirety, with guidance and input from Dr. Karim Khan, Dr. Jennifer Davis, and Dr. Robert Petrella. A separate manuscript, of which I am the lead author, was developed from the contents of this thesis and has been accepted to the British Medical Journal Open (BMJ Open).


All authors contributed to the study concept and design, as well as the writing and critical review of the manuscript. AW contributed to the design of the workshop and delivered the training intervention. JD contributed to the statistical analysis. The BMJ Open Manuscript includes Figure 1, Table 2, Table 3, Table 4, and Table 5 from this thesis.

Statement of Research Ethics Approval:

The study was approved by the Behavioural Research Ethics Board at the University of British Columbia (H13-01977) and by the Fraser Health Authority Research Ethics Board (2014-013).
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Dedication

To my Lord, my wife, my family and friends.
Chapter 1: Introduction

1.1 The Problem of Physical Inactivity

“Eating alone will not keep a man well; he must also take exercise” [1]. Hippocrates introduced the idea that physical activity has a positive impact on health in 400BC. Yet, some posit that physical inactivity may be the biggest public health problem of the 21st century [2]. To understand the problem of physical inactivity, it is first necessary to define physical activity and inactivity, detail the recommended physical activity guidelines, determine the epidemiology and health burden of physical inactivity, and to discuss how physical activity can be promoted at a number of different levels (individual, social, institutional, community). At that point, I will highlight family medicine as one important setting in which to promote physical activity.

1.1.1 Physical Activity, Exercise, and Physical Inactivity: Definitions and Guidelines

A seminal paper by Caspersen and colleagues [3] in 1985 remains the foundation for the definition of physical activity. Physical activity is defined as “any bodily movement produced by skeletal muscles that results in energy expenditure”. Physical activity is differentiated from exercise as it does not have to (a) be planned, structured or repetitive, or (b) have an objective of improving physical fitness, both of which are characteristics of exercise. Therefore, physical activity can also be achieved through recreational pursuits, occupational demands, household chores, sports, or other activities.

As the evidence demonstrating the health benefits associated with adequate physical activity continues to grow, many have investigated what levels of activity are required to accrue these
benefits. Over the past few decades, this has led to the establishment of many national and international guidelines [4–7]. In Canada, the Canadian Society of Exercise Physiology (CSEP) and the Public Health Agency of Canada (PHAC) jointly compiled the Canadian Physical Activity Guidelines [4]. These guidelines recommend that adults achieve at least 150 minutes of moderate-vigorous physical activity each week, and participate in two days of muscle and bone strengthening activities targeting all major muscle groups [4].

These guidelines align almost identically to those of the American College of Sports Medicine (ACSM) [8] and American Heart Association [7], the World Health Organization (WHO) [5], and the United Kingdom’s Department of Health [9]. Each of these bodies share the same 150 minutes of moderate to vigorous physical activity (MVPA) per week recommendation, espoused as 30 minutes of MVPA done on five or more days of the week. These activity sessions are to be done in bouts of 10 minutes or more. In all of these except for the Canadian guidelines, vigorous physical activity, such as running or jogging, and defined as activity that substantially increases one’s rate of breathing, can achieve the same health benefits in half of the time of moderate activity [5,8,9]. Thus, individuals are recommended to engage in vigorous activity for ≥20 minutes/day for ≥3 days/week, totalling ≥75 minutes/week, or in any equivalent combination of moderate and vigorous intensity exercise [5,8,9]. Explained in all of these guidelines is the overarching message that some activity is better than none, and that accumulating more activity than the guidelines is associated with even greater health benefits.

These public health guidelines highlight the recommended minimum levels of physical activity to achieve its associated health benefits. Physical inactivity is defined as the failure to reach these recommended levels of physical activity. Physical inactivity is a significant risk factor for a host
of chronic diseases and premature mortality [10]. Sedentary behaviour, defined primarily as time spent in a day sitting, is emerging as an independent risk factor for chronic disease, and is differentiated from physical inactivity [11]. However, sedentary behaviour is beyond the scope of this thesis.

1.1.2 Epidemiology and Health Burden of Physical Inactivity

Due to its prevalence, severity and public health impact, the Lancet published a five article “Physical Activity Series” [12–16], and referred to the issue of physical inactivity worldwide as “pandemic”. Its prevalence was highlighted in Hallal et al’s global inactivity review [13], which indicated that 31% of adults worldwide are physically inactive [13]. However, the calculations included in their global review relied upon self-reported measures of activity, specifically the International Physical Activity Questionnaire (IPAQ) [17] and Global Physical Activity Questionnaire (GPAQ) [18]. Although these measures have the benefit of providing surveillance data from about two thirds of the world’s countries, they have had their reliability questioned due to the common occurrence of over-reporting [19–21]. In Canada, the most recent data from the Canadian Health Measures survey, as measured by accelerometry, indicate that only 15% of Canadians meet the national recommendations for physical activity [22]. Economic calculations based on self-reported data, and therefore potentially underestimated physical inactivity levels, indicate an annual economic burden of $5.3 billion to the Canadian Healthcare System [23].

The prevalence of physical inactivity is alarming when considering that physical activity can prevent non-communicable diseases. Non-communicable diseases (NCDs) are a major worldwide health burden, accounting for 44% of premature deaths, and 65% of all deaths, with an estimated climb to 75% by the year 2030 [24]. In developed countries, 90% of deaths are attributable to
NCDs and injuries [25]. NCDs are characterised as non-contagious chronic diseases, and include cardiovascular disease, diabetes, cancer, chronic respiratory disease, hypertension, dyslipidemia, obesity, metabolic syndrome, arthritis, osteopenia/osteoporosis, degenerative disc disease, depression, sarcopenia and frailty, cognitive impairment, cerebrovascular disease, neurodegenerative disease, and rheumatoid arthritis. 6-10% of all deaths from NCDs can be attributed to physical inactivity, with the strongest associations linking physical activity to a reduction in cardiovascular disease, stroke, hypertension, colon and breast cancers, type 2 diabetes, and osteoporosis [26,27].

Beyond its effectiveness as a primary prevention tool, physical activity also serves as an effective secondary treatment for many of these chronic diseases. A recent metaepidemiological review found that physical activity interventions were similar to pharmaceutical interventions in their secondary prevention of coronary heart disease, stroke rehabilitation, heart failure treatment, and diabetes prevention [28]. Moreover, physical activity also increases physical function and capacity [29,30], improves quality of life [31], and improves mental health [32,33]. It should be noted that there are risks associated with physical activity, especially vigorous exercise (including musculoskeletal injuries, dehydration and sudden cardiac death) [34]. However, it is accepted that the benefits of regular activity outweigh the potential risks [34].

Given the health benefits associated with physical activity, both in primary prevention and as a secondary treatment, the American College of Sports Medicine and other bodies continue to promote that “Exercise is Medicine” [35,36]. If considered as medicine, physical activity could be described as a “polypill” [37], a single treatment effective in improving a wide variety of outcomes.
1.1.3 Interventions to Promote Physical Activity

Physical activity is a complex, multifactorial issue. Factors associated with physical activity levels include age, sex, health status, self-efficacy, genetic makeup, the built environment, and more [16]. Due to this complexity, no single intervention is sufficient to address the problem of physical inactivity alone. Instead, a variety of interventions contribute to promoting physical activity in different environments and stages of life.

The Toronto Charter for Physical Activity: A Global Call to Action (2010), was put together by the Global Advocacy Council for Physical Activity and International Society for Physical Activity and Health, and provides an example of a collection of interventions and principles that come together to promote physical activity [38]. The Global Advocacy for Physical Activity Group also produced a companion document that highlights 7 distinct investments, each an important component of helping increase population levels of physical activity [39]. These investments are:

1) Whole of school programs.

2) Transport policies that prioritise walking, cycling, and public transport.

3) Urban design and infrastructure providing equitable and safe access for recreational physical activity, and recreational and transport-related transportation.

4) Physical activity and NCD-prevention integrated into primary health care systems.

5) Public education, including mass media.

6) Community-wide programs involving multiple settings and sectors.

7) Sports systems and programs that promote ‘sport for all’ and encourage lifetime participation.
In this thesis I focus on the fourth investment, the integration of physical activity into primary health care, specifically through training family physicians to prescribe activity to their patients. Importantly, this is just one of several key areas that contribute to the effective promotion of physical activity at the population level.

1.2 The Role of Family Physicians in Promoting Physical Activity

Family physicians are well-suited from a population health perspective to change physical activity levels for two main reasons: 1) their reach, and 2) their influence. Firstly, more than 85% of Canadians see their family physician in a given year, more than any other healthcare provider [40]. Secondly, patients report that family physicians are an important source of lifestyle advice, are motivated to comply with this type of advice [41], and are more satisfied with their consultations when lifestyle advice or preventative care advice is given [42].

1.2.1 How Can Family Physicians Promote Physical Activity?

Physical activity promotion by family physicians can take a number of approaches, varying in level of engagement, time requirement, or involvement of other professionals. Specifically, family physicians may engage patients in a consultation through 1) assessing, 2) prescribing, and/or 3) referring (see below). Family physicians may engage in none, one, or any combination of these 3 practices, depending on the specific consultation.
1.2.1.1 Assessing Physical Activity Levels in Family Practice

Assessing physical activity levels identifies those patients who are physically inactive, makes it possible to monitor activity levels over time, and demonstrates to the patient that physical activity is important enough to assess. It is therefore important that some assessment of physical activity levels is completed in family practice settings.

Both subjective and objective measures may be used to assess physical activity levels. The simplest method of assessment is through self-reported physical activity. American healthcare insurer Kaiser Permanente incorporated physical activity into their standard practice by integrating exercise as a fifth vital sign with all their patients. This ‘vital sign’ consists of two simple questions that all patients are asked: (1) How many days a week do you engage in moderate-vigorous physical activity, and (2) on those days, how many minutes do you engage in those activities [43,44]. These answers are multiplied together to get an estimate of minutes/week of activity to be compared with the pertinent physical activity guidelines and monitored during follow-up visits [43,44]. This serves as a time-efficient, easily-repeated measure of self-reported activity [43,44].

Patients’ physical activity levels can also be measured through a direct assessment of their physical fitness levels. For example, Dr. Robert Petrella and colleagues implemented a brief submaximal step test in primary care settings, and used the results to provide tailored physical activity prescriptions to patients [45,46]. Obviously, such assessments require a greater time commitment from the family physician, but provide a more objective, valid measurement than self-reported activity and may enable more tailored physical activity prescriptions.
Although it may seem self-evident that family physicians would be the professionals responsible for physical activity prescription, there are also other members of the primary care team who may be involved in the assessments. For example, Kaiser Permanente’s exercise vital sign is often done and entered into the electronic medical record system by practice nurses or medical assistants [43]. For the purpose of this thesis, I will focus on family physicians as those responsible for assessment, but acknowledge this may not always be the case in primary care settings.

1.2.1.2  Prescribing Physical Activity in Family Practice

Family physicians should prescribe physical activity to patients if they are found to be physically inactive. Physical activity prescriptions may range from brief verbal counselling, such as an iteration of the physical activity guidelines or recommendation to increase physical activity levels, to a tailored, written physical activity prescriptions [45]. Brief advice has the benefit of requiring a smaller time commitment from the physician, but may lack individualization to the patient and does not provide the patient anything to take out of the consultation.

Tailored written physical activity prescriptions have been extensively examined in a number of research settings worldwide. These include “Green Prescriptions” in New Zealand [47–49], “Physical Activity on Prescription” in Sweden [50–53], the Activity Counselling Trial in the United States [54], as well as clinical trials in Australia [55–57], Switzerland [58], the UK [59,60], and Canada [45,46,61]. Collectively, these trials show that physical activity prescriptions have a modest, but consistent positive effect in improving patient physical activity levels.
Notably, there is currently no consensus that family physicians are the health care providers best suited to prescribe physical activity. As some have noted, family physicians are challenged by a lack of time, lack of formal education and self-efficacy in prescribing physical activity, and lack of institutional support [62]. Moreover, physical activity prescriptions may be given by exercise physiologists [63], physical activity counsellors [64], and nurses [65]. Compared to family physicians, many of these professionals have received more extensive education in exercise science and physical activity prescription, and possess more experience counselling individuals on physical activity [62,63,66]. However, these professionals generally see a substantially smaller portion of the population than family physicians, do not have the same levels of formal medical training, and may be less cost-effective [67].

1.2.1.3 Referring Patients for the Purpose of Physical Activity

Family physicians may utilize referrals to physical activity professionals in the same way they collaborate with other specialists through referral. This may be especially appropriate for patients with higher risk medical conditions, given that certain professionals, such as certified exercise physiologists, have additional expertise in physical activity prescription for patients with a wide variety of conditions [63,66].

Traditionally, exercise referral schemes incorporate physical activity professionals as external to the primary care team, sending patients for personal assessment and physical activity programming. These schemes have been extensively utilized and evaluated in the United Kingdom [68,69]. According to a National Institute for Health and Care Excellence (NICE) Review [70], exercise referral schemes involve four components:
1) Assessment to determine someone is not meeting current UK physical activity guidelines.

2) Referral by a primary care or allied health professional to a physical activity specialist or service.

3) A personal assessment involving a physical activity specialist or service to determine what program of physical activity is recommended.

4) An opportunity to participate in a physical activity program.

However, physical activity professionals may also be incorporated into the primary care team, instead of used as an external referral source. Examples of this include the incorporation of physical activity counsellors in the Canadian Physical Activity Counselling Trial [61], physiotherapists in Sweden [52], and nurses in the “enhanced Green Prescription” program [65].

To date, there is still insufficient evidence to suggest that any one of these arrangements are optimal, or that exercise referral schemes are superior to interventions performed by family physicians alone [71,72].

1.2.2 Can Family Physicians Effectively Change Patients’ Physical Activity Levels?

The efficacy of physical activity prescription in primary care settings has been evaluated in a variety of settings worldwide [47,51,56,60,61,73]. While virtually all these investigations have included some level of assessment of patients’ physical activity levels, there is significant heterogeneity in regards to the intensity of the intervention, the delivery agents of physical activity prescription, and the format of prescription.
Sweden’s “Physical Activity on Prescription” program incorporated patient-centered, motivational counselling of patients in primary care units to evaluate the effectiveness of physical activity prescriptions to change patient behaviour. Patients who were identified as physically inactive or suffering from a chronic disease related to physical activity were considered candidates for prescription, and if a motivational interview revealed they were ready to make physical activity changes, they would receive a written physical activity prescription form with individualized activity advice [52]. At 6 months follow-up, patients’ self-reported physical activity levels significantly increased, and quality of life improved [52].

“Green Prescriptions” were developed and implemented in the late 1990s in New Zealand, as a response to the nation’s goal of reducing physical inactivity [48]. These Green Prescriptions were written physical activity prescriptions distributed by primary care physicians or practice nurses to inactive patients with or without concomitant chronic diseases. The prescriptions lasted 3 months, and included follow up phone calls where the patient would be counseled based on their current state within the transtheoretical model of change (Precontemplation, Contemplation, Preparation, Action, Maintenance) [74]. Like Physical Activity on Prescription, the Green Prescription program had success in improving patients’ self-reported physical activity levels [47,65,75]. Notably, physicians also indicated that they preferred the written green prescription to verbal advice alone [75].

Many trials have similarly indicated the efficacy of physical activity prescriptions, showing increased self-reported physical activity levels [56,76], decreased body mass index [45], and increased physical fitness levels [45,46]. However, these positive findings are not universal, and other randomized trials have provided conflicting evidence, showing no benefit from physical
activity counselling [77]. Moreover, the optimal type and intensity of counselling has also proved elusive. Some trials have shown brief verbal counselling to be as effective as more intensive strategies, including written components [46,59,78], while others indicate that intensive strategies are more efficacious [57,76,79].

Until recently, systematic reviews shared these mixed results. While some identified a significant benefit of physical activity prescription [80–82], others determined that it was not effective [83], or that the research was inconclusive, recommending further research [84]. As more evidence has accumulated, recent systematic reviews have consistently indicated that physical activity prescriptions are efficacious for small to modest improvements of patients’ physical activity levels for at least 6-12 months [72,85,86].

A recent meta-analysis, which included 15 randomized trials with a minimum of 12 months follow-up, showed a significant impact of physical activity prescription on patients’ self-reported activity levels (OR=1.42 [1.17 – 1.73]). The authors calculated that for one inactive patient to reach the minimum physical activity guidelines through the implementation of physical activity prescription, the number needed to treat (NNT) is 12 [72].

The optimal approach and intervention intensity to promote physical activity in family practice remains debated. While some identify no difference between types of interventions [87], others have suggested that more tailored interventions that include a written component have a greater impact on patient behaviour [80,81].

In conclusion, physical activity prescription has level 1 evidence supporting its efficacy to induce improvements in patients’ physical activity levels [72,85,86]. Although a full discussion of cost-
effectiveness is beyond the scope of this thesis, data also indicate that physical activity prescription is a cost-effective intervention [88].

1.2.2.1 The Efficacy of Physical Activity Referrals in Family Practice

Some studies document that intensive interventions including counselling from non-physician professionals (such as physical activity counsellors), show more significant effects than brief advice from physicians alone [61]. Moreover, some have suggested that other professionals are more appropriate to prescribe physical activity than family physicians, emphasizing physical activity referral over physical activity prescription alone [62].

Exercise referral schemes have been most utilized and evaluated in the UK [68] and have shown a small, but significant effect on patients’ physical activity levels [69]. However, systematic review evidence indicates it is not more effective than physical activity prescription in primary care settings alone [72]. Further, NICE Guidelines have recommended that exercise referral schemes should not be used in inactive adults without pre-existing health conditions that could benefit from physical activity [70]. These referrals are also the least cost-effective method of physical activity promotion in primary care, since they often require direct supervision of patients [67].

Since they have not been shown to be more efficacious and may be less cost effective, physical activity referrals may be less appropriate for dissemination and implementation than physical activity prescription by a family physician. However, physical activity professionals may still play an important role in promoting physical activity through incorporation into primary care settings, and especially for prescribing activity for certain high-risk patients [63,66].
1.2.2.2 How Can Physical Activity Prescription Be Made More Effective?

Systematic reviews of physical activity prescription interventions have failed to identify specific characteristics of interventions that maximize success [72,86]. However, since physical activity prescription is preventative medicine aimed at patient behaviour change, one can learn from other successful preventative counselling interventions such as smoking cessation [89]. One particular aspect common to behaviour change interventions is a growing emphasis on patient-centered counselling and shared decision making to facilitate change [90–92]. Two primary examples of such counselling include (i) the 5As framework, and (ii) motivational interviewing [93].

The 5As framework may increase the effectiveness of physical activity prescription [91,94]. This framework includes the dimensions of Assess (or Ask), Advise, Agree, Assist, and Arrange. In the physical activity context, the physician engages with the patient through assessing patient behaviours and attitudes, advising the patient appropriately, agreeing with the patient on a set of goals and plan of action, assisting the patient to anticipate barriers and develop a specific action plan, and arranging follow up support or referral as necessary [91]. This format of counselling has been shown efficacious in a variety of behaviours and has been recommended as a construct for behavioural counselling in primary care by the United States Preventative Services Task Force [95], and by the American College of Preventative Medicine for use in physical activity promotion [90].

Although evidence has continued to grow in support of incorporating the 5As in preventative counselling and physical activity prescription, it should be noted that some studies include minor variations in the interpretation of what the 5 As are in the context of physical activity prescription. For example, Carroll and colleagues include both “Ask” and “Assess” in their framework, but do
not include “Agree” [94]. In examining physicians’ use of the 5As through direct observation, Carroll et al. [94] note that of the 5 As, physicians in their sample were least likely to assist patients in establishing specific goals or plans of action (39% of consultations), and arrange follow up (6% of consultations). These findings suggest physicians are more likely to engage in the didactic aspects of the framework, such as assessing and advising patients, but less likely to engage in the shared-decision making components such as assisting.

Motivational interviewing (MI) in healthcare, as described by Miller and Rollnick [93], is a shared decision making approach to behaviour change whereby patients and physicians agree on a goal that the patient is confident they can achieve. It is directed by the principles of 1) collaboration between patient and provider, 2) evocation of patient motivation and 3) patient autonomy [96]. In many ways it reflects the “agreeing and assisting” phases of the 5As framework, emphasizing the need for family physicians to ‘roll’ with resistance to change, and through shared decision making arrive at suitable solutions. A recent review demonstrated the efficacy of MI in healthcare, and supported it in addressing patients’ physical activity and dietary habits [97]. Martins and McNeil [97] also highlight that a strength of MI is that it can be incorporated in time-sensitive situations common in primary healthcare.

It is evident that patients’ physical activity levels should be assessed, and that when indicated, they should be advised to participate in physical activity through physical activity prescriptions. However, these prescriptions may be more effective if given in a patient-centered consultation. Although they may require an increased time commitment from the physician, this type of approach encourages shared decision making and facilitates tailored interventions that are appropriate to the individual patient. Therefore, these principles should be incorporated in
physician counselling on physical activity whenever possible to facilitate patient adherence and change.

1.3 How Frequently Do Family Physicians Prescribe Physical Activity?

Family physicians’ rates of physical activity prescription vary substantially depending on who is sampled, and the measurement tool used. When physicians are asked about their practice behaviours, approximately 7/10 physicians report that they use physical activity counselling in Scotland, (68% of GPs) [98], Australia (68% of GPs) [99], and England (69% of GPs and Practice Nurses) [100]. A survey of Danish physicians found 95.5% self-reporting that they counselled patients on physical activity at least weekly, and surveys in the United States show that between 59% [101] and 91% [102] of American physicians report prescribing physical activity to their patients.

Patient reporting and direct observation of physician behaviours tell a different story, suggesting that family physicians’ may over-report these behaviours. In the United States, direct observation of physician consultations indicates that 20% of visits involve physical activity counselling [103]. In two national patient surveys, 28% [104] to 34% [105] reported receiving physical activity counselling from their family physician. A similar survey of 2,120 Brazilian adults found only 29% had been prescribed physical activity in a medical consultation [106]. In New Zealand, a national survey after the implementation of Green Prescriptions found that only 13.3% of patients reported receiving any physical activity advice from their family physician, and only 3% reported receiving a Green Prescription [107]. It should be noted that patient data may be underreported, as
direct observation of exercise counselling in Ohio physicians, found that when counselling was performed in 22.3% of visits, only 13% of patients reported receiving such counselling [108].

Petrella and colleagues’ 2007 national survey [109] received responses from 13,166 Canadian family physicians. Of respondents, 85% reported asking their patients about physical activity levels, 26% assessed patient fitness, 11% referred patients to others for fitness assessment or appraisal; 70% reported using verbal counselling to promote physical activity, and 16% reported using written prescriptions for a physical activity promotion program [109]. As indicated by comparing physician data with patient-reported measures, these percentages may be over-reported. The results of this national survey, in particular the low proportion of family physicians providing written prescriptions to their patients, prompted Professor Petrella and colleagues [109] to suggest that there is a need to implement targeted physician training to promote the incorporation of written physical activity prescriptions into routine practice.

Family physicians report a greater desire and positive attitude toward physical activity counselling than they report implementing it in practice [110]. Therefore, it is necessary to understand the factors associated with prescription behaviours, and to determine the barriers to prescription.

1.3.1 Factors Associated with Physical Activity Prescription Behaviours

Demographic factors, including age and sex, may play a small role in the physical activity prescription practices of family physicians. In Canada, physicians surveyed in Petrella and colleagues’ national survey were more likely to report providing written prescriptions if they were female, aged 35, and in practice less than 15 years [109]. Female physicians were also more likely to ask patients about physical activity and provide verbal counselling than male counterparts [109]. This increased frequency of physical activity prescription among female physicians is consistent
with other surveys [111,112], and other preventative behaviours [113,114]. However, it should be noted that direct observation data indicate that physician demographic factors may not be associated with prescription practices [103]. Further, while some surveys find young physicians more likely to prescribe physical activity [109], others find that older physicians prescribe more regularly [112].

1.3.2 Facilitators of Physical Activity Prescription

Family physicians prescribe physical activity more regularly if they are confident in their abilities to prescribe it. Not surprisingly, physicians who report having received training/education and having higher self-efficacy in physical activity prescription counsel patients on physical activity more regularly [115–118]. Therefore, increasing family physicians’ knowledge and confidence through educational training in physical activity prescription is important to facilitate its incorporation into their clinical practice [119].

Family physicians’ personal physical activity levels are also strongly associated with their physical activity prescription behaviours [110,120–122]. This association is seen already among medical residents in the United States [123] and Canada [124]. The predictive nature of physicians’ personal behaviours on their preventative counselling practices has been similarly shown in smoking cessation, dietary behaviours, and alcohol use [112]. Notably, patients are also more likely to engage in preventative health practices if their physicians are compliant with that behaviour [125,126].

Those physicians who emphasize preventative care and counsel patients on other preventative measures may be more likely to counsel patients on physical activity [103]. Similarly, family
physicians who consider physical activity important enough to assess are also more likely to counsel their patients on the topic. A national study in Brazil found that the most significant factor in predicting whether family physicians would counsel their patients about physical activity is whether they assessed patients’ activity levels [118].

Family physicians prescribe physical activity more frequently to individuals with pre-existing health conditions related to physical inactivity, such as a high body mass, than they do to disease free, but physically inactive individuals [48,108,127]. Thus, it may be that family physicians perceive physical activity to be important in the treatment of patients with certain medical conditions, but not for apparently health, but physically inactive patients. When they do counsel patients, physicians address strength training less frequently than aerobic training [128], potentially due to greater knowledge about, and value ascribed to, aerobic activity [129].

1.3.3 **Barriers to Physical Activity Prescription**

Many family physicians either do not prescribe physical activity, or do so less frequently than they believe they ought to [130,131]. The most commonly cited barrier to physical activity prescription is a lack of time, with other barriers including a lack of education in medical school or continuing education, lack of knowledge, lack of resources or tools, and a lack of patient compliance/motivation [98,100,128,130,131]. Of these barriers, lack of time and a lack of patient compliance are challenging to address. However, lack of education and tools are both barriers that can be directly targeted through clinician training.

Since education is a barrier to physical activity prescription, it is of note that among 4th year medical students at the University of British Columbia, 86% thought their training in physical
activity prescription was inadequate [124]. This perception is supported by physician surveys demonstrating a lack of knowledge regarding national physical activity guidelines. In the United States, only 23% of surveyed physicians were familiar with the ACSM Guidelines, while 78% felt there was a need for a course related to the medical aspects of exercise [102]. Brazilian physicians performed even worse in a recent national survey, with 93% of physicians responding incorrectly to moderate-intensity physical activity recommendations, and 98% responding incorrectly regarding vigorous-intensity physical activity [118].

If family physicians are to incorporate physical activity prescriptions into their practice, these barriers must be addressed through improved education, targeted training and the provision of tools and resources.

1.4 Investigating Interventions to Change Family Physicians’ Practices

Changing physician behaviour is a complicated, multifactorial process, with both internal and external barriers. To date, little research has evaluated changing family physicians’ physical activity prescription behaviours in routine practice. Although a full investigation of clinician behaviour change interventions is beyond the scope of this thesis, it is helpful to discuss the themes and characteristics of other effective strategies. Since this thesis evaluates an intervention that was delivered through a face-to-face continuing education medium, I will focus specifically on methods of maximizing change through face-to-face education.

Less intensive and less interactive interventions appear to be relatively ineffective [132]. Therefore, print media appear to be less effective than live media, and single exposures tend to be
less effective than multiple exposures [133]. In regards to in-person training, large venues may be less effective than smaller ones, due to a more didactic style and reduced opportunities for interaction.

It is important to note that brief educational interventions and written materials provided to family physicians may be the most frequently utilized form of continuing education, but they may not be the most effective [134,135]. However, it was chosen in this study to embed the intervention within the regular continuing medical education program in the study population. Therefore, the aim was to maximize the effectiveness of training in this context.

Face-to-face training remains a cornerstone of continuing medical education (CME). These interventions have been indicated to be more effective than print and web-based delivery systems [133], and are preferred by physicians [136]. Face-to-face continuing medical education may be optimized in a number of ways, as highlighted by Davis and Davis’ review [137]. First, the increased effectiveness of interactive sessions indicate that smaller settings may facilitate change more effectively than larger venues such as conference halls [138]. Second, needs assessments are an important step preceding continuing education sessions, to ensure that the delivered material addresses the issues pertinent to the attendees [137].

It is important to acknowledge that there are other single interventions effective for changing physician practices beyond traditional continuing education sessions, such as reminders and academic detailing [139,140]. Moreover, physician behaviours are more apt to change when more than one intervention is implemented [134,135]. However, continuing education delivered through face-to-face training may still effect physician practices, especially if it incorporates elements that are known to optimize its effectiveness.
Using the preventative practices of smoking cessation as an example demonstrates the impact that physician training can have, both on physician behaviour and patient outcomes. A recent review details that healthcare professional training had a significant effect on the frequency with which physicians engaged in smoking cessation advice [141]. Today, 98% of Canadian family physicians report taking histories of tobacco use and more than 90% counsel for smoking cessation [109].

1.5 Training Primary Care Physicians to Incorporate Physical Activity Counselling

Most studies that have incorporated physician training in physical activity counselling have occurred as efficacy or effectiveness trials investigating physical activity prescription on patient outcomes [142–144]. These trials provide insight not only about the efficacy of physical activity prescription, but about the effects of targeted training on physicians’ behaviours, attitudes, and perceptions of physical activity prescription.

The Activity Counselling Trial investigated the effectiveness of physician advice alone with a more comprehensive intervention including behavioural counselling from trained health educators. Physicians who volunteered for the study received a one-hour training session that educated them on providing physical activity counselling [142]. Results of patient surveys from participants showed that 99% received physical activity advice from their physician during the study. Further, 63% of participating physicians reported that the advice resulted in little or no increase in the time of an average visit, 64% believed the training improved their ability to provide physical activity counselling, and 83% believed the counselling was a positive asset to their practice [142].
Petrella and Wight [143] investigated the efficacy of physical activity prescriptions for improving patient physical activity and fitness levels by conducting a submaximal step test with patients and then giving a personalized physical activity prescription. Intervention physicians received information from the ACSM, detailed explanation of implementing the STEP test protocol, and a list of community resources to share with patients. Following the study, intervention physicians had higher levels of self-reported knowledge and confidence to deliver physical activity prescriptions when compared with control physicians [143]. A similar increase in self-efficacy was seen in a group of 21 internal medicine residents compared with controls after an educational intervention consisting of two separate 2-hour lectures about physical activity [145].

Evidently, family physicians who receive training within the context of physical activity prescription studies have reported increased knowledge and confidence regarding physical activity prescription, as well as increased use of prescriptions. However, a limitation of these studies is that they all investigate physicians who have volunteered to participate, are motivated to change, and have agreed to adopt these behaviours in the context of the research investigation.

To my knowledge, only a handful of studies have examined family physician practices before and after interventions designed to increase physical activity prescriptions in routine clinical practice [146–149]. Most recently, Carroll and colleagues trained physicians to use the 5As framework over the course of four one-hour sessions, then recorded behaviour changes through patient-reported Physical Activity Exit Interview (PAEI) questionnaires. Two groups took part in the intervention, with eight months between intervention times, with mixed results. While group 1 did not increase their PAEI scores either immediately post-intervention or at 6 months follow-up, group 2 had an increase at both time points after the intervention [146]. However, in both groups
clinician confidence increased for assessing an exercise history, negotiating an exercise plan, turning setbacks into learning, helping patients cope with barriers, counselling in a cost-effective manner, and having knowledge of community resources useful for patient needs [146].

Dacey and colleagues evaluated the impact of two continuing education programs in lifestyle medicine, both of which included physical activity prescription [149]. Evaluating the results of baseline surveys and follow up surveys 90 days later, they found an increase in the number of physicians prescribing exercise and providing handouts or written material, as well as an increase in confidence and decrease in perceived impact of knowledge, materials, and patient change as barriers to prescription [149].

Two larger scale public health interventions in Australia, the 10,000 Rockhampton Steps Project [148], and the Victorian Active Script Program [147], included physician training as a component of the intervention, and evaluated changes in clinical practice behaviour as part of their outcomes. Both of these interventions identified an increased use of physical activity prescriptions among participating family physicians. These trials provide evidence that physician training may be effective for increasing physical activity prescriptions in primary care, especially in the context of community-level interventions.

1.6 Gaps in the Literature

From a review of the available literature, family physicians may be an important investment in reducing the prevalence of physical inactivity in Canada, given their reach [40] and influence [41,42,150]. Though the efficacy of physical activity prescriptions within primary care settings
has been well documented [85], approximately a third of Canadian family physicians (30%) do not counsel their patients about physical activity, and most (84%) do not provide any written physical activity prescriptions. Lack of time, training and resources are all commonly listed barriers to physical activity prescription, and many lack the self-efficacy to counsel patients effectively.

Very few studies have evaluated interventions designed to change the routine practice of family physicians. This discrepancy is captured by the implications described by the authors of a recent systematic review: “Since research shows that physical activity counselling promotes physical activity but is not widely practiced, primary care providers will require training and tools to operationalize physical activity counselling” [86].

This call for operationalization – putting physical activity prescription into practice in the existing healthcare system - requires investigation into the feasibility of different interventions for encouraging these changes in family physicians’ physical activity prescription practices. The few interventions that have been done provide some promising results [146–149], but none have been conducted exclusively with family physicians, and none have specifically focussed on the provision of written physical activity prescriptions exclusively in family physicians. Moreover, no one has investigated any of these types of interventions in a Canadian context. Thus, there is a need for a Canadian-based intervention of family physicians to determine whether physician training is a feasible way to change the behaviours of family physicians and to operationalize the use of written physical activity prescriptions.
Chapter 2: Aims of the Thesis

The objective of this thesis is to investigate the feasibility of using an educational workshop and providing practical tools in order to change the physical activity prescription behaviours of family physicians in Abbotsford and Mission, British Columbia.

The specific aims of the thesis were to:

1) To ascertain the feasibility of using educational training to change physician behaviour by evaluating the effects of a three-hour educational workshop with practical tools on the self-reported written physical activity prescription behaviours of Abbotsford and Mission-based family physicians.

2) To explore and describe the effects of the brief clinician-targeted training intervention on five additional outcome parameters known to be associated with family physicians’ physical activity prescription behaviours:

   a. The proportion of family physicians engaging in other self-reported physical activity prescription practices - (i) asking, (ii) assessing, (iii) referring, and (iv) verbally counseling their patients - and the frequency with which they report using them.

   b. Physicians’ perceived barriers to physical activity prescription.

   c. Physicians’ knowledge and confidence in regards to physical activity prescription.

   d. Physicians’ ability to correctly identify the Canadian Physical Activity Guidelines.

   e. Physicians’ personal self-reported physical activity levels.
To address my primary aim, I propose the following hypothesis:

1) Given that both a lack of education and a lack of tools have been cited as barriers to physical activity prescription by family physicians, I hypothesized that a significantly greater proportion of family physicians would report providing written physical activity prescriptions to their patients four weeks after the workshop compared with baseline. I hypothesized that this increase would be approximately 25%, from ~15% to ~40%, assuming a baseline level of prescription equal to the national survey data from Petrella and colleagues [109].

To address the second aim, I did not have any a priori hypotheses for any of these exploratory outcomes. Instead, I carried out exploratory analyses on each of these 5 outcome parameters in order to identify and describe any significant effects of the workshop on physicians’ other physical activity prescription behaviours, or on other known barriers and facilitators included in the survey.
Chapter 3: Methods

3.1 Study Design

This thesis utilized a single-sample, pre-post study design with data collected at baseline – with responses received in the 3 weeks leading up to the educational workshop – and four weeks after the delivery of the workshop, in order to evaluate the feasibility of physician training to change family physicians’ use of physical activity prescriptions.

Using the framework for feasibility studies laid out by Bowen and colleagues [151], the current study sets out to investigate the “Can it work?” stage of intervention development, as very little research has been carried out within this specific field. This stage of intervention development precedes the follow-up questions of “Does it Work?” and lastly “Will it Work?” As the authors outline, “few previously published studies or existing data using a specific intervention technique” may indicate the appropriateness of a feasibility trial, which can subsequently inform future large scale efficacy, effectiveness, and dissemination trials [151].

Bowen and colleagues [151] discuss 8 appropriate areas of focus for feasibility studies: 1) acceptability, 2) demand, 3) implementation, 4) practicality, 5) adaptation, 6) integration, 7) expansion, and 8) limited-efficacy testing. This current study focuses on this last area of “limited efficacy” testing, wherein I test the current intervention in a limited way with limited statistical power and a shorter follow period. While it should be noted that this is not an ‘efficacy-trial’ given its pre-post study design and real-world setting, it examines this area of focus most closely.
3.2 Study Sample

The study population included family physicians practicing in the municipalities of Abbotsford (124,000 residents), and Mission (38,000 residents), neighbouring cities in southern British Columbia, Canada. A total of 158 potential participants were identified through their registration with the Abbotsford Division of Family Practice (121 members) or Mission Division of Family Practice (37 members). All registered members were invited to complete a physical activity prescription questionnaire and attend the educational workshop. Of these, a total of 41 family physicians completed the baseline survey, and 26 of these physicians participated in the physical activity prescription workshop. All local family physicians are expected to be members of their local Division, no random selection was of physicians was undertaken, since the entire study population was invited to participate.

This population was chosen primarily due to its feasibility. The study utilized the unique existence of a local committee, Exercise is Medicine Abbotsford (EIMA), to implement the intervention. EIMA included representatives from the City of Abbotsford, the Abbotsford Division of Family Practice, the UBC Department of Family Practice and UBC Department of Experimental Medicine, and included a city employee, family physician, strength and conditioning specialist and administrative assistant. This multidisciplinary team with affiliations in key organizations made it possible to conduct the intervention with the entire local family medicine community, and within the regular continuing education program sponsored by the Division of Family Practice.

The city of Mission was included for two reasons. First, Abbotsford and Mission’s Divisions of Family Practice had the same Executive Director, and share the training responsibilities of UBC Medical Residents. Therefore, they commonly hold joint continuing education and professional
development events, such as the one utilized to deliver the current intervention. Since the aim was to deliver the intervention within the existing routines and structures in place, fidelity to the community context would be highest by including both communities. Second, sample size calculations indicated a need for at least 29 physicians to be included in the intervention. Since response rates for physician surveys have commonly seen as low as 25-35% [128,152], and this study involved voluntary attendance at the workshop, I concluded that increasing the available population by including Mission family physicians would increase the likelihood of having enough sufficient power for the primary outcome analysis.

Eligibility criteria included only that family physicians be registered with their local Division of Family Practice and still practicing family medicine. Therefore, physicians who were retired or in full time research were excluded from participation. Medical residents were also excluded from the study and invited to a separate training session on physical activity prescription, outside the bounds of this current study.

3.3 Questionnaire

To examine changes in physical activity prescription behaviours, perceived barriers, and other variables known to be associated with physical activity prescription, I developed a bespoke - unique for the purpose of this study – questionnaire based on a review of the literature.
3.3.1 Questionnaire Design and Pre-Test

To my knowledge, there is no validated questionnaire to measure family physicians’ physical activity prescription behaviours or changes in these behaviours. Although direct observation through audio or video recordings are considered the gold standard of measuring clinician consultation behaviour [91], I did not have the resources to utilize these methods and relied on self-reported survey data.

Due to the absence of any previously validated questionnaire, I developed a questionnaire that incorporated elements from other surveys of physical activity prescription to capture both the physical activity prescription behaviours of family physicians and a collection of known associated variables. Content of the survey was informed by a review of the available literature and included known barriers and facilitators to prescription.

The five-page questionnaire consisted of 23 questions divided into three main sections, 1) demographic information, 2) physical activity prescription behaviours and associated variables, and 3) self-reported physical activity (See Appendix 1). The survey took approximately ten minutes to complete. The survey was pretested with a number of medical residents and non-family physician professionals for the purpose of ensuring face validity and determining the time it took to complete. Minor amendments were made based on pretesting feedback.

3.3.2 Questionnaire Content

The survey (see Appendix 1) included a brief section of demographic information (gender, age, years in practice, practice characteristics), before addressing physical activity prescription
behaviours and a collection of associated variables. For the purpose of my analysis, these variables were divided into five categories:

A) Physical Activity Prescription Behaviours: Petrella and colleagues’ national survey (2007) [109] of 13,166 family physicians included five questions regarding physical activity prescription. Their survey inquired whether physicians: 1) ask their patients about their physical activity levels, 2) assess the physical activity levels or physical fitness of their patients, 3) refer their patients to other healthcare providers for fitness assessments, 4) provide their patients with verbal physical activity counselling, or 5) provide written physical activity prescriptions to their patients. This current study adopted these same 5 parameters of physical activity promotion in order to investigate changes in these behaviours after the intervention.

To those physicians who answered “Yes” to any of these types of behaviours to specify the proportion of patients with whom they performed that behaviour (1-20%, 21-40%, 41-60%, 61-80%, 81-100%). This allowed the frequency of these behaviours to be measured, as well as measure changes in the frequency of prescription among those who already engaged in these behaviours at baseline.

B) Perceived Barriers to Physical Activity Prescription: Many variables have been identified that are perceived by physicians to impede physical activity prescription. For the purpose of this study, I chose to replicate the barrier list used by Kennedy and Meeuwisse [131], as it sampled Canadian physicians, and was the most extensive list reported in the literature. Family physicians were asked to rank how important they perceived a list of 12 barriers to
be in preventing them from prescribing physical activity more regularly (1=Not Important, 5=Extremely Important).

C) Physicians’ Self-Reported Confidence and Knowledge: Family physicians self-reported their perceived knowledge and confidence regarding physical activity prescription on a 10 point Likert scale (1=not confident/knowledgeable, 10=extremely confident/knowledgeable), as well as listed the proportion of patients they believed would change their physical activity behaviours as a result of their counselling on a five point scale (1-20%, 21-40%, 41-60%, 61-80%, 81-100%). These variables were incorporated due to the known association of self-efficacy with increased physical activity prescription [130], and their inclusion in other studies evaluating physical activity prescription training [149].

D) Physicians’ Knowledge of the Canadian Physical Activity Guidelines: It has been noted that family physicians may lack education and knowledge regarding the guidelines recommendations for physical activity [98]. Therefore, in addition to their self-reported knowledge of physical activity prescription, the survey included two questions regarding the Canadian Physical Activity Guidelines. 1) How many minutes of moderate physical activity/week (60, 90, 150, 300) are recommended by the national guidelines? and 2) How many days/week (1, 2, 3, 4+) of muscle and bone strengthening activities were recommended by the Canadian Physical Activity Guidelines [153]?
E) **Self-reported Physical Activity Levels:** It is well documented that physicians’ personal health habits are significantly associated with their counselling practices [110,120,121]. Those who are regularly active themselves are more likely to prescribe physical activity to their patients. To take this into account, family physicians completed the short form of the International Physical Activity Questionnaire (IPAQ), a validated measure of self-reported physical activity levels based on previous 7 day recall [17]. Their results were used to estimate their MET-Minutes/week and categorical activity level (Low, Moderate, High) as per the IPAQ scoring protocol [154].

### 3.3.3 Questionnaire Distribution

The administrative assistant of the Abbotsford Division of Family Practice compiled the email and mailing addresses of all family physicians registered with the Abbotsford and Mission Divisions of Family Practice and coordinated the distribution of the surveys. One week prior to the mailing of the questionnaire, an introductory email detailed the study and invited physicians to participate when they received the mailed package. The baseline survey package was distributed in February 2014 to all 158 family physicians registered with the Divisions of Family Practice in Abbotsford, and Mission, British Columbia. In addition to the questionnaire, the package included a preaddressed, postage-paid return envelope, an informed written consent form, and a signed letter from the President and Lead GP of the Abbotsford Division inviting them to participate. Two follow up emails were sent to all family physicians, one and two weeks after the original survey distribution.

Invitations to attend the educational workshops were distributed in accordance with all other professional development breakfast meetings through the local Division of Family Practice. This
occurred throughout March, 2015, following the mailing of all the questionnaires. All family physicians who registered to attend the workshop were sent an additional reminder to complete the baseline questionnaire prior to attending.

One month after the workshop, the same survey delivery procedure was performed to deliver follow up questionnaires to all family physicians who filled out the baseline questionnaire and attended the workshop. The follow up time of one month was chosen to maximize follow up response rate while allowing for a period of time for physicians to incorporate changes to clinical behaviour after the workshop. Further, continuing medical education interventions have been evaluated in their ability to effect changes for greater than or equal to 30 days in the literature [133].

All participants were informed that participation was voluntary and completed informed written consent with the baseline survey. The study was approved by the Behavioural Research Ethics Board at the University of British Columbia (H13-01977) and by the Fraser Health Authority Research Ethics Board (2014-013).

### 3.4 Workshop Design and Delivery

To explore the feasibility of physician training in a real world setting, the clinician-targeted workshop was integrated into the regular professional development program hosted by the Abbotsford Division of Family Practice. Specifically, the Abbotsford and Mission Divisions of Family Practice held regular ‘breakfast meetings’, aimed at continuing education and professional development. Held on average every two months, the meetings last approximately three hours;
breakfast is provided to the physicians, and a continuing education workshop is delivered on a relevant family medicine topic.

Within this framework, the three-step physical activity workshop was developed by one strength and conditioning specialist (this author), and one local family physician, Dr. Adriaan Windt, in consultation with the research team and other members of the EIMA committee. The primary goals of the workshop were to educate local family physicians on the value of physical activity prescription and provide them with the tools to assess and prescribe physical activity efficiently and effectively in their clinical practice.

The workshop design and delivery format was in alignment with current CME recommendations, as per Davis and Davis’ review [137]. First, a needs assessment was completed by a thorough review of the literature, identifying common barriers to physical activity prescription among Canadian family physicians. Namely, a lack of time, education and tools were identified. Second, the workshops were designed to be interactive in nature, with case studies provided and frequent interaction incorporated throughout the session. This interaction was facilitated by the relatively small (<20 individuals) venue which was utilized for the training.

Furthermore, the content reflected the recommendations of the American College of Preventative Medicine’s Position Statement, which provides suggestions into the training of physicians to provide physical activity. Among other items, they suggest training in behavioural counselling techniques that emphasize collaboration between patient and provider through shared decision making, assessment of readiness to change, and the provision of tailored physical activity prescription [90]. Accordingly, the current workshop outlined three main steps for family physicians to follow with patients: (1) assess patients’ physical activity levels; (2) utilize patient-
centered Motivational Interviewing techniques [93,96] to assess patients’ readiness to change and encourage patients through shared decision making, and (3) provide written physical activity prescriptions to patients.

Assessing physical activity was presented as an additional ‘vital sign’ that family physicians should investigate at each consultation, through brief self-reporting of physical activity levels. This recommendation stems from Kaiser Permanente and Exercise is Medicine, who discuss the importance of measuring physical activity as a fifth vital sign in addition to body temperature, blood pressure, pulse, and breathing rate[44]. Motivational interviewing was chosen as a target behaviour change strategy to encourage patient-centered consultation due to its success in improving physical activity levels [97]. Specifically, family physicians were encouraged, as time permitted, to work with their patients to establish goals that were attainable and realistic, which the patients were confident they could attain. Finally, written physical activity prescriptions were encouraged whenever appropriate, through the use of the Exercise is Medicine Canada Physical Activity Prescription Pad, developed in 2015 by the Exercise is Medicine Canadian Taskforce [155].

In addition to these steps, the educational content of the workshop included the health benefits of physical activity, as well as the most recent Canadian Physical Activity Guidelines [153]. Educational material delivered to the family physicians included digital and print copies of workshop content and copies of the PAR-Q+ physical activity screening forms [156].

Two practical tools were provided to family physicians to facilitate the process of physical activity prescription. First, they were provided with paper and electronic copies of the ‘physical activity vital sign’ [43,44], allowing them to quickly assess the physical activity levels of their patients,
and keep records on file. Second, they were given copies of the physical activity prescription pads developed by the Exercise is Medicine Canadian Taskforce [155,157].

Finally, physicians were all given a FitBit zip accelerometer, and invited to join an online group consisting of all physicians who attended the workshop. Since physicians’ personal physical activity levels relate positively to their counselling behaviours [112], this was intended to encourage them to increase their own physical activity levels.

Participating physicians were given the option of attending one of two identical workshops, delivered on two consecutive Fridays in April 2014, led by Dr. Adriaan Windt. No booster sessions, reminders, or other follow-up training sessions were provided.

3.5 Data Entry and Analysis

All coded questionnaire data was inputted by this author, and all entries were double checked to ensure accurate data entry. The most common data entry issue encountered was that a number of participating physicians who did engage in the five measured physical activity prescription behaviours would skip the “Yes/No” portion of questions 1-5, and proceed to simply answering the second part of the question: “If yes, with what % of patients” … At baseline, this type of omission occurred by 9 respondents, and with 5 physicians at follow up. I assumed that if subjects responded positively to the second part of the question but left the first part blank, they did engage in the behaviour and were therefore were recorded as responding positively to the first part of the question.
3.5.1 Processing International Physical Activity Questionnaire Data

International Physical Activity Questionnaire (IPAQ) – Short Form data was processed as per established IPAQ protocol, which includes standardized methods for data cleaning, exclusion of outliers, truncation of data [154]. One issue not discussed in the document for standardized data entry and analysis of the IPAQ is the situation when subjects report ranges for activity. For example, subjects’ may report that they participate in moderate physical activity two days a week, and on those days, they perform this activity for 1-2 hours. For the purpose of evaluation, I used the mean value of these ranges. This occurred 4 times at baseline, and 3 at follow up.

3.5.2 Handling Missing Data

At baseline (n=25), 5 subjects had missing data on at least one survey item. None of these subjects had more than two total responses missing. Further, no variable had missing data from more than one subject, so no variables had to be removed from the analysis. At baseline, 0.62% of total data was missing, with 6 missing data points out of a total 975. The 975 data points were the product of 25 participants and 39 outcome points. At follow up, responses were collected from all participants, with no missing survey data.

I acknowledge that advanced imputation methods are possible and are recommended in most instances to deal with missing data [158–160]. However, these techniques were considered beyond the scope of this thesis project, and not essential based on the small proportion of missing data present.

Due to the small sample size of this study, and common criticisms of listwise deletion techniques, it was determined that listwise deletion for missing data would be inappropriate [159]. In this case
it would reduce the sample size to 20, even though it was already four subjects fewer than determined by power calculations.

Therefore, I used pairwise deletion for missing data and performed an available case analysis. In this type of analysis, all data available for an analysis are included, and cases are only excluded from specific analyses when data is missing for that outcome [159]. Given the paired nature of the data, when data points were missing for a variable of interest at baseline, the case was removed as per pairwise deletion at both time points for statistical analysis. In total, this was done for six variables, leaving 24 available cases in each of those instances. However, for descriptive purposes, all available responses are displayed.

3.5.3 Data Analysis

Sample size calculations were conducted based on changes in the proportion of family physicians providing written physical activity prescriptions. Evaluating changes using McNemar’s test for paired proportions, in order to achieve a power of 0.80, with \( \alpha = 0.05 \), and to observe a change in proportions of at least 0.25 [161], 29 participants were required.

Basic descriptive analysis was performed in Microsoft Excel (Microsoft Office, 2013 Edition). All statistical tests were performed using R (Development Core Team, 2011). Frequency distributions were carried out for all demographic and outcome variables.

3.5.3.1 Primary Outcome Analysis

I used McNemar’s chi-square test for paired data for primary outcome analysis to determine whether there was a significant change in the proportion of family physicians providing written physical activity prescriptions before and after the intervention [162].
3.5.3.2 Exploratory Outcome Analysis

I performed exploratory analyses on the changes to five additional outcome parameters: family physicians’ 1) other physical activity prescription behaviours, 2) perceived barriers to physical activity prescription, 3) knowledge and confidence regarding physical activity prescription, 4) knowledge of the Canadian Physical Activity Guidelines, and 5) self-reported physical activity levels. For these, McNemar’s test evaluated the changes in all paired binomial data before and after the intervention. This included changes in other physical activity prescription behaviours, and in the number of physicians who correctly identified the Canadian physical activity guidelines after the workshop. Wilcoxon signed-rank tests assessed all changes in paired five-point Likert data before and after the workshop. This included changes in the perceived importance of barriers, as well as the changes in the frequency of physicians engaging in each of the physical activity prescription behaviours. Due to the non-normal distribution of the IPAQ data and the recommended reporting of median values, Wilcoxon signed-rank test was used to determine changes in physicians’ self-reported physical activity levels before and after the intervention. Finally, paired t-tests assessed changes in self-reported knowledge and confidence [162]. All analyses were performed with a significance level of p<0.05.
Chapter 4: Results

4.1 Responder Characteristics

Of the 158 family physicians who were invited, 33 (21%) family physicians attended the workshop. Of these, 26 (16%) filled out the baseline questionnaire prior to attending the workshop. There were an additional 15 physicians who completed the baseline questionnaire, but did not attend the training workshop. One individual was excluded from the study as they were no longer practicing family medicine. A total of 25 family physicians (16%) were included in the final analysis. Follow up questionnaires were collected from all 25 family physicians (Figure 1).

Of the eligible participants, 21 participants were male (84%), and 4 were female (16%). The average age of participants was 51 (±11, range = 31-70) years, and the average years in practice was 23 (±11, range = 1-43). Electronic medical records (EMR) were used by 23 (92%) of the physicians, of which 7 said there was some measure of physical activity incorporated into their EMR system.

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<th>Variable</th>
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<td><strong>Sex (n=25)</strong></td>
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<tr>
<td>Male</td>
<td>21 (84%)</td>
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<tr>
<td>Female</td>
<td>4 (16%)</td>
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<td><strong>Primary Place of Practice (n=25)</strong></td>
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</tr>
<tr>
<td>Abbotsford</td>
<td>18 (72%)</td>
</tr>
<tr>
<td>Mission</td>
<td>7 (28%)</td>
</tr>
<tr>
<td><strong>Use EMR(^1) in Practice (n=25)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>23 (92%)</td>
</tr>
<tr>
<td><strong>EMR has Physical Activity Incorporated (n=24)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 (28%)</td>
</tr>
</tbody>
</table>

\(^1\)EMR = Electronic Medical Records
Data for the family physicians who did not complete the baseline questionnaire were not available, so the representativeness of the attendees in relation to this specific study population in Abbotsford and Mission could not be evaluated. When compared to family physician data from the 2014 National Physician Survey [163], the mean age of the study sample (51.3) was similar to the national average (50.9), while the % of male physicians (86%) in the present study was higher than the national average (56%).

Figure 1: Flow chart describing inclusion of eligible family physicians.
4.2 Primary Outcome – Written Physical Activity Prescription

The proportion of family physicians who reported providing written physical activity prescriptions increased significantly from 10 (40%) before the intervention, to 17 (68%) four weeks after the intervention (p<0.05). The changes in all 5 measures of physical activity are depicted in Figure 2 and detailed further in Table 2.

Figure 2: Proportion of family physicians engaging in 5 specific physical activity prescription behaviours before and after the intervention.
TABLE 2: Physical activity prescription practices of family physicians pre- and post-intervention.

<table>
<thead>
<tr>
<th>Behaviour</th>
<th>Pre-Intervention n (%)</th>
<th>Post-Intervention n (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ask (n=25)</td>
<td>25 (100%)</td>
<td>25 (100%)</td>
<td>1.0</td>
</tr>
<tr>
<td>Assess (n=24)</td>
<td>13 (54%)</td>
<td>18 (75%)</td>
<td>0.13</td>
</tr>
<tr>
<td>Refer (n=25)</td>
<td>9 (36%)</td>
<td>16 (64%)</td>
<td>0.004*</td>
</tr>
<tr>
<td>Verbally Counsel (n=25)</td>
<td>25 (100%)</td>
<td>25 (100%)</td>
<td>1.0</td>
</tr>
<tr>
<td>Written Prescription (n=25)</td>
<td>10 (40%)</td>
<td>17 (68%)</td>
<td>0.04*</td>
</tr>
</tbody>
</table>

*p<0.05

ASK – do physicians ask their patients about their physical activity levels?
ASSESS – do physicians assess the physical activity levels or physical fitness of their patients?
REFER – do physicians refer their patients to other healthcare providers for fitness assessments?
VERBALLY COUNSEL – do physicians provide patients with verbal physical activity counselling?
WRITTEN PRESCRIPTION – do physicians provide patients with written physical activity prescriptions?

4.3 Exploratory Outcomes

4.3.1 Other Physical Activity Prescription Behaviours

A significant increase was also seen in the proportion of physicians who reported referring patients for the purpose of physical activity assessment or prescription, from 9 (36%) to 16 (64%) (p<0.01).

Most often, these referrals were to a physiotherapist, personal trainer, or kinesiologist (Figure 3).

![Figure 3: Number of physicians who reported referring patients to different professionals.](image)
After the intervention, 18 family physicians (75%) reported assessing their patients’ physical activity levels, compared to 13 (54%) before the intervention. This change was not significant (p=0.13). There were also no changes in the number of physicians who asked their patients about their physical activity levels or gave verbal counselling to their patients, as 100% of participating family physicians reported doing so both before and after the workshop.

Family physicians who responded “Yes” to performing each of these behaviours were asked to identify the frequency with which they did so by categorizing the percentage of patients (1-20, 21-40, 41-60, 61-80, 81-100) with whom they performed each practice. This question enabled evaluation of changes among physicians who already engaged in these behaviours at baseline, through changes in the frequency of their behaviours. Table 3 details these frequencies before and after the workshop for physicians who engaged in each of the five behaviours at baseline. Among these family physicians, there was a significant increase in the percentage of patients whom physicians reported asking about physical activity (Wilcoxon signed-rank, p<0.01) and assessing (Wilcoxon signed-rank, p<0.05) their patients’ physical fitness or physical activity levels.
TABLE 3: The frequency with which each physical activity prescription behaviour was used among physicians who engaged in the behaviour both before and after the intervention.

<table>
<thead>
<tr>
<th>BEHAVIOUR</th>
<th>1-20% n</th>
<th>21-40% n</th>
<th>41-60% n</th>
<th>61-80% n</th>
<th>81-100% n</th>
<th>Difference (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ask</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before (n=25)</td>
<td>3</td>
<td>4</td>
<td>9</td>
<td>6</td>
<td>3</td>
<td>0.008*</td>
</tr>
<tr>
<td>After (n=25)</td>
<td>2</td>
<td>1</td>
<td>11</td>
<td>7</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td><strong>Assess</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before (n=13)</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>0.02*</td>
</tr>
<tr>
<td>After (n=13)</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td><strong>Refer</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before (n=9)</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0.12</td>
</tr>
<tr>
<td>After (n=9)</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Verbally counsel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before (n=25)</td>
<td>3</td>
<td>5</td>
<td>9</td>
<td>4</td>
<td>4</td>
<td>0.62</td>
</tr>
<tr>
<td>After (n=25)</td>
<td>3</td>
<td>4</td>
<td>10</td>
<td>7</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Written prescription</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before (n=10)</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1.0</td>
</tr>
<tr>
<td>After (n=10)</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

ASK – do physicians ask their patients about their physical activity levels?
ASSESS – do physicians assess the physical activity levels or physical fitness of their patients?
REFER – do physicians refer their patients to other healthcare providers for fitness assessments?
VERBALLY COUNSEL – do physicians provide patients with verbal physical activity counselling?
WRITTEN PRESCRIPTION – do physicians provide patients with written physical activity prescriptions?
4.3.2 **Barriers to Physical Activity Prescription.**

Family physicians’ categorized how important they perceived 12 common barriers to physical activity prescription before and after the workshop. Their responses are detailed in Table 4. The most common barrier to physical activity prescription before and after the workshop was lack of time, with 76% of physicians reporting it as “Important”, “Very Important”, or “Extremely Important” before the workshop. This increased to 84% after the workshop.

Prior to the workshop, the next most important barriers were lack of tools, lack of education, and lack of continuing education, with more than 64% reporting each of these as ≥ “Important”. At follow up, the next most significant barriers after lack of time were reported as lack of education, lack of continuing education, and lack of financial incentive.

Two barriers significantly changed in perceived importance one month after the workshop. First, lack of tools significantly decreased in perceived importance one month after the workshop (p<0.05). Conversely, a lack of financial incentive for physical activity prescription significantly increased in perceived importance at follow up (p<0.05). The number of family physicians ranking lack of education, lack of knowledge, lack of continuing education, and lack of guidelines as ≥ “Important” all decreased, but none of these changes were significant.
## TABLE 4: Perceived importance of selected barriers to physical activity prescription pre- and post-intervention.

<table>
<thead>
<tr>
<th>BARRIER</th>
<th>Not Important 1 n (%)</th>
<th>Somewhat Important 2 n (%)</th>
<th>Important 3 n (%)</th>
<th>Very Important 4 n (%)</th>
<th>Extremely Important 5 n (%)</th>
<th>I + VIP + EIP (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of time</td>
<td>Before (n=25)</td>
<td>After (n=25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 (12%)</td>
<td>2 (8%)</td>
<td>5 (20%)</td>
<td>6 (24%)</td>
<td></td>
<td>76%</td>
<td>0.41</td>
</tr>
<tr>
<td>Lack of tools</td>
<td>Before (n=24)</td>
<td>After (n=25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.01*</td>
</tr>
<tr>
<td></td>
<td>2 (8%)</td>
<td>8 (32%)</td>
<td>5 (20%)</td>
<td>6 (24%)</td>
<td></td>
<td>71%</td>
<td></td>
</tr>
<tr>
<td>Lack of education</td>
<td>Before (n=25)</td>
<td>After (n=25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.44</td>
</tr>
<tr>
<td></td>
<td>2 (8%)</td>
<td>6 (24%)</td>
<td>6 (24%)</td>
<td>1 (4%)</td>
<td></td>
<td>68%</td>
<td></td>
</tr>
<tr>
<td>Lack of continuing education</td>
<td>Before (n=25)</td>
<td>After (n=25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>1 (4%)</td>
<td>7 (28%)</td>
<td>5 (20%)</td>
<td>2 (8%)</td>
<td></td>
<td>64%</td>
<td></td>
</tr>
<tr>
<td>Patients not interested</td>
<td>Before (n=25)</td>
<td>After (n=25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>4 (16%)</td>
<td>7 (28%)</td>
<td>5 (20%)</td>
<td>2 (8%)</td>
<td></td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>Patients prefer pharmaceuticals</td>
<td>Before (n=25)</td>
<td>After (n=25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.51</td>
</tr>
<tr>
<td></td>
<td>2 (8%)</td>
<td>7 (28%)</td>
<td>5 (20%)</td>
<td>1 (4%)</td>
<td></td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>Lack of guidelines</td>
<td>Before (n=25)</td>
<td>After (n=25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>3 (12%)</td>
<td>7 (28%)</td>
<td>7 (28%)</td>
<td>3 (12%)</td>
<td></td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>Lack of knowledge</td>
<td>Before (n=25)</td>
<td>After (n=25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>4 (16%)</td>
<td>9 (36%)</td>
<td>8 (32%)</td>
<td>4 (16%)</td>
<td></td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>Lack of incentive</td>
<td>Before (n=25)</td>
<td>After (n=25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.02*</td>
</tr>
<tr>
<td></td>
<td>8 (32%)</td>
<td>7 (28%)</td>
<td>8 (32%)</td>
<td>4 (16%)</td>
<td></td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>Patients won’t change</td>
<td>Before (n=25)</td>
<td>After (n=25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>4 (16%)</td>
<td>10 (40%)</td>
<td>6 (24%)</td>
<td>3 (12%)</td>
<td></td>
<td>44%</td>
<td></td>
</tr>
<tr>
<td>Other changes more important</td>
<td>Before (n=24)</td>
<td>After (n=25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>9 (38%)</td>
<td>14 (56%)</td>
<td>5 (21%)</td>
<td>3 (12%)</td>
<td></td>
<td>33%</td>
<td></td>
</tr>
<tr>
<td>Lack of evidence</td>
<td>Before (n=25)</td>
<td>After (n=25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.66</td>
</tr>
<tr>
<td></td>
<td>18 (72%)</td>
<td>17 (68%)</td>
<td>3 (12%)</td>
<td>1 (4%)</td>
<td></td>
<td>16%</td>
<td></td>
</tr>
</tbody>
</table>

* p<0.05, ** I+VIP+EIP = Important + Very Important + Extremely Important
4.3.3 **Self-reported Knowledge and Confidence Levels.**

Family physicians’ self-reported knowledge and confidence were significantly correlated with one another before (Pearson r=0.84) and after (Pearson r=0.95) the intervention. At baseline, physicians’ mean self-reported knowledge and confidence on a 10 point scale were 6, and 6.2, respectively. One month after the intervention, physicians’ mean self-reported knowledge increased to 7.1, and confidence to 7.0, both significant increases based on the results of paired t-tests (p<0.01).

However, the increase in family physicians’ self-reported knowledge and confidence did not coincide with a change in the way they perceived their effectiveness in changing patient behaviour. After the workshop, the proportion of patients that physicians believed would change their behaviour as a result of their counselling was changed (p=0.83).

4.3.4 **Knowledge of Canada’s Physical Activity Guidelines.**

The number of family physicians who were able to correctly identify the Canadian Physical Activity Guidelines for both moderate-vigorous physical activity and muscle/bone strengthening activity increased significantly from four (16%) to thirteen (52%) (p<0.01). As demonstrated in Figure 4, more physicians correctly identified the aerobic guidelines than the resistance training guidelines both before (20 vs. 5) and after (21 vs. 13) the workshop.
Figure 4: Number of family physicians correctly identifying the Canadian Physical Activity Guidelines for moderate-vigorous physical activity and strength training.

4.3.5 Physicians’ Self-Reported Physical Activity Levels.

The median MET-minutes per week for family physicians based on their IPAQ responses was 1624 before, and 1704 MET-minutes/week one month after the intervention – this difference was not significant. At baseline, 19 of the physicians (79%) were at least in the “Moderate” category of the IPAQ scoring system, meaning they reached the recommended levels of physical activity set forth by the Canadian Physical Activity Guidelines. At follow up, 21 (84%) of the physicians obtained at least this level of activity (Table 5).
TABLE 5: Family physicians’ self-reported physical activity levels pre- and post-intervention.

<table>
<thead>
<tr>
<th></th>
<th>Pre-Intervention (n=24)</th>
<th>Post-Intervention (n=25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MET Minutes [Median (IQR)]</td>
<td>1624 (1026-2335)</td>
<td>1704 (1011-2542)</td>
</tr>
<tr>
<td>Low [n (%)]</td>
<td>5 (21%)</td>
<td>4 (16%)</td>
</tr>
<tr>
<td>Moderate [n (%)]</td>
<td>10 (42%)</td>
<td>10 (40%)</td>
</tr>
<tr>
<td>High [n (%)]</td>
<td>9 (37%)</td>
<td>11 (44%)</td>
</tr>
</tbody>
</table>

**MET** = Metabolic Equivalent of Task, or metabolic equivalent. Equivalent to the energy cost associated with sitting still.

**Low** = Reported no physical activity or not enough to reach “Moderate” category.

**Moderate** = Equivalent to at least 5 days of activity with at least 30 minutes of activity on those days. Enough reported activity to reach public health recommendations.

**High** = A third category of physical activity associated with increased health benefits, equivalent to an hour of moderate activity daily.
Chapter 5: Discussion

This study explored the feasibility of physician training to change the physical activity prescription practices of family physicians. The results indicate that continuing education and practical tools may be a feasible method of encouraging physicians to increase their use of physical activity prescriptions.

5.1 Written Physical Activity Prescription Behaviours

Feasibility was primarily ascertained by evaluating the change in the number of family physicians providing written physical activity prescriptions one month after the delivery of a three-hour workshop to family physicians in Abbotsford and Mission, British Columbia. Since the workshop was designed to address known barriers to physical activity prescription, I hypothesized that there would be a significant increase in the proportion of family physicians providing written physical activity prescriptions. In line with the original hypothesis, I saw a significant increase in the proportion – from 40% to 68% – of family physicians who provided written prescriptions to their patients, four weeks after the intervention (Figure 1).

Many trials have examined the efficacy of physical activity prescription in controlled research settings and documented high rates of physician physical activity prescription [142]. However, to this author’s knowledge, only two other studies have evaluated changes in primary care providers’ physical activity prescription practices after clinician training [146,149]. Notably, neither of these studies were done in a Canadian context, nor exclusively with family physicians. The first of these studies by Carroll et al. [146] differed this present study in a number of ways. They investigated a
smaller number of providers (n=10), included nurse practitioners and physician assistants, and utilized patient-reported Physical Activity Exit Interview (PAEI) results as their measurement tool. As their primary outcome, they focused on clinical use of the 5As Framework and community referrals, not on the distribution of written physical activity prescriptions. They noted a significant improvement in the use of the 5As framework immediately after the intervention but not at 6 month follow-up [146]. My current results extend their findings by highlighting the effects of physician training on written physical activity prescription practices, and by focusing exclusively on family physicians.

The second study was conducted by Dacey and colleagues [149], and evaluated the effects of two face-to-face CME programs in lifestyle medicine on healthcare providers’ barriers, knowledge, confidence, and lifestyle counselling practices. Compared to this current investigation and Carroll et al.’s study [146], Dacey et al. had a significantly larger sample size (n=200), although less than half (49%) of these participants were family physicians [149]. Their study also differed in that it evaluated a broader range of lifestyle counselling outcomes, including diet, stress management, and smoking cessation. The two programs evaluated were, 1) a one-day general lifestyle medicine program, and 2) a two-and-a-half day program, “Active Doctors, Active Patients” [149]. Similar to my study, participation in the CME programs and completion of the baseline and follow up surveys were completely voluntary, which replicates many real-world continuing education programs.

After 90 days, Dacey et al. found that a significantly greater proportion of providers prescribed exercise (from 43.5% to 55%) to their patients [149]. To my knowledge, this is the only other study that has demonstrated increases in written physical activity prescription behaviour after physician
training. Notably, my current results found a greater increase in the proportion (from 40% to 68%) of physicians giving written prescription, even though the intervention was substantially shorter (3-hours compared to the 1 day or 2.5 day programs). However, this may be partly attributable to the shorter follow-up time in this current study. Although my current study and Dacey et al.’s study are limited by their pre-post design, together they provide some promising preliminary data into the feasibility of live CME training to increase physical activity prescription within primary care.

Two Australian-based dissemination studies have incorporated physician training within larger scale implementation of physical activity promotion [147,148]. The 10,000 Steps Rockhampton Project provides one example of a large-scale dissemination study, conducted over the course of two years [148]. In their project, family physicians were one component of a 2-year, multi-strategy, community-based physical activity intervention. Like this current study, all physicians in the local community were invited to participate in the intervention. Family physicians that volunteered to participate in the project, 1) underwent two continuing medical education workshops which trained them to counsel patients on physical activity, 2) were provided with written resources to share with their patients, and 3) were encouraged to loan pedometers to their patients. Further, physicians received practice visits from research staff to encourage them to implement exercise counselling and incorporate the educational materials and pedometers as part of the 10,000 Steps Project [148]. Utilizing the RE-AIM framework to evaluate the public health impact of dissemination trials [164], the authors documented high levels of GP uptake and reasonable implementation levels. Most notably, effectiveness was demonstrated by increased rates of physical activity prescription reported by patients in Rockhampton compared to a control community, based on community telephone surveys [148].
The Victorian Active Script program is another Australian-based dissemination study which aimed to increase physical activity prescriptions in primary care through education and the provision of resources [147]. Participating physicians received educational training through seminars, practice visits, or clinical audits, as well as received supplementary resources to facilitate their use of “Active Scripts”. Similar to the Rockhampton Project, the investigators utilized the RE-AIM framework to conduct their evaluation and demonstrated modest results in terms of physician and patient reported data. Notably, they demonstrated that the program was cost-effective, even using conservative estimates of patient behaviour change [147]. Similar to my study, the Active Script program was disseminated through partnerships with the Divisions of General Practice. Therefore, the trial was able to providing much needed insight into the effectiveness, not just efficacy, of physical activity prescription in this Australian primary care context.

These two Australian-based dissemination trials provide encouraging examples of how physician training can be incorporated into large scale projects to increase physical activity promotion within primary care. However, given the multi-factorial nature of such dissemination studies, it is impossible to determine which factors elicited changes in family physicians’ physical activity prescription practices within these trials. Therefore, more research is indicated to determine the optimal characteristics of physician training interventions. Nonetheless, these trials demonstrate how physical activity prescription in primary care can be effectively disseminated in real-world settings, and provide a model to follow for future investigations in different settings and contexts.
5.2 Exploratory Outcomes

5.2.1 Other Prescription Practices

Although limited by a small sample size, I conducted exploratory analyses with other available variables to investigate additional changes after the intervention. As with Petrella et al.’s national survey [109] and others [102], a substantially larger proportion of family physicians in this current study reported asking (100%) and verbally counselling (100%) their patients in comparison to the other behaviours (assessing, referring, and providing written prescriptions) at baseline and follow up (Figure 2). Since lack of time is the most common barrier to physical activity prescription [130], it may be that the efficiency with which family physicians can ask and provide verbal counselling allow them to utilize these behaviours more frequently than other, more time intensive behaviours.

In addition to a significant increase in the use of written prescriptions, the proportion of physicians who reported referring patients for the purpose of physical activity assessment or prescription increased from 36% to 64%. Carroll et al.’s study [146], which included an emphasis on community referral also found that the one of the groups in their study were more comfortable referring patients to these programs at follow up. These findings are in contrast to the study by Dacey et al., in which physicians were significantly less likely to refer patients to specialists or support groups (e.g. Weight Watchers) 90 days after CME training in lifestyle medicine [149]. This discrepancy may be explained by differences in educational content and emphases between the respective interventions. Further, the EIM Canada Prescription Pad and Referral Tool, which was one of the primary tools given to physicians during the current workshop, was designed to allow easy referral to other physical activity professionals if indicated [155]. This may have facilitated the increase in referrals seen in our current study.
By asking the frequency with which family physicians engaged in each of the 5 physical activity prescription practices, I was able to evaluate whether those who already engaged in each of the behaviours at baseline changed their routine practice after the intervention (Table 3). All participating family physicians (100%) reported asking patients about their physical activity levels before and after the intervention. However, the proportion of patients that they asked increased at follow-up. Before the workshop, 18 family physicians asked at least 40% of their patients about their physical activity levels. After the workshop, this increased to 22 physicians who asked ≥40% of their patients. Physicians (n=13) who assessed patients’ physical activity or fitness at baseline and follow up also did so more frequently after the intervention, with 12 of 13 physicians assessing ≥40% of their patients, compared to 9 of 13 before the intervention.

It should be noted that in this current study, there were no changes in verbal counselling frequency reported by family physicians. This may have been attributed to the high baseline rates of verbal counselling among participating physicians, or due to the emphasis of the training workshop on providing written physical activity prescriptions.

5.2.2 Perceived Barriers to Physical Activity Prescription

The perceived importance of the twelve included barriers (Table 4) resemble those of previous studies. As with previous physician surveys [100,130,131], “lack of time” was considered the most important barrier to physical activity prescription at baseline, followed by a lack of tools, lack of education, and a lack of continuing education. Lack of time did not change in perceived importance after the workshop. Although lack of time is repeatedly mentioned, it may be noted that during the Activity Counselling Trial, 63% of physicians reported that providing physical activity prescriptions resulted in little or no increase in the length of an average visit [142].
Lack of tools was the only barrier to physical activity prescription that decreased in perceived importance one month after the workshop (Table 4). At baseline, it was the second most cited barrier, and only the 8th most important at follow up. It is possible that the provision of specific tools (written and electronic copies of a physical activity vital sign, and EIM Canada’s Exercise Prescription and Referral Tool), in conjunction with the educational intervention, played a role in changing physicians’ behaviours in the present study. Further, the preference of physicians for tailored written prescriptions over verbal advice alone in New Zealand’s Green Prescription program supports the use of tools to facilitate physical activity prescription in family practice [75].

The changes in family physicians’ perceptions of time and tools as barriers to prescription after this training intervention replicate those of Dacey et al. [149]. In conjunction with increases in providers’ physical activity prescription practices, they also found that lack of time was the most significant barrier at baseline and follow up, and did not significantly change after the lifestyle counselling intervention [149]. Conversely, lack of materials significantly decreased (mean decrease from 5.3 to 3.8 on a 10 point scale) as a perceived barrier 90 days after training [149].

A lack of education and related factors have been repeatedly cited as barriers to physical activity prescription [100,131]. 73% of US physicians feel there is a need for further education regarding physical activity prescription [102], and among 4th year medical students at the University of British Columbia, 86% thought their training in physical activity prescription was inadequate [124]. These findings are supported by this current study, as a lack of education and lack of continuing education were ranked as the 3rd and 4th most important barriers at baseline (Table 3). However, our current intervention did not change physicians’ perceptions of education or continuing education as barriers.
The only barrier that increased significantly in perceived importance was a lack of financial incentive. For physical activity prescriptions to become more common, it may be important that family physicians receive training on how to prescribe in a time-efficient manner, or receive reimbursement that compensates them for the additional time spent performing physical activity counselling with their patients.

5.2.3 Self-Reported Knowledge and Confidence Regarding Physical Activity Prescription

Family physicians who report having received education, and possess higher self-efficacy regarding physical activity prescription, are more likely to engage in these practices with their patients [115,116]. Moreover, addressing the barrier of education by providing physician training has been shown to increase physicians’ self-reported knowledge and confidence regarding physical activity prescription [147,149]. Therefore, it is not surprising that physicians’ self-reported confidence and knowledge (on a 10 point scale) regarding physical activity prescription increased after the current workshop, with mean increases of 1.1 in knowledge (from 6.0 to 7.1), and 0.8 (from 6.2 to 7.0) in confidence. These effects were very similar to those found by Dacey et al. [149], as healthcare providers’ knowledge (from 6.8 to 8.0) and confidence (from 7.2 to 8.5) regarding exercise counselling both increased 90 days after lifestyle medicine training. However, Dacey et al. [149] were reliant on these self-reported indicators and acknowledged that their inability to verify any actual change in knowledge was a limitation of their investigation. Conversely, in the current study, family physicians’ knowledge was tested through whether they were able to correctly identify the Canadian Physical Activity Guidelines.
5.2.4 Physicians’ Knowledge of the Canadian Physical Activity Guidelines

A substantially greater proportion of family physicians (52% compared to 16% at baseline) were able to correctly identify the Canadian Physical Activity Guidelines one month after the intervention (Figure 4). Lack of education and knowledge as barriers to physical activity prescription may be identified in a lack of guideline knowledge at baseline, when only 16% of family physicians were able to identify the Canadian Physical Activity Guidelines. This aligns with previous data indicating that 23% of surveyed physicians in the United States were familiar with the ACSM Guidelines, while 78% felt there was a need for a course related to the medical aspects of exercise [102]. Similarly, less than 10% of Brazilian physicians were able to identify guidelines for moderate and vigorous physical activity [118]. Finally, in Scotland, although there were high levels of enthusiasm reported by physicians for physical activity prescription, only 13% of family physicians could correctly describe the national physical activity guidelines [98].

5.2.5 Physicians’ Personal Physical Activity Levels

It has been well-documented that family physicians’ physical activity prescription habits are positively associated with their own personal physical activity levels [112]. In this study, the majority of physicians, 79% at baseline and 84% at follow up (Table 5), were classified at least as moderately active by their IPAQ scores, which corresponds to meeting the Canadian Physical Activity Guidelines. Thus, although participating family physicians demonstrated a lack of baseline knowledge regarding physical activity guidelines, most were physically active themselves. It may be that the workshop attracted those who were in need of further education, but were personally invested in the area of physical activity. This may help to explain why the baseline
levels of all the physical activity prescription behaviours were higher than in previous cross sectional surveys [109,131].

5.3 Study Strengths

First, I investigated the feasibility of a real-world training intervention to change family physicians’ clinical practice behaviours. Although literature on the efficacy of physical activity prescription in primary care is abundant, research into the potential for continuing education and other interventions to increase family physicians’ routine physical activity prescription practices is in its infancy. My data showing an increase in the number of physicians using written physical activity prescriptions provides some preliminary evidence for the feasibility of educational interventions to change physician behaviour and highlights the need for more research.

Second, the workshop addressed known barriers to physical activity prescription, and incorporated elements known to improve the effectiveness of in-person CME training. Specifically, the training sessions delivered the educational content in an interactive format, addressed known barriers to behaviour change, and incorporated the provision of practical tools that facilitated the targeted changes. Further, to my knowledge, this is the first study to incorporate the Exercise is Medicine Canada’s Exercise Prescription and Referral Tool [157].

Moreover, as opposed to a strict research environment common to efficacy trials, the intervention was incorporated within the routine CME program of the local Divisions of Family Practice. Although this type of setting lacks the methodological rigor of a randomized efficacy trial, it may increase the feasibility of its dissemination into different primary care settings through their
respective Divisions of Family Practice and allow for large scale effectiveness trials. For example, the Active Script program in Australia was similarly disseminated through their Divisions of General Practice [147].

Finally, to my knowledge, this is the first study to report an increase in the use of written physical activity prescriptions after a brief training intervention exclusively for family physicians, and the first to incorporate such a training intervention in a Canadian setting. Although Dacey et al. found similar increases in primary care providers’ physical activity promotion practices, the two interventions they evaluated were one day long, and two-and-half days long, respectively, compared to this current intervention which was only three hours [149]. Although my current study involved a shorter follow up time, it is encouraging that a brief training intervention was enough to initiate these changes in family physician practices.

5.4 Study Limitations

First, like the other two published studies investigating training interventions to change providers’ physical activity prescription practices [146,149], this study utilized a pre-post study design and therefore the findings must be interpreted with caution. Although pre-post study designs have been proposed as appropriate in feasibility studies [151], the lack of a control group means that I cannot confirm whether changes in family physician behaviours were solely attributable to participation in the training intervention.

Although I identified a significant decrease in the perceived importance of lack of tools and conducted exploratory analyses on a variety of outcomes, the small sample size of 25 limits the
statistical power of the study. Therefore, I was not able to fit a model to identify predictors of observed changes in written prescription behaviours. Further, the study lacked power to detect changes in exploratory variables that may have been statistically significant in a larger sample.

Given the reliance on self-reported survey data for outcome measures, the potential impact of selection bias and response bias are notable limitations of the study. Selection bias – wherein a selected sample is unrepresentative of the population from which it was selected – may have played a substantial role in the current study. Since all family physicians in the two municipalities were invited to participate, there was no random selection of participants to whom the survey was delivered. However, there was an inherent risk of self-selection bias, as all physicians had the opportunity to participate, with only 16% of the total study population included in the analysis. In this case, it may be that more motivated physicians chose to attend the workshops and respond to the survey. This may help to explain why the baseline levels of physical activity prescription behaviours were higher than in previous cross-sectional surveys [109,131].

Due to the reliance on self-reported data, there was also an inherent risk for response bias, where family physicians may have responded in what they perceive to be a socially desirable way, in this case that they prescribe physical activity more frequently. Since it is known that the rates of physicians’ self-reported physical activity prescription behaviours are higher than patient reported data and direct observation, they may have over-reported some of their responses in the current study.

The external validity of the study is limited, given that the intervention was implemented within two neighbouring cities in Western Canada. The lack of data on non-responders also prevented examination of the representativeness of participating family physicians with the study population.
However, it may be noted that previous Canadian surveys have found similar rates of physical activity counselling across Canadian provinces [112].

Finally, the short follow-up time (4 weeks) of this current study does not indicate sustained behaviour change. Therefore, although brief training and the provision of tools may be a feasible method of increasing family physicians’ use of written physical activity prescriptions, more intensive interventions may be necessary to sustain and maximize these practice changes. Reviews indicate that more comprehensive interventions, including follow-up sessions and reminders, may be advantageous in changing physician practices and sustaining these changes [135]. Moreover, interviews with physicians in Carroll et al.’s study [146] indicated that follow up sessions would have been useful to encourage continued implementation of physical activity prescriptions and referrals using the 5As framework. Nonetheless, it is encouraging that I was able to identify an improvement in physicians’ practices with only a single continuing education session, which may allow for easier implementation in other settings.

5.5 Contributions of This Study to the Field and Future Research Directions

Very few studies have investigated the feasibility of interventions designed to change the behaviours of currently practicing family physicians, and none in a Canadian context. This study provides some insight to the feasibility of brief physician training with the provision of practical tools as an intervention to increase the use of physical activity prescriptions in family practice.

Within Bowen and colleagues’ [151] framework for feasibility studies, I aimed to answer the question “Can it work?”, as it pertains to increasing physical activity prescription among family physicians in my sample. This is the first stage of intervention development, and is appropriate in
this instance since very few studies have investigated this type of training in real-world settings. My results are promising, and provide some preliminary evidence for the feasibility of brief training with the provision of practical tools to increase the use of physical activity prescription by family physicians. To my knowledge, this is the first study to show these changes in a group of Canadian family physicians. As outlined by Bowen et al. [151], positive outcomes from feasibility studies indicate that such interventions are appropriate for further testing.

First, effectiveness trials with increased sample size and comparison designs are needed to strengthen the evidence base for physician training to increase physical activity prescription in primary care, and to determine optimal methods of training. To overcome the limitations of the current study, more objective measurements should be used to assess clinician behaviour, such as direct observation of consultations [94], along with patient behaviours and health outcomes. Given that multiple interventions are most effective for creating and sustaining long-term changes in physician practices [132], future trials to increase family physicians’ use of physical activity prescriptions should incorporate these multiple interventions, including reminders and follow-up sessions. These may facilitate and sustain physician behaviour change.

Ideally, long-term dissemination (>2 year) trials should be implemented to examine the public health impact of physician-targeted training interventions. No such trial has been conducted in a Canadian context, so research is indicated. It is recommended that these dissemination trials utilize existing infrastructure, such as local Divisions of Family Practice, to implement these interventions. This type of dissemination will facilitate the scalability of the intervention into different communities while allowing for flexibility to specific community contexts. These dissemination trials should utilize the RE-AIM framework to quantify the public health impact of
such interventions [165], and if possible, document their cost-effectiveness. Both the 10,000 Steps Rockhampton Project [148] as well as the Victorian Active Script Program [147] provide useful examples of these types of dissemination trials.
Chapter 6: Conclusion

Family physicians have been increasingly called upon to play a significant part in the fight against physical inactivity [2,35,36,166,167]. Even though physical activity prescriptions in primary care are efficacious in changing patient behaviour [45,47,72], few have investigated the feasibility of interventions designed to change family physicians’ physical activity prescription behaviours. I found that educational training in conjunction with practical physician tools may be a feasible method of promoting these behaviours, indicated by an increase in the proportion of family physicians – from 40% to 68% - providing written physical activity prescriptions to their patients one month after the intervention.

Exploratory analyses found that after the intervention, “lack of tools” decreased as a perceived barrier to physical activity prescription, family physicians’ self-reported knowledge and confidence increased regarding physical activity prescription, and a greater number of physicians correctly identified the Canadian Physical Activity Guidelines.

Although the findings need to be interpreted with caution as a feasibility trial, this study indicates that educational training and the provision of tools for family physicians may be a feasible method to promote physical activity prescriptions. Therefore, similarly constructed training interventions may be a feasible and important component in future dissemination trials investigating physical activity prescription in primary health care.

I conclude that physician training combined with practical tools provide a feasible, promising method of encouraging physical activity prescriptions among Canadian family physicians.
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Appendixes

Appendix A Bespoke Questionnaire

1. What is your gender? (Circle 1)
   
   Male       Female

2. What is your age?
   
   ________

3. How many years have you been practicing family medicine?
   
   ________

4. Do you use electronic medical records (EMR) in your practice? (Circle 1)
   
   Yes       No

5. Do your medical records include physical activity levels as a measure? (Circle 1)
   
   Yes       No
Physical Activity Prescription Behaviors:

1) Do you ask/inquire about the physical activity behaviors of your patients? (Circle 1)  Yes  No
   a. If yes, with what % of patients do you inquire? (Circle 1)
      1  2  3  4  5
      1-20% 21-40% 41-60% 61-80% 81-100%

2) Do you assess the physical fitness or activity levels of your patients? (Circle 1)  Yes  No
   a. If yes, what % of patients do you assess? (Circle 1)
      1  2  3  4  5
      1-20% 21-40% 41-60% 61-80% 81-100%
   b. If yes, what method(s) of assessment do you use? ________________________________
      ____________________________________

3) Do you refer your patients to other professionals for fitness assessment and/or prescription? (Circle 1)  Yes  No
   a. If yes, what % of patients do you refer? (Circle 1)
      1  2  3  4  5
      1-20% 21-40% 41-60% 61-80% 81-100%
   b. If yes, to which types of fitness professionals do you refer, for the purpose of physical fitness assessment or prescription? (Circle all that apply)
      i. Physiotherapist
      ii. Chiropractors
      iii. Exercise Physiologist
      iv. Personal Trainer
      v. Kinesiologists
      vi. Other(s) ________________
      ____________________________________

4) Do you provide verbal counselling on physical activity to your patients? (Circle 1)  Yes  No
   a. If yes, to what % of patients do you verbally counsel/prescribe physical activity to? (Circle 1)
      1  2  3  4  5
      1-20% 21-40% 41-60% 61-80% 81-100%

5) Do you provide written physical activity prescriptions to your patients? (Circle 1)  Yes  No
   a. If yes, to what % of patients do you give written physical activity prescriptions? (Circle 1)
      1  2  3  4  5
      1-20% 21-40% 41-60% 61-80% 81-100%

6) What percentage of patients do you believe would increase their physical activity levels if you were to counsel them about physical activity? (Circle 1)
      1  2  3  4  5
      1-20% 21-40% 41-60% 61-80% 81-100%
7) On a scale of 1-10, how would you rate your knowledge in regards to physical activity counseling? (Circle 1)  

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not knowledgeable</td>
<td>Extremely knowledgeable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

8) On a scale of 1-10, how would you rate your confidence in regards to physical activity counselling? (Circle 1)  

<table>
<thead>
<tr>
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<th>1</th>
<th>2</th>
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<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not Confident</td>
<td>Extremely confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9) How important do you perceive the following barriers to be in preventing you from prescribing physical activity more regularly? (Circle a number for each item below, using the response options shown below)  

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Not Important</th>
<th>Somewhat Important</th>
<th>Important</th>
<th>Very Important</th>
<th>Extremely Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not enough time</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Patients will not change</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Patients not interested in exercise</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Lack of standard guidelines on physical activity counselling</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Patients prefer pharmaceutical interventions</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Lack of tools available</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Lack of evidence for health benefits of physical activity</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Not enough financial incentive</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Lack of exercise education in medical school</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Lack of continuing education in physical activity</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Lack of personal knowledge</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Other lifestyle changes are more important</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

List any other barriers you deem important: ____________________________________________________________

10) The Canadian Physical Activity Guidelines recommend that adults get how many minutes of moderate physical activity/week? (Circle 1)  

<table>
<thead>
<tr>
<th></th>
<th>60</th>
<th>90</th>
<th>150</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4+</td>
</tr>
</tbody>
</table>

11) The Canadian Physical Activity Guidelines recommend that adults engage in bone and muscle strengthening activities at least how many times/week? (Circle 1)  

<table>
<thead>
<tr>
<th></th>
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<th>2</th>
<th>3</th>
<th>4+</th>
</tr>
</thead>
</table>
International Physical Activity Questionnaire – Short Form

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport. Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   _____ days per week

   [ ] No vigorous physical activities ➔ Skip to question 3

2. How much time did you usually spend doing vigorous physical activities on one of those days?

   _____ hours per day
   _____ minutes per day

   [ ] Don’t know/Not sure

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

   _____ days per week

   [ ] No moderate physical activities ➔ Skip to question 5
4. How much time did you usually spend doing moderate physical activities on one of those days?

_____ hours per day

_____ minutes per day

☐ Don’t know/Not sure

Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

_____ days per week

☐ No walking

Skip to question 7

6. How much time did you usually spend walking on one of those days?

_____ hours per day

_____ minutes per day

☐ Don’t know/Not sure

The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the last 7 days, how much time did you spend sitting on a week day?

_____ hours per day

_____ minutes per day

☐ Don’t know/Not sure