A TEAM-BASED MODEL OF CARE: QUALIFIED EXERCISE PROFESSIONALS AND THE IMPACT ON AGING HEALTH

by

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A Team-Based Model of Care: Qualified Exercise Professionals and the Impact on Aging Health

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Abstract

Background: Physical inactivity is a rising global concern as it relates to the risk of non-communicable diseases (NCD) and associated burden on health care. Failure to incorporate 150 minutes per week of physical activity (or 15-30 minutes per day) has been shown to increase the risk of NCDs such as cancer, heart disease, stroke, and diabetes by 20-30%, and decreases longevity by 3-5 years. The importance of 15-30 minutes of physical activity should no longer be undervalued in Canada, and globally.

Objective: To evaluate the impact of a twelve-month team-based care model within a private healthcare setting that included three or more qualified exercise professional visits on improving physical fitness and other risk factors for cardiovascular disease compared to their matched controls.

Methods: 288 male and female patients' charts of any age (m=61) were retrospectively reviewed for their engagement in a team-based care model between 2005-2016. The patients were assigned to one of two groups, a primary prevention group or a secondary prevention group based on elevated risk for or diagnosed with cardiovascular disease and received three or more fitness follow ups throughout program length by a qualified exercise professional (QEP) or did not. Measures of physical fitness and cardiovascular health were assessed for change over the twelve-month program length.

Results: The patients who attended three or more sessions with a QEP over a 12-month program showed statistically significant improvements in their engagement in physical activity, and BMI. Waist circumference improved significantly for those engaged patients who had a high-risk waist size at baseline but were not coded with chronic disease (primary prevention). Over time, the overall cohort, who participated in the team-based care model, resulted in statistically significant improvement in their physical activity engagement, cardio-respiratory fitness, waist circumference, and systolic blood pressure.

Conclusion: A team-based care approach with regular QEP visits was effective at improving cardio-metabolic health of adults Canadians. A team-based care approach led to improving measures of cardio-metabolic health of adult Canadians. Future research should consider how to effectively measure a team-based care model in primary and secondary prevention.

Lay Summary

Physical inactivity is a rising global concern as it relates to the risk of non-communicable diseases (NCD) and associated burden on health care costs (World Health Organization, 2009). Most research focuses on the benefits of collaborative care or certain care streams on improving the health of those with chronic disease. There is very little research trying to quantify maintaining good health and pushing back the onset of disease. This study evaluated whether a team-based care model with three or more visits with a QEP over the twelve-month program benefited the cardio and metabolic health of 288 Canadian adults. After the team-based care model with QEP visits, body habitus, physical activity level, and aerobic capacity of those Canadian adults were improved, affirming a positive impact of team-based care and exercise professionals.

Preface

Nadine M. Sinnen was the primary author of this manuscript and was responsible for the identification of the topic of this research, study design, chart reviews, and creation of this thesis. All analysis was done by Nadine M Sinnen. All of the work in this thesis is original and unpublished.

The team-based health care provided by Copeman Healthcare Centre assisted in the collection of data and data entry.

Ethical approval for this investigation was obtained from the UBC Clinic Research Ethics Board (H16-03206-A004).

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List of Abbreviations

ACSM	**American College of Sports Medicine**
BMI	**Body Mass Index**
CSEP	**Canadian Society for Exercise Physiology**
CRF	**Cardio-Respiratory Fitness**
DBP	**Diastolic Blood Pressure**
HDL	**High Density Lipoprotein**
LDL	**Low Density Lipoprotein**
MET	**Metabolic Equivalent of Task**
NCD	**Non-Communicable Diseases**
OECD	**Organisation for Economic Corporation and Development**
PA	**Physical Activity**
QEP	**Qualified Exercise Professional**
SBP	**Systolic Blood Pressure**
VO2max	**Maximal Aerobic Capacity**
WC	**Waist Circumference**

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Accomplishments don't happen in isolation, it takes a team of dedicated people who support, motivate, and believe in one another.

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To my husband Myron, and our boys Kai and Neko, may we set the supreme example of life balance and good health to our family.

To all Canadians who strive for better health

Chapter 1: Introduction

1.1 Introduction and Rationale

Physical inactivity is a rising global concern as it relates to the risk of non-communicable diseases (NCD) and associated burden on health care costs (World Health Organization, 2009). In 2008, the number of global deaths linked to inactivity equalled the number of deaths linked to smoking at 5.15 million (Shavelle, et al., 2008). Failure to incorporate 150 minutes per week of physical activity (or 15-30 minutes per day) has been shown to increase the risk of NCDs such as cancer, heart disease, stroke, and diabetes by 20-30%, and decreases longevity by 3-5% (World Health Organization, 2009, Lee, et al.,2012, Tremblay, et al., 2011). The value of physical activity is undeniable and has been known for many decades. In Canada, guidelines were originally published in 1998 to promote physical activity (PA) and to encourage Canadians to move more. Updates to the recommended dosage of physical activity in Canada are ongoing and were endorsed by multiple groups including the Public Health Agency of Canada (PHAC), and 'ParticiPACTION' in 2011 (Tremblay, et al., 2011). Physical activity guidelines for adults (aged 18-65) encourage 150 minutes per week or more at a moderate-to-vigorous intensity. This exercise can be done in bouts of 10 minutes or more, and more is suggested to have a greater benefit to health. The performance of muscle and bone strengthening exercises twice per week or more is also encouraged (Tremblay, et al., 2011). For those who are deconditioned, a small positive change in physical fitness may respond with marked health outcomes status change. The dose – response relationship between relative risk and PA level is thought to be bell-curved, yet not fully understood (Warburton, et. al., 2011).

With improvements seen across so many chronic diseases such as cardiovascular disease, hypertension, cancer, depression, stroke, and diabetes (Pederson & Saltin, 2015), exercise has a key role in clinical practice as a modality for risk reduction and prevention. Why then, if the benefits are so clear, are only 15% of Canadians currently meeting the recommended daily guidelines for exercise (Colley, et al., 2013)? This rate is down from 21% in 1999 (Centre for Disease Control and Prevention, 1999). And what about those who fall well below the guidelines (Myers, et al., 2002)? One angle to address these declining numbers is to consider the frequency that primary care practitioners assess and promote exercise to their patients as part of an effective treatment plan (Pate, et al., 1995). Further education and resources made available to healthcare workers on the benefits and accessibility of exercise therapy could improve patient care.

1.2 Aims

The aim of this study was to assess whether frequent in-office visits to Qualified Exercise Professionals (QEP) working under a physician lead in the context of a team-based model of care over a 12 month period, resulted in improved measurable cardio-metabolic health outcomes to include physical activity level, cardiorespiratory fitness, body mass index, fasting blood sugar levels, total cholesterol levels, high density lipoproteins, low density lipoproteins, waist circumference, and heart rate reserve (see Table 1). A 12-month retrospective cohort study design was used.

Table 1 Health Measures

Health measures	Units
Predicted VO2max	METs
Waist Circumference	cm
Blood Pressure	mmHg
Cholesterol	mmol/L

HDL Cholesterol	mmol/L
LDL Cholesterol	mmol/L
Triglycerides	mmol/L
Fasting Blood Sugar	mmol/L
Body Mass Index	kg/m^2
Heart rate reserve	BPM

1.3 Hypothesis

We hypothesized that three or more visits with a QEP (intervention group) as compared to no additional visit with a QEP (matched control group) would result in improved cardio-metabolic health measures in these patients over a twelve-month period as compared to their matched controls.

Chapter 2: Background and Literature Review

Canada currently ranks amongst the highest for its spending on health-care compared to the other income earning OECD countries that have access to universal healthcare. B.C. is estimated to have a 23.2 week wait time for consult and surgery with the longest wait times being for those who need orthopaedic surgery at 39.0 weeks (Fraser Institute, 2019). The economic burden of disease risk factors in Canada is estimated at 50.3 billion dollars annually, 8-12% of which is associated with physical inactivity (Krueger, Turner, Krueger, & Ready, 2014). The long-term economic benefit of reducing risk factors of smoking, physical inactivity, and excess weight even by 1%, is estimated within 15 years, to result in a cost savings of 8.5 billion dollars per year. This information provides a good basis for problem solving strategies to reduce risk factors amongst Canadians.

Physical inactivity has accounted for 3.7% of total health care spending, or 6.8 billion dollars in 2009 (Jannsenn, 2012). The awareness of health and economic benefits of exercise, decreasing and/or regressing certain chronic conditions, has been proven and advocated, for many years (Pate, et al., 1995). A position statement by the American College of Preventive Medicine (ACPM) in 2005 stated that primary care practitioners should participate in physical activity counselling (Jacobson, Strohecker, Compton, & Katz, 2005). The Canadian Medical Association (CMA) addressed health promotion in the policy resolution GC04-47, and further advocates for physicians to counsel physical activity, work with those allied health professionals who offer PA services and receive ongoing education in prevention and health promotion (Canadian Medical Association Policy, 2001).

With global statistics of NCDs rising yearly, further action on health promotion has become a global priority. In 2007, Jamnik, et. al., recognised the expanding scope of qualified university educated fitness professionals, and the need to revise the clearance criteria for participation in physical activity, with the highest level of qualification in Canada for a fitness professional still being a Canadian Society for Exercise Physiology – Certified Exercise Physiologist title. In 2007, the AMA and ACSM partnered to form Exercise is Medicine (EIM), within two years, this became a global initiative, arriving in Canada in 2012. The Exercise is Medicine Canada (EIMC) mission statement reads "To provide national leadership in promoting physical activity as a chronic disease prevention and management strategy to improve the health of Canadians".

The basic model of EIMC is to assess PA, prescribe PA, and refer to a PA specialist to help make Canadians healthier (Lobelo, Stoutenberg, & Hutber, 2013) (Canadian Institute for Health Information, 2011). To determine whether this type of model works we will briefly review different arms of referral care models that exist for secondary and tertiary prevention and examine exercise's role in different stages of disease management. We will then transition to exercise prevention research, specifically looking at health and PA, PA promotion and referral in primary care.

2.1 Team-Based Care Strategies

In literature team-based care takes on many definitions without full agreement on a theoretical definition and presents like a better model than siloed care providers.

For the purpose of this study, we will use the National Academy of Medicine's (2016) definition of team-based care. Team-based care is defined as "...the provision of health services to individuals, families, and/or their communities by at least two health providers who work collaboratively with patients and their caregivers -to the extent preferred by each patient - to accomplish shared goals within and across settings to achieve coordinated, high-quality care".

The primary intent of team-based care is to provide patient centred-care, improved access to care, practicing to scope, optimizing patient care, and improving work efficiency for care providers involved.

2.2 The Role of Exercise and Exercise Referrals in Disease Management

Exercise is a well-established component of secondary and tertiary prevention in cardiac rehabilitation and diabetes research. Cancer survivor research is underway with potential for good outcomes on functional and psychosocial well-being. If we look at exercise's role in cardiac rehabilitation, which dates back to the 1940s and 1950s, where chair exercises and short bouts of walking were introduced, we now know that exercise can assist in decreasing mortality risk, sense of well-being, aerobic capacity, and symptoms of the disease for individuals with ischemic heart disease, post heart surgery, and heart failure (Mampuya, 2012). Recent research highlights the importance of peak metabolic equivalent level and associated risk reduction, suggesting an improvement in mortality risk by as much as 10-20% when peak metabolic equivalent level (MET) is increased by one, and as much as 30% risk reduction for those who have cardiovascular disease (CVD) and participate in a cardiac rehabilitation program (Myers, et. al. 2015) when peak MET is increased by one.

2.2.1 Diabetes Educators

Diabetes research suggests lifestyle interventions are remarkably effective in reducing the incidence of diabetes by as much as 58% and drug therapy by 31%, when compared to a placebo (Knowler, et al., 2002). The National Certified Board for Diabetes Educators (NCBDE) was established in 1986, recognising the need for patient education on self-monitoring and behaviour-change counselling. Specific patient education and counselling in the management of diabetes has been shown to be effective (Brown, 1990). The model of care for Certified Diabetes

Educators (CDE) is that practitioners who work within a collaborative healthcare team are trained to promote and educate on behaviour change (AAD7). This model has been shown to improve management of health outcomes (Diabetes Prevention Program Research Group, 2004) (Duncan, et al., 2011).

2.2.2 Cancer and Exercise

In the cancer survivor population, which includes anyone living with or overcoming a cancer diagnosis, studies are currently underway assessing the health benefits associated with participation in referral-based community exercise programs. In one current cancer exercise therapy program, run by Dr. Santa Mina out of the Wellspring Cancer Exercise program (WCP) in Toronto, results of his prospective cohort study abstract look promising. The WCP is a program that delivers exercise programming to cancer survivors by referral to a community-based site in two phases: an initial phase which includes two community-based exercise classes per week for ten weeks, followed by a transition phase, where the participants' community-based exercise classes are reduced to one in-class session per week for the remaining 20 weeks. In the cohort study, 229 participants volunteered between 2012-2014. Outcome measures of cancer related to fatigue, quality of life, PA frequency, aerobic fitness, blood pressure, balance, body composition (waist, and body mass index), and upper body strength were measured at baseline, every ten weeks, and 16 weeks post program completion. Outcome measures during the baseline-to-initial phase were significantly better for cancer-related fatigue, aerobic capacity, systolic blood pressure, balance, and PA volume. The transition phase shows significant improvements in quality of life as well. Exercise has a strong role for prevention of cancer and breast cancer in women (Warburton, et al., 2013), and exercise may continue to play a strong role within this population for secondary, and tertiary prevention.

2.3 The Role of Exercise and Exercise Referrals in Disease Prevention

2.3.1 Pre-Diabetes and Exercise

Pre-diabetes research performed to determine the benefits of up to 50 sessions of individual and group lifestyle intervention appointments over a one-year timeline, demonstrate that the more frequent the contact with a healthcare team member, the larger the decrease in body mass, body mass index, and waist circumference. Interestingly, when a kinesiologist was seen two or more times, a significant improvement in physical capacity was reported (Bouchard, Baillargeon, Gagnon, Brown, & Langlois, 2012). From this study, we determined that a measurement of care quantified as number of visits attended can be used to support outcome measures and potential assessment of health care costs associated, specifically with a QEP and should be considered in future research. Knowler, et al. (2002), remind us of the independent value of a lifestyle intervention of physical activity as compared to medication therapy and placebo therapy on incidence of diabetes as measured by blood glucose and glycosylated haemoglobin (HbA1c) over four years. Lifestyle intervention PA accounted for 4.8 persons per 100 who needed medical intervention for Type II diabetes, a significantly smaller number than the pharmacotherapy that accounted for 7.8 per 100 persons, and the placebo therapy that accounted for 11.0 per 100 persons, affirming the need for health care practitioners to evaluate PA as a vital sign and make appropriate recommendations and referrals.

2.3.2 Physical Activity Counsellor in Primary Care

In 2001, a behavioural scientist out of Ottawa, Dr. Michelle Fortier, published an article discussing the role of the physical activity counsellor in primary care, encouraging the need for a multidisciplinary model of care that focuses on disease prevention. Fortier proposed a model for family physicians and physical activity counsellors to collaborate to improve patient outcomes.

This article was a response to the national survey that was done at the time looking at PA advice and support (Glasgow, Eaking, Fisher, Bacak, & Brownson, 2001). Fortier links the need for family physicians and physical activity counsellors to work under one roof, sharing the 7A's model of counselling. The success of our patients' health may depend on our strengths as a team, which we know has a direct economic benefit (Lee, et al., 2012). Simons-Morton, et al. (2001) conducted an activity counselling trial (N= 874), that examined the effects of three different types of counselling (advice, assistance, or counselling) on self-reported PA levels and cardiorespiratory fitness over 24 months in men and women. Women showed increases in cardiorespiratory fitness levels as measured by a graded exercise test, in the assistance and counselling groups by both approximately 5% over the two-year period compared to the advice group (80 ml/min, and 73.9 ml/min respectively). Self-reported levels of PA did not change significantly over the two-year period across men or women, and men showed no difference in maximum oxygen consumption measures. This study suggests that advice around promoting PA may not be enough for behavioural changes to take place; what are required are more robust counselling strategies with or without regular follow-up. Also, this study suggests that different counselling strategies need to be explored for different genders, in that men did not respond with the same improvements in their cardiorespiratory fitness levels across any one of the three counselling types as compared to women. Wister, et al., (2007) studied a telehealth lifestyle intervention to reduce the risk of cardiovascular disease among mid-life persons and found a significant impact of ACSM Certified Lifestyle Counsellors using a Health Report Card and Framingham risk scores in the primary prevention cohort (N = 315) working with family physicians. Telehealth counselling (30 min) started within 10 days of the patient receiving the annual report card and every 6 months. Control groups received usual care from their family physician. The mean global risk score decreased by 3.07 points in the intervention group compared to 1.10 in the control group (F=9.84, p=0.71). Significant differences were found in Framingham Global Risk Score, total cholesterol, systolic blood pressure, nutritional level and health confidence.

2.3.3 Telehealth Counselling and Exercise

Lawton, et al. (2008) studied exercise prescription in women (mean age=58.9) measuring clinical and biochemical variables over a 2-year period. This study's intervention was an initial general practitioner (GP) or nurse practitioner (NP) counselling moment for 7-13 minutes using motivational interviewing techniques, followed by written prescription for PA, and submitting the prescription to a community-based exercise facility for monthly telephone monitoring. Primary measures of PA levels through long form PA questionnaire, and secondary measures of quality of life (SF-36), weight, waist, blood pressure, fasting lipids, HbA1c, glucose, insulin were repeated at 0, 12, and 24 months using an intention-to-treat analysis. The findings indicated that exercise prescription promotes increases in levels of PA over one year (43% vs 30% P<0.001) which were sustained over two years (39% vs 33% p<0.001). Some variables of quality of life also improved significantly over the two years. No secondary clinical or biochemical measures showed any significant change over one or two-year period.

Research conducted in New Zealand retrospectively reviewing the physical activity level of community dwellers who received their "green prescription" initiative represents one of only a few longitudinal studies worldwide assessing the value of the assess, refer, and prescribe PA approach on change in a health measure. The green prescription involved looking at change in physical activity level over 2-3 years post original prescription using a telephone survey (IPAQ-SF). In the group (n= 147), 91 participants adhered to the green prescription, and reported an increase in physical activity as compared to PA levels assessed prior to prescription (47%), increasing physical activity by 64 minutes per week, and were more likely to attain 150 minutes per week or more of physical activity as per recommended guidelines (27).

Orrow, Kinmonth, Sanderson, & Sutton, (2012) conducted a systematic review and meta-analysis of randomised control trials (RTCs) that looked at physical activity promotion based in primary care with sedentary adults. Of these 15 studies that met the inclusion criteria, physical activity levels were reported to increase across the 12-month time frame. Four of the 15 RCTs measured aerobic capacity in L/min. A non-significant effect was measured in aerobic capacity resulting from these studies. Three of the 15 RCTs measured referral interventions, again, with non-significant effects at 12 months. The outcomes suggest (although with a low number of studies as a limitation) that PA promotion with this population increases PA levels over 12 months.

Ten years after Fortier's article on the role of the physical activity counsellor in primary care, Fortier published a study looking exactly at this type of care model. In this study entitled the 'physical activity Counselling (PAC) trial', 120 participants (both male and female) were recruited from a Canadian primary care practice who were not meeting the 150 minutes per week of exercise. These participants were randomly assigned to one of two counselling groups, intense counselling (IC) or brief counselling (BC). The trial lasted three months, with a 12-week maintenance phase period. Measures of PA level, and QoL were measured at onset of the trial, as well as every 6 weeks until end of post intervention period. Additional clinical measures were taken at onset of the study, 12 weeks, and 24 weeks (maintenance phase period). The intense counselling group reported higher levels of PA (quantified as 2 – 20-minute sessions as light and moderate intensity) throughout the 12-week intervention timeline compared to the brief counselling group. This increase in PA did not continue into the maintenance phase however. Also, metabolic measures of fat mass, body fat percent, and fasting plasma glucose levels were significantly better at the 12-week time point, with some measures sustaining improvement until end of maintenance phase in IC group. The short study timeframe is suggested to have limited the observed benefits. This is the first known study in Canada to look at physical activity counselling done by an exercise professional after brief counselling done by physician, and the first to record promoting PA in primary care.

2.3.4 Physician Led Team-Based Model of Care

The reviewed research shows benefits for health and PA promotion counselling; PA referral models of care show potential for impact on health outcomes, but due to the minimal amount of current research available, it is hard to quantify the level of evidence and benefit.
In a similar design to this study, Jeejeebhoy, et al., 2017, led a feasibility study looking at a physician-led team-based lifestyle intervention approach on patients with metabolic syndrome. The study consisted of weekly follow-up with kinesiologists and dietitians for 1-3 months and transitioned to monthly follow-up visits until 12 months. Quarterly visits were completed with a family physician (physician lead), with metabolic syndrome health measures repeated at baseline, quarterly, and at 12-month interval (study completion). This study reminds us that significant improvements in an elevated risk group can occur in as little as 3 months for reversal of metabolic syndrome (<3 of 5 points of metabolic risk) (19% of patients), a significant reduction in metabolic syndrome components (33-41% of patients), and a significant increase in aerobic capacity (16%); health improvements that were sustained at 12 months.

This feasibility study has provided support for leading change in how we can manage patients with elevated risk for CVD and Diabetes specifically with this inclusion of a team-based care model.

We know that the relative risk for seven chronic diseases including coronary artery disease (CAD), stroke, hypertension, colon cancer, breast cancer (in Women), type 2 diabetes, and osteoporosis, is associated with physical inactivity (Warburton, et al., 2013). With medications at times providing similar benefits to exercise, delivery of exercise as medicine needs to improve (Naci & Ioannidis, 2013), and with our aging population that accounts for more than 50% of hospital visits, exercise prescription and referral in primary care as an initiative may be the momentum QEPs, researchers, and government policy makers need to change physical inactivity levels in Canada.

Chapter 3: Thesis Investigation: A Team-Based Model of Care - Qualified Exercise Professionals and The Impact on Aging Health

3.1 Purpose/Rationale

The impact on patient health outcomes when using a team-based care model that promotes, prescribes, and follows up on regular PA in primary care will be evaluated. The purpose of this study was to evaluate whether more in-office fitness follow up visits with a QEP throughout a twelve-month program length within a physician-led team-based care model associated with an improvement in patients' health, specifically cardiorespiratory fitness (CRF), and secondary health measures of waist circumference (WC), blood pressure (BP), fasting glucose (FG), total cholesterol (Chol), high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), triglycerides (Trigs), self-reported physical activity level, and heart rate reserve (see Table 1).

We hypothesized that three or more visits over twelve months with a QEP (intervention group) as compared to one visit within twelve months with a QEP (control group) resulted in improved cardiorespiratory fitness (CRF) as measured by peak metabolic equivalent of task (peak MET) and improved positive changes in secondary health measures (see Table 1) in newly enrolled patients over a twelve-month period.

We hypothesized that patients in the intervention group (>= 3 QEP visits) would have greater improvements in health measures at twelve months as compared to patients in the control group (1 QEP visit per year). We also hypothesized that patients in the intervention group who had elevated risk for CVD, would experience significant improvements in CRF and secondary health measures at twelve months as compared to the control group. It was also anticipated that the secondary prevention intervention group (elevated risk group) would have a significant improvement over the 12-month period.

3.2 Procedures and Methods

A retrospective chart review was performed for 460 patients who registered in a preventative health care program between 2005 and 2018 and remained enrolled in the program for 36 months or more and completed all annual health measures as outlined in Table 1. The patient data was managed by a health care centre housed on a secure server, in Vancouver, B.C.

3.2.1 Research Design

Patients included in the study were those whose baseline peak metabolic equivalent of task was less than 9.0 using the Bruce treadmill protocol and an indirect measure of aerobic capacity based on final stage completed on the test (see Appendix D).

This cohort (n=460) was followed for 12 months as outlined in the team-based care model approach (Figure 1). The cohort was assigned to one of two groups, control or intervention, based on follow-up frequency with their QEP, 1 per year or 3 or more per year. Patients who received one QEP visits per year were assigned to the control group, and patients who received three or more sessions with a QEP were assigned to the intervention group. Each patient was assigned to a primary prevention or secondary prevention group based on an elevated risk with medical management and/or diagnosis of CVD by their physician lead as denoted by disease codes for the respective diseases, or not. Patients were assigned to the primary prevention group if no medical management or diagnosis of CVD was coded at baseline or throughout the twelve-month program length. Patients were assigned to the secondary prevention group if medical management or diagnosis of CVD was coded at baseline or throughout the twelve-month program length.

Primary Prevention Group

It was anticipated that CRF, and secondary health measures of WC, BP, CHOL, HDL –C, LDL-C, FG, and TRIGS would improve across the 12-month timeline, from year zero to year one for those who receive the intervention of three or more fitness follow-ups with a QEP compared to matched control group.

Secondary Prevention Group

It was anticipated that there would be positive and significant change over the twelve-month timeline in measures of body habitus (BMI, WC), physical activity level, and MET for patients who received three or more office QEP visits per as compared to matched control group.

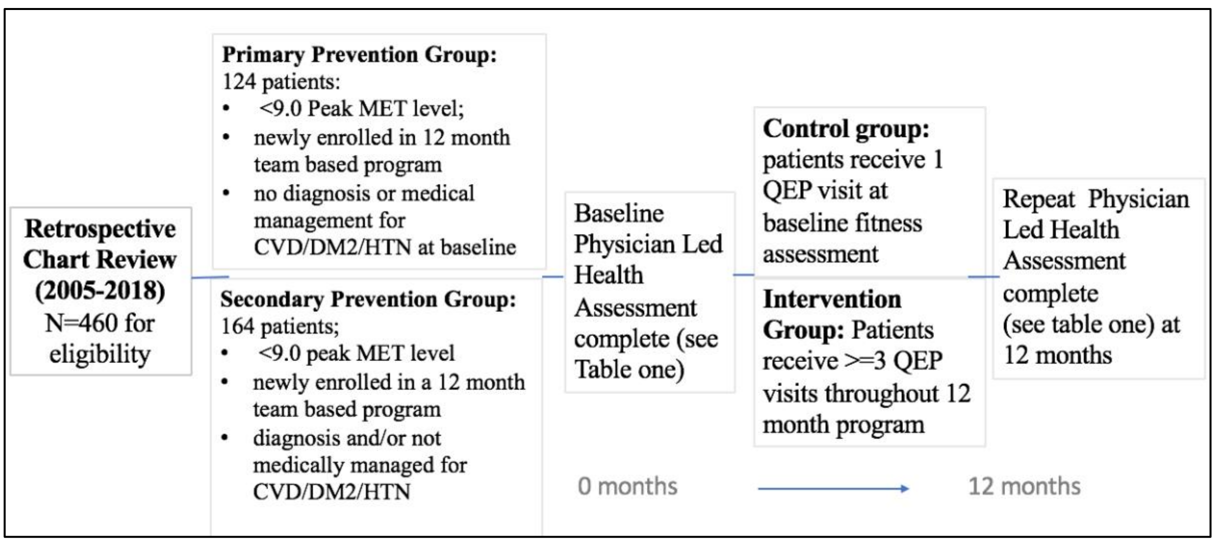

Figure 1: Study Design for team-based model of care

3.2.2 Methods

Patients who signed up for a team-based care model at a private health care centre for a twelve-month program length received a complete annual health screening delivered by a team-based model of care to include a physician lead, family health nurse, dietitian, QEP, lab and diagnostics screening coordinator and had access to their clinical team members over the 12-month period.

The complete annual health screening measured many variables of the health of the patient to include those listed in Table 1. The team-based approach involved a health screening questionnaire reviewed by a family health nurse, lab work, and a one-hour physical examination with a physician lead (attending family physician). As part of this visit, the patient saw a QEP for one hour who assessed behaviour change readiness and physical fitness and counselled on exercise related habits. As part of this visit, a dietitian spent 30-60 minutes reviewing the patients' food diary and counselled on best nutrition practice with the patient. A 30-minute review of the results of their complete health screening in the form of a care plan, with their lead physician followed two weeks or more after the initial screening visit. For those patients who engaged in regular in office follow ups throughout the 12-month program length with their QEP would have engaged in any of the following depending on the assessed readiness of the patients during initial assessment with QEP: behaviour change talk and goal setting (based on motivational interview training), repeat assessment of behaviours and/or physical fitness level, exercise prescription and review, and/or exercise training session. The care plan may or may not have included more recommended visits with the QEP and other allied health professionals for health optimization. The team-based health assessment was repeated annually for those patients who stay registered in this program.

To determine the effectiveness of this team-based care model on patient health outcomes, the measurements of self-reported physical activity, aerobic capacity, waist circumference, body mass index, blood pressure, fasting blood sugar, total cholesterol levels, low-density lipoproteins, high density lipoproteins, triglycerides, and heart rate reserve were evaluated for change over two time points, zero months (pre-test) and 12 months (post-test).

Within the one-hour QEP appointment, patients were counselled further using motivational interviewing techniques, followed by physical/musculoskeletal testing of body composition measures, strength, balance, movement, flexibility, and aerobic capacity testing. For the purposes of this study, measures of exercise capacity and body composition were evaluated.

3.2.3 Protocols for Testing Health Measures

Low levels of cardiovascular fitness increase risk of cardiovascular events and death (Pate, et al., 1995), improving aerobic capacity through regular physical activity can reduce cardiac events by 17-23% (Willia, 2001). With a dose-response relationship between physical fitness and relative risk of cardiovascular disease (CVD) or coronary heart disease (Willia, 2001), and with an increase in one MET level resulting in a 17-29% and 28-51% decrease in non-fatal and fatal cardiac events in men with and without known risk factors (Laukkanen, Kurl, Salonen, Rauramaa, & Salonen, 2004), the primary measure of preventative health established for this study was cardiorespiratory fitness, expressed in oxygen consumption/METS (which at rest is considered to be 3.5 ml/kg/min, or expressed as a metabolic equivalent task of one (1-MET)) as it relates to relative risk of death from NCDs, such as cardiovascular disease. Myers, J., Prakash, M., Froelicher, V. et al (2002) suggested that aerobic capacity is a strong predictor of mortality in men, with an increase in 1-MET level (3.5 ml.kg.min-1) improving survival rates by as much as 12%. Jeejeebhoy, et. al. (2017) showed a significant improvement in CRF of study (Jeejeebhoy, et al., 2017) participants with a 16% increase within the first 3-6 months of participation in their collaborative care plan.

As part of the team-based care approach in this study, the QEP assessed aerobic fitness by testing aerobic capacity using a graded exercise test with the Bruce Treadmill protocol.

Exercise capacity was estimated in METS based on final stage workload. Termination of test was subjective volitional fatigue unless contraindications presented (see Appendix D).

Blood Pressure

Blood pressure was measured by physician in-office during the one-hour health screening appointment. A BpTRU was used following a standardized protocol. Patients' who were previously medically managed for hypertension were asked to continue taking their medication and will not be excluded from this study (see Appendix E).

Waist Circumference

Waist circumference was measured by the physician during the one-hour health screening appointments. The physicians at this facility were instructed to follow the National Institute of Health's (NIH) well-established waist measuring protocol (see Appendix F).

Laboratory Measures

Bloodwork consisted of total cholesterol levels, low-density lipoproteins, high density lipoproteins, and fasting blood sugar using standard laboratory procedures in-office or at any external clinical laboratory at least one-week prior (on most occasions) to the date of the annual health screening visit with the patients' clinical team. All measures were taken yearly, as close to the same month and date as possible from year to year. Body mass was measured by the lab and diagnostic screening coordinators using a standard scale (see Appendix C). Waist circumference and blood pressure were repeated by the same physician at month zero and month twelve, in most incidents.

3.2.4 Statistical Analysis

The data were analysed using IBM SPSS Statistics software version 25 (2017). Participant characteristics, including means and standard deviations were calculated for all measures within each group, primary prevention and secondary prevention at baseline. T-tests were used to identify differences between groups. Baseline characteristics were the same across groups. A two-way mixed analysis of variance (ANOVA) was used to assess changes in measures from pre-intervention (baseline) to post-intervention and across group, control and intervention with a significance level of $p<0.05$. Primary variables analysed included self-reported physical activity level, metabolic equivalent of task (MET) during indirect ventilatory oxygen consumption testing using the Bruce treadmill protocol, waist circumference, and body mass index. Secondary variables analysed included systolic blood pressure, diastolic blood pressure, fasting sugars, cholesterol levels, and heart rate reserve.

This was a mixed study design with one between-subject factor (treatment condition) and one within-subject factor (time). There are two levels for both factors: treatment condition (1 QEP visits per year or >=3 QEP visits per year) and time (0 months and twelve months). The dependent variables affected by treatment condition of frequency of fitness follow-ups include all health measures listed in Table 1.

To analyse both between and within-subject factors, a two-way mixed analysis of variance (ANOVA) for each health measure was conducted to identify whether there was a statistically significant two–way interaction between the two levels of treatment condition, and the two levels of time. If the two-way interaction was significant, a one-way ANOVA was conducted to analyse if the simple main effects for the between-subject factor of treatment condition was significant. A one-way repeated measures ANOVA was carried out to analyse the simple main effects for the within-subject factor of time.

If the two-way interaction was not statistically significant, a two-way mixed ANOVA was conducted to determine if there were statistically significant main effects, whether health measures changed over the twelve-month period, and whether health measures changed according to QEP visit frequency. Given the retrospective nature of this study, an effect size (Cohen's f) was calculated using a sample of data from this study for the primary outcome variable of peak metabolic equivalent measure. A total sample size of 108 patients (54 per group) was needed to detect a medium effect size of 0.39 with 80% power at an alpha level of 0.05.

3.2.5 Participant Characteristics

There were 133 male and 160 female patients of the 288 total patient charts reviewed. The age range of participants 35-86, average 61 years old. See Table 2 and Table 3.

Table 2 Primary Prevention participant characteristics and baseline comparisons of health measures

Primary Prevention Group Characteristics	**Total Group (N=125)**	**Control (N=74)**	**Intervention (N=49)**
Variables	n=124	n=74	n=49
Age	61.3	61.7	60.7
Estimated VO_2max (MET)	7.6 (0.98)	7.7 (0.94)	7.4 (1.03)
BMI (kg/m^2)	25.4 (5.9)	27.8 (6.1)	23.0 (4.7)
WC (cm)	93.3 (15.3))	91.9 (15.0)	95.3 (15.5)
CHOL (mmol/L)	5.3 (1.01)	5.2 (1.04)	5.5 (0.94)
HDL (mmol/L)	1.64 (0.55)	1.64 (0.56)	1.65 (0.47)
LDL (mmol/L)	3.1 (0.85)	3.05 (0.90)	3.2 (0.78)
TRIGS (mmol/L)	1.5 (1.01)	1.31 (0.59)	1.68 (1.38)

FBS (mmol/L)	5.2 (0.53)	5.2 (0.54)	5.2 (0.52)
HRR (BPM)	82 (23.4)	83 (23.0)	81.5 (25.3)
Blood Pressure (mmHg)			
Systolic BP	121 (17.3)	122.7 (16.7)	120 (17.8)
Diastolic BP	76.5 (9.3)	78.1 (9.1)	74.5 (9.2)
% PA per week (days per week)			
< 3 dpw	41%	39%	44%
>/=3-5 dpw	59%	61%	56%

Table 3 Secondary prevention participant characteristics and baseline comparisons of health measures

Secondary Prevention Group Characteristics	**Total Group**	**Control**	**Intervention**
	N=164	N=98	N=66
Age	61.4	62.8	59.3
Estimated VO_2max (MET)	7.6 (1.1)	7.6 (1.1)	7.6 (0.97)
BMI (kg/m²)	29.2 (5.5)	28.2 (4.5)	30.5 (6.1)
WC (cm)	99.6 (13.0)	98.2 (12.7)	101.6 (13.4)

% PA per week			
< 3 dpw	51%	46%	59%
>/=3-5 dpw	49%	54%	41%

3.3 Results

A two-way mixed ANOVA was conducted for each health measure listed in Table 2 for the control and intervention groups pre and post twelve-month timeline. Outliers were handled appropriately as assessed by inspection of boxplots. Shapiro-Wilk's test was conducted for each health measure, as well as Levene's test of homogeneity of variance. If violations were present, analyses were conducted, and violations were noted. For the interaction effect pre and post twelve-month results for primary and secondary prevention groups, see Table 4 and Table 5 below.

3.3.1 Primary prevention group

Results shown for primary prevention group below.

Table 4 Primary prevention group interaction effect results between health measures and time at 0 months and at 12 months

		0 months (pre)		**12 months (post)**		
Health Measures	N	Mean (M)	Standard Deviation (SD)	Mean (M)	Standard Deviation (SD)	*p*-value
PA (units)	112	1.54	0.057	1.63	0.07	0.163

MET (units)	124	7.56	0.98	8.11	1.28	0.212
WC (cm)	108	92.7	14.33	91.7	12.8	0.154
BMI (kg/m²)	111	27.8	5.59	27.6	5.64	0.772
FBS (mmol/L)	73	5.22	0.57	5.31	0.54	0.067
BPSys (mmHg)	110	121.1	16.1	117.1	16.9	0.060
BPDias (mmHg)	114	76.8	9.32	76.5	8.9	0.971
Chol (mmol/L)	108	5.37	0.88	5.36	0.94	0.396
HDL (mmol/L)	105	1.57	0.474	1.57	0.35	0.704
Trigs (mmol/L)	103	1.26	0.53	1.21	0.47	0.598
HRR (bpm)	57	85.1	17.9	87.0	17.3	0.255

There were no significant interactions for any measures between control and intervention groups in the primary prevention group over time. Therefore, we fail to reject the null hypotheses.

3.3.2 Secondary Prevention group

Results shown below for the secondary prevention group.

Table 5 Secondary Prevention group interaction effects results between health measures and time at 0 months and at 12 months

		0 months (pre)		**12 months (post)**		
	N	Mean (M)	Standard Deviation (SD)	Mean (M)	Standard Deviation (SD)	*p*-value
PA (units)	145	1.49	0.5	1.61	0.49	0.019*
MET (units)	160	7.64	0.97	8.06	1.27	0.622
WC (cm)	137	98.7	10.6	97.5	9.6	0.197
BMI (kg/m^2)	158	28.4	4.08	28.3	3.96	0.029*

Statistically significant interaction effects resulted for self-reported PA and BMI in the secondary prevention group, therefore we rejected the null hypothesis for these two health measures. We accepted the null hypothesis for the remaining health measures displayed in Table 5. The remaining health measures including blood pressures (systolic and diastolic), cholesterol, HDL, triglycerides, fasting blood sugar, and heart rate reserve were not analysed within the secondary prevention group due to the inability to control for individual differences in the medical management of their chronic conditions. Of the 167 patients who were categorized in the secondary prevention group, 138 patients were taking medication for metabolic conditions throughout the one-year period.

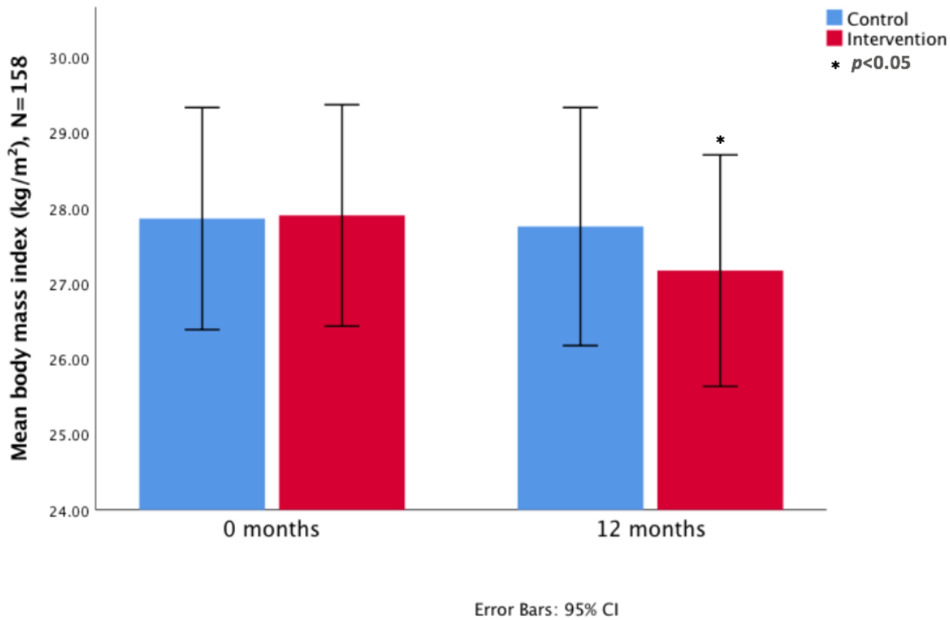

Figure 2: There was a statistically significant interaction between the intervention and time on BMI, F(1, 156) = 4.85 p =0.029, partial η2 = .030, the mean BMI was lower at post-test for the intervention group compared to pre-test by 0.33 kg/m².

Physical Activity

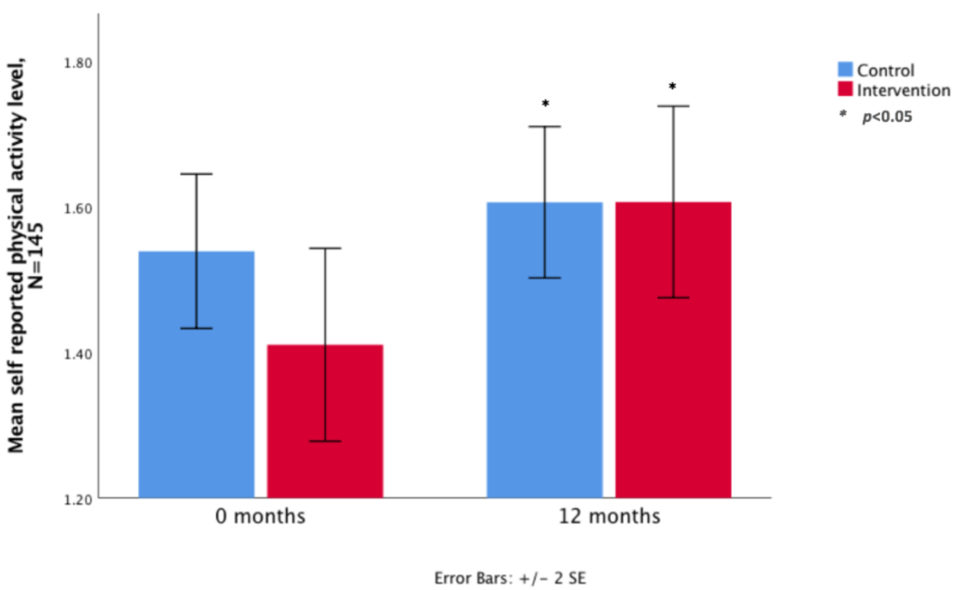

Figure 3: There was a significant effect of time on PA level for the control group and the intervention group, respectively, $F(1,88)=6.36$, $p=0.013$, partial η2 =0.067; $F(1, 55) = 13.44$, p = .001, partial η2 = 0.196.

Physical activity level was higher at post-test than pre-test for the control group (M= 0.07 SE= 0.027, $p=0.013$), and the intervention group (M=0.196, SE= 0.054, $p=0.001$). Although both control and intervention groups resulted in higher self-reported physical activity level scores post-test, the control group increased by 7%, and the intervention group increased by 22%.

3.3.2.1 Simple Main Effects

Table 6 Simple main effects result for primary prevention group or entire cohort between health measures and time at 0 months and at 12 months

		0 months (pre)		**12 months (post)**		
	N	Mean (M)	Standard Deviation (SD)	Mean (M)	Standard Deviation (SD)	*p*-value
PA -entire cohort (units)	252	1.51	0.50	1.62	0.48	0.001*
MET -entire cohort (units)	282	7.58	1.03	8.09	1.47	0.001*
WC -entire cohort (cm)	137	96.1	16.4	95.7	14.9	0.015*
BMI-entire cohort (kg/m^2)	277	28.6	5.57	28.4	5.74	0.09
FBS -primary prevention group (mmol/L)	73	5.22	0.57	5.31	0.54	0.167

BPSys- primary prevention group (mmHg)	112	121	16.1	117	16.9	0.044*

Four health measures, self-reported PA, MET, WC, and systolic BP resulted in significant simple main effects, outlined in the figures below.

Physical activity

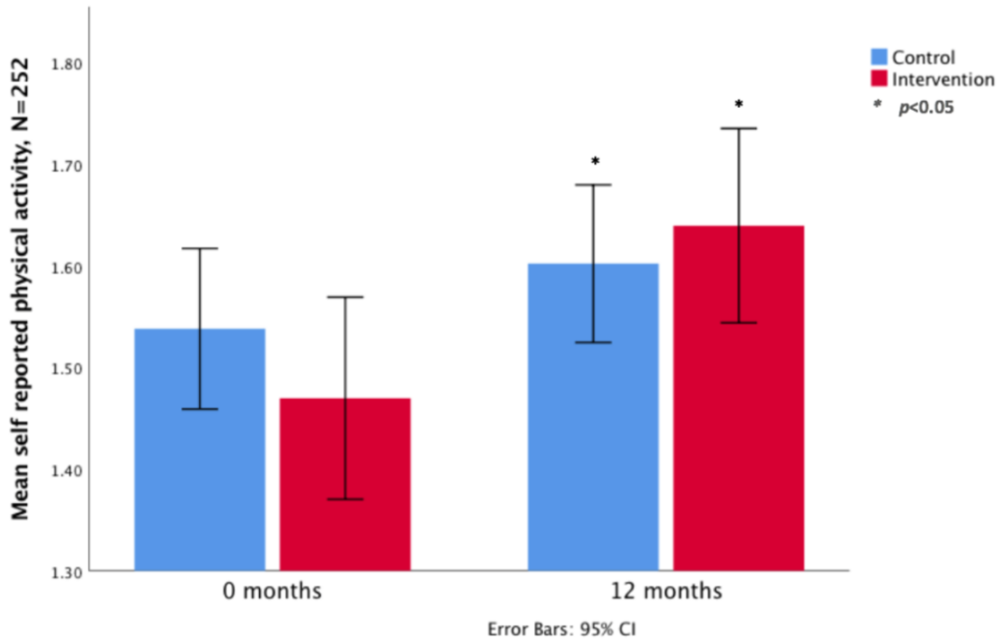

Figure 4: There was a significant mean increase in self-reported PA level over time for the control group and the intervention group, of 0.064 units ($p<0.05$) and 0.170 units ($p<0.05$) respectively.

The main effect of time showed a statistically significant difference ($F(1, 253) = 7.40$, $p < 0.05$, partial $\eta2 = .028$), with a mean increase of 0.117 units over the twelve-month study timeline ($p<0.05$).

Metabolic Equivalent of Task

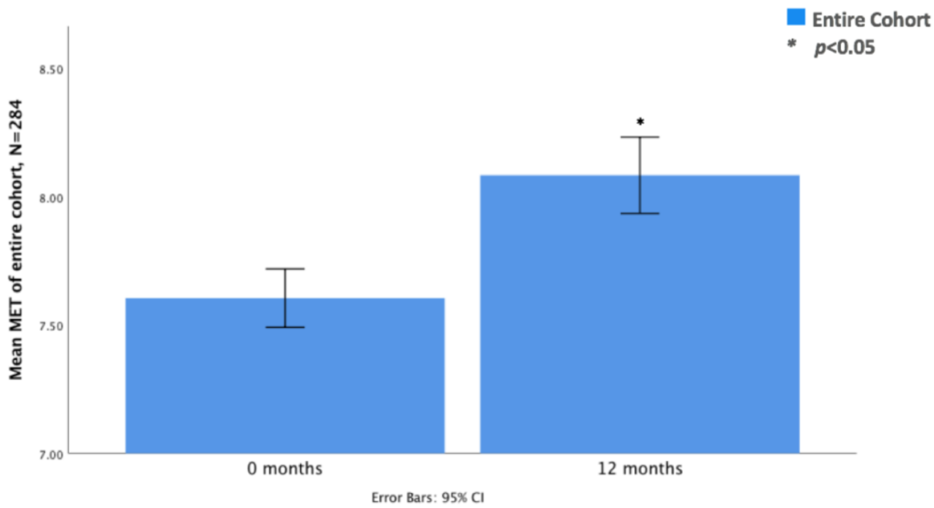

Figure 5: There was a significant increase in mean MET over time across entire cohort, by mean increase of 0.48 MET (SE=0.058, $p<0.001$), $F(1, 158) = 75.0$, partial $\eta2 = .210$.

Waist Circumference

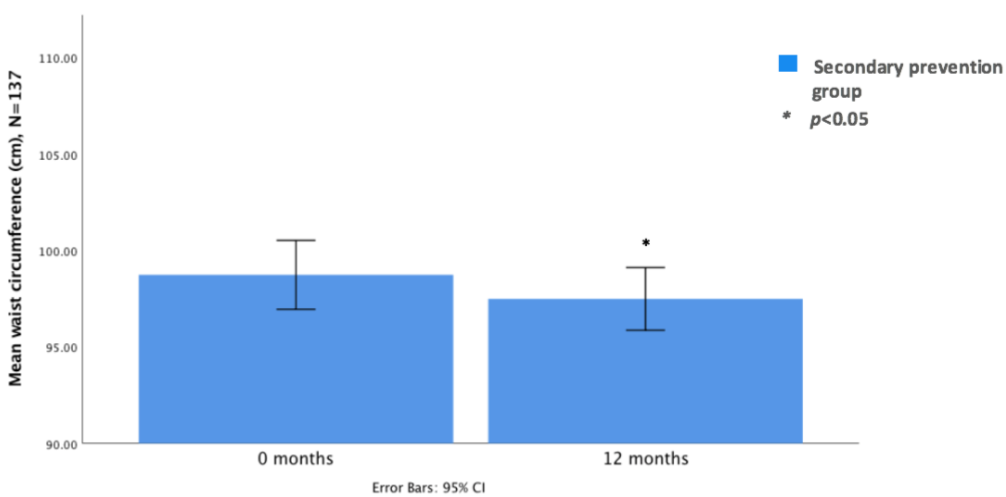

Figure 6: There was a significant decrease of 1.35 cm in waist circumference in the secondary prevention group at different time points, $F(1, 135) = 6.10$, $p = .015$, partial $\eta2 = .043$.

Systolic Blood Pressure

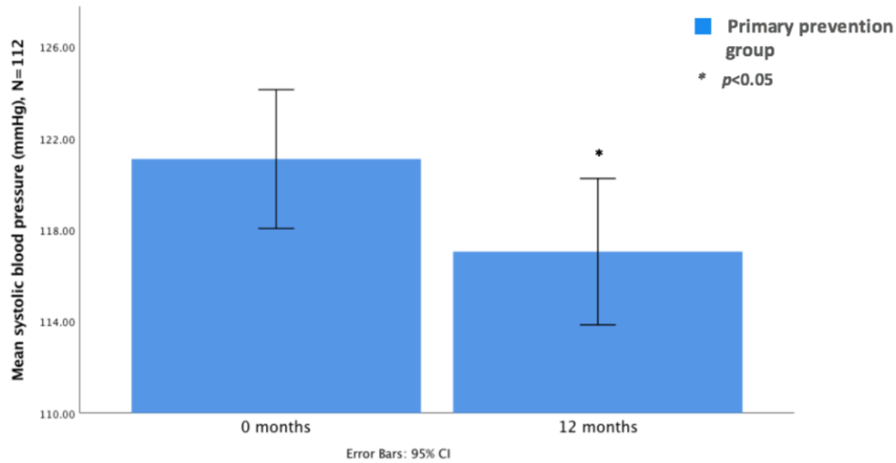

Figure 7: There was a significant mean decrease in systolic blood pressure level at the different time points over time, F(1, 108) = 4.16, *p* = .044 partial η2 = .037.

An analysis for a subgroup of patients whose waist circumference was considered high at >=88 cm for females and >= 102 cm for men was conducted, as well as a subgroup of patients who participated in a personal training program as part of the intervention during the twelve-month program length.

3.3.2.2 Subgroup Results

Subgroup Group High Waist Circumference

There were 87 patients who had a waist circumference greater than or equal to 88 cm for females and greater than or equal to 102 cm for males reported at pre-test during the retrospective chart review of the patients in the secondary prevention group.

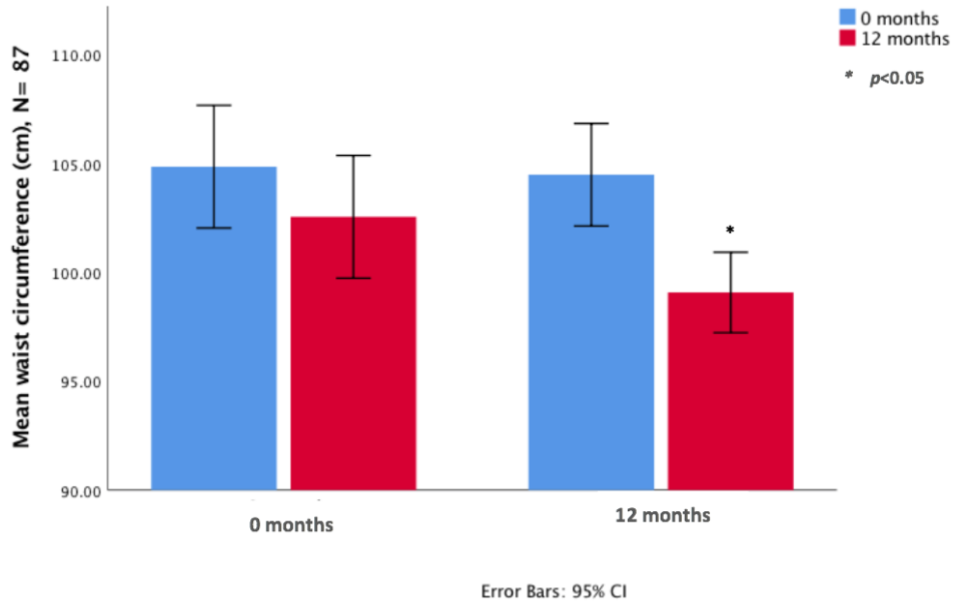

Figure 8: Waist circumference was significantly reduced for the intervention group at post-test timeline compared to pre-test by a mean loss of 5.41 cm (M=-5.41, SE=1.12, $p<0.05$). Waist circumference was lower in the intervention group at post-test by a mean difference of -3.47 (M= -3.47, SE=1.7, $p=0.044$) compared to control group.

The mean waist circumference was lower at post-test compared to the pre-test for the overall group by a mean difference of -3.86 cm, SE=0.751, $p<0.05$.

Subgroup Personal Training program and MET level

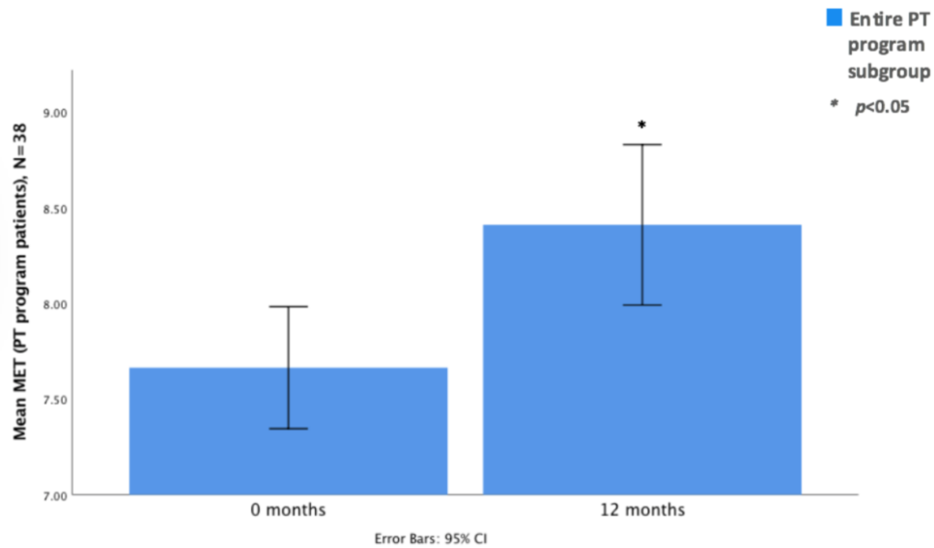

Figure 9: Mean MET level increased by 0.75 METs (p<0.01) for patients who participated in a personal training program 1-3 times per week for at least 3 months throughout the twelve-month timeline.

3.4 Discussion

The aim of the study was to determine whether a twelve-month team-based care model with three or more QEP in-person visits throughout the program length impacted cardiorespiratory fitness and secondary metabolic health measures significantly compared to a matched control group who received a twelve-month team-based care model without ongoing QEP support throughout the program length. As shown in the results section, we will discuss the significant findings for both primary and secondary groups, as well as the two subgroups analysed. The primary prevention group did not result in significant interaction effects across any of the health measures, therefore, we fail to reject the null hypotheses. The secondary prevention group resulted in significant changes in the following health measures PA and BMI, subgroup WC, and subgroup MET.

There were significant mean changes for the overall group for the following health measures that will be discussed as evidence for the practice of a team-based care model in maintaining and reducing morbidity and mortality risk: PA, MET, WC, and systolic BP.

Interaction effects

One of the drivers for maintaining and improving CRF and body habitus like waist size and BMI is sustaining exercise habits that meet or exceed our Canadian guidelines. Our guidelines currently call for 150 minutes per week of moderately intense physical activity. For this study, the patients were assigned to one of two categories based on their self-reported physical activity level status: either 90 minutes or more, or less than 90 minutes of moderately intense physical activity per week. There was a significant improvement in PA for both control and intervention groups in the secondary prevention group over the one-year period, better outcomes resulted for the intervention group, with 15% more patients exercising with moderate intensity 90 minutes or more per week. This finding aligns with Fortier, M., Hogg, W., et. al. (2011) study results, demonstrating that intensive health counselling sessions that occur regularly throughout the year (eg. quarterly), show a significant increase in adherence to physical activity.

New Zealand's exercise initiative in primary care (Hamlin, Yule, et al. 2016) also demonstrates that individuals that adhere to a program will have better outcomes, in their case, an average of 64 minutes of exercise per week than those who had dropped out of the telephone counselling and follow up sessions addressing behaviour change. A systematic review of RTCs in older adults >=60 years, demonstrates a positive benefit of health coaching on physical activity adherence. The average age of the secondary prevention group in the current study was 61.4 years old, and results for those who received 3 or more QEP visits per year align with the Oliveira, JS., Sherrington, C, et. Al. (2017) meta-analysis.

The secondary prevention group entered the program with a mean BMI of 29.9 kg/m², 3.8 kg/m² greater than the mean of the primary prevention group. The secondary prevention group experienced a significant decrease in BMI in the intervention group over time compared to the control group (-0.33 kg/m²), likely the benefit of the 15% increase in 90 minutes or more of physical activity across this intervention group. Although, in isolation, it is beneficial to cardiovascular disease risk reduction to reduce body mass when overweight or obese, the Rotterdam study reminds us that maintaining higher levels of physical activity per week regardless of body habitus, associates with reduced CVD risk and events over time (Koolhaas, Dhana, et. al. 2017).

Subgroup Waist Circumference

The clinical significance of reducing waist circumference for adults and older adults with elevated waist size is the association of increased CVD risk and increased mortality risk pertaining to this excess abdominal fat (Lee, Pedley, et. al 2017) (Mayo Clin Proc., 2014). For both men and women patients presenting with a high-risk waist circumference, it is suggested that a reduction of 5 cms or more may reduce mortality risk by 1.4 - 2.3 years respectively (Cerhan, J. et. al, 2013). Years of life lost for adults and older adults can be as much as 1.5-3 years for men with a high-risk waist size, and 3-5 years for women with a high-risk waist size. Our study demonstrated a significant circumference loss of 5.41 cms for patients in the intervention group with a high-risk waist size, losing a mean difference of 3.47 cms more than the control group post-test. In addition, 57% of the intervention group decreased waist size by 2.5 cm or more.

The benefit of the program for these patients, as per the literature, is that patients are healthier, at lower risk of CVD and mortality, a benefit that reduces the financial burden of health care costs in Canada, and improves the quality of life

Evidence supporting team-based care

This study demonstrated that when patients accessed team-based care throughout the twelve-month period, outcomes for PA, CRF, WC, and systolic BP improved.

The team-based aspect of this study has clearly supported improvements in preventative health measures that align with research in this field. Jeejeebhoy's feasibility study looking at a physician-led team-based model on Metabolic Syndrome specifically demonstrated that regular follow-up with a team (physician, dietitian, and kinesiologist) had excellent results across all participants, with the largest impact being those participants with the highest risk status. Participants who entered the physician-led program, with metabolic disease, improved their VO2max by a mean of 15%. In our study, 63% of all patients (to include those with metabolic disease and those without) increased their overall MET level over the twelve-month period. 26.5% of all patients increase their overall MET level by >= 1.0 METs (>=3.5 ml/kg/min^{-1}). The subgroup of 38 patients who participated in regular physical activity sessions led by a QEP onsite during the twelve-month program improved their CRF by a mean of 0.75 METs. The significance of this finding relates to protection against cardiac events. It is suggested that 1.0 MET can decrease the risk of cardiac events by as much as 20-30% (Laukkanen, Kurl, Salonen, Rauramaa, & Salonen, 2004). In this study, 75 patients reduced their risk of cardiac events, and 180 patients improved their MET level suggesting that these patients had maintained and improved their exercise prevention strategies to ward off chronic disease and may be rewarded with added protection to their health if continued.

There is an established association between low CRF and high risk of CVD and all-cause mortality. The American Heart Association released a scientific statement (2016) reviewing evidence supporting the notion that the survival benefit per MET could be within a range from 8% to 35%, (mean of 17.5%) based on a series of longitudinal studies. Most agree that <5 METs puts individuals at higher risk for CVD and all-cause mortality, with 8-10 METs being associated with relative protection against CVD, and reduced risk of mortality. The American Heart Association has advocated for CRF to become a clinical measure to be captured regularly as a 'vital sign' within clinical practice. They also indicated that for metabolic diseases, the least fit population have the largest benefit. The metabolic benefit, which actually resulted in metabolic syndrome reversal in 19% of patients in Jeejeebhoy's study, was large and likely the result of the participants with metabolic syndrome who were less fit at the start of the study. 42% of participants finished the 12-month lifestyle intervention with a decrease in the number of metabolic syndrome criteria, and 33% established improvement by the first quarter of the program. They also significantly improved their waist circumference over twelve months. Our study resulted in some of the largest improvements seen in waist circumference for our subgroup of patients who were at elevated risk for cardio-metabolic disease. This finding could have been due to the participants who started with the highest waist circumference benefiting the most from the intervention. Clinical significance in the primary prevention group did not result, and may be due to the health measures of these patients starting within a healthy range at baseline. Although primary prevention group health measures did not result in improvement, a decline in these health measures also did not occur, suggesting that the primary prevention group, (whose mean age was 61.3) maintained their health measures over the twelve-month period, which may be beneficial in the long-term, although we were not able to quantify the value of this benefit.

Although there was no interaction effect in the primary prevention group, systolic blood pressure did improve over time by a mean decrease of 3.51 mmHg, ($p<0.050$) across both groups. Mean systolic pressure started at >120 mmHg, and at twelve months was <120 mmHg. This result was very consistent with research that shows evidence that exercise has a beneficial effect on systolic blood pressure to account for about 4.8 mmHgs of improvement when BP is elevated above the optimal range (>120 mmHg) (Carpio-Rivera, E. et. al., 2016). It is also worth noting that more than half (54%) of our patients showed a reduction in systolic BP over the twelve-month period, 43% increased, and 3% did not change. Of the patients who started with a systolic BP above >135 mmHg at baseline (moderate risk or higher), although none of these patients were able to optimize (<120 mmHg) their systolic BP with exercise alone, 70% reduced their BP by a mean of 7.8 mmHg. This study demonstrates that a team-based approach is associated with an increased engagement in physical activity which in turn improves CRF, leading to positive changes in systolic blood pressure and body habitus (waist circumference and BMI).

If we are accountable to someone, such as a QEP, a physician lead, a dietitian, a diabetes educator as examples, as part of a team-based care approach, we are more likely to maintain or increase our physical activity level which may associate to the findings in this study of improved cardiorespiratory fitness, body habitus, and systolic blood pressure. The improvements measured in this study enhance the quality of life of these patients, and for some will reduce the risk of cardiac events and improve risk of all-cause mortality.

With such a high relative economic burden in Canada, and an aging population, it seems increasingly important to focus on regular prevention strategies, from monitoring CRF as a vital sign to ensuring regular monthly to quarterly follow-ups with a member of the care team to mitigate the costs that contribute to physical inactivity risks.

3.5 Limitations

Although this study provides intriguing information on the benefits of a team-based model of care that includes QEPs, measuring the benefits of team-based care and the benefits of regular visits with a QEP throughout a one-year period was not without its limitations. Patients had access to their team members for a one-year period. Patients were accessing team-based care by way of telehealth visits, virtual visits, emails, and in-office visits. The evaluation of one session of care by a QEP was defined as one in-office visit. Other forms of contact such as email or telephone were not quantified in this study. There were potentially many patients who were in the control group and intervention group who received care by telephone and email frequently throughout the one-year period and this was not measured as part of this study. It is recommended that future studies capture both in-office visits and telehealth and virtual visits as these may better represent the future best practice when it comes to preventative health strategies in Canada.

Another potential influencer of behaviour change involved the in-office, telehealth, and virtual visits that were completed during the one-year period by other members of the care team, such as dietitians, nurses, and physicians. Although the focus was to evaluate the health benefits when attending more than 3 visits per year with a QEP, the influence and benefit of being cared for by other members of the team were not excluded or sub grouped and may have played a substantial role in the cardio-metabolic improvements seen in both the primary and secondary prevention groups. Aerobic capacity was a focused measure to establish a direct connection between a measurement and QEP care. But even still, the motivation to exercise more or maintain good exercise practices and better management of overall health can be influenced by many voices within a healthcare team. When reflecting on the cohort as a whole, and looking at change over time, it seems apparent that the team-based care influenced improvement in many of the health measures captured. Future exercise studies looking at primary prevention strategies are encouraged to aim at measuring outcomes influenced by a team, as opposed to singling out one specific healthcare provider within that team, in this case a QEP.

Another limitation was that the number of external QEP visits by patients (outside of the private centre) over the twelve-month period were not captured. Future studies are encouraged to collect these data as part of a global measure of QEP visits and group or subgroup accordingly. Given that there were no significant interaction effects in the health measures for the primary prevention group, it is recommended that future studies aiming to measure the preventative benefits of physical activity control more rigorously for age, gender, and self-reported physical activity and obtain a larger sample size.

There was an enrolment fee for this team-based care model, which may have attracted patients from a higher socioeconomic status. The patients may have also been more motivated to succeed given the cost incurred to enrol in the program, research should target participants from a broader range of socioeconomic statuses.

3.6 Knowledge Translation

Any future opportunity to deliver this information to the Ministry of Health through advocates for health and fitness and prevention / primary care will be considered. An abstract will be submitted to the “CSEP for the health of it: applying exercise science research to practice” conference this year (2019). https://csep.formstack.com/forms/?i-5232757-eyKNN3tVBc

The study findings will be presented to the medical quality and standards committee at the private centre where the data originated, for review and improvement opportunities on the team-based model of care currently provided. The study findings will also be presented to a group of QEPs, broader clinical teams, and marketing teams working within a team-based care model in Fall of 2019.

Chapter 4: Conclusion

This chapter describes the contribution this research has on the value of qualified exercise professionals working within a team-based model, and the value of a team-based model of care in Canada.

There are only a few studies which aim to evaluate the benefit of QEPs within a team-based care model in primary health prevention. More research is needed to benefit Canadians having access and support at maintaining primary health prevention strategies to help take the burden and pressure off our healthcare system and maintain and improve the quality of life and longevity. The team-based model of care on the overall cohort demonstrated positive change over time in aerobic capacity and other cardio-metabolic outcomes. QEP visits was further associated with an increased frequency of engagement in physical activity and body habitus, particularly in those patients with elevated waist circumference. The research findings are significant in that even those who are considered at elevated risk for morbidity have the ability to maintain or improve risk level when monitored by a structured care team, ultimately reducing morbidity and mortality risk. Investing in preventive strategies to support a healthier ageing population could be one of the answers to reducing surgical wait times and reducing the overall high current costs of healthcare in Canada.

Overall, the team-based model of care with regular QEP visits, as well as the team-based model of care alone was successful in improving the health status of many adults living in British Columbia.

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Appendices

Appendix A: Team Base Model of Care Pathway

Enrolment into clinic - Health History (Family Health Nurse 30-45min) -Laboratory Screening & Diagnostics Panel - Complete Medical Exam (MD 60 mins) - Dietary assessment (RD 30-60 mins) - Fitness Assessment (QEP 60 mins) - Care plan follow up (MD 30 mins + FHN 0-30 min)

Appendix B: Exercise Stress Testing Protocol

All participants signed an informed consent with their family physician reviewing the risks associated with having an exercise stress test conducted prior to the stress testing date.

Participants are encouraged to abstain from vigorous exercise, caffeine, and alcohol intake at least 24 hours prior to exercise stress test date.

Participants are encouraged to wear appropriate athletic gear in preparation for exercise stress test.

During the exercise stress testing session, the certified fitness professional (CFP) (certified through ACSM or CSEP) preps skin and conducts a 12 lead –ECG maximal exercise treadmill test. The CFP uses the Bruce treadmill protocol, and watches for absolute and relative contraindications to stopping the test based on ACSM guidelines. The CFP also monitors blood pressure and heart rate pre-test and every 1-3 minutes during the Exercise Stress test, and post-test for a recovery period of 3-5 minutes. The CFP encourage participants to aim for maximal effort (volitional fatigue) during the test, and will terminate test when participant requests to stop, or when criteria is met for termination per the ACSM guidelines.

The participants' aerobic capacity is evaluated based on the duration achieved on the treadmill during the exercise phase of the treadmill stress test, and calculated into an oxygen consumption score, and into a metabolic equivalent of task score. If handrails are used throughout the test, a slight decrease in oxygen consumption of 0.2 METs is calculated.

Further evaluation of the 12 lead ECG from the exercise stress test is reviewed by a local Cardiologist, with results sent back to attending physician for ongoing care.

Appendix C: Health Measures and Disease Codes Requested for Retrospective Chart Review

Bruce Treadmill -Exercise time in minutes
Bruce Treadmill -Exercise time in seconds
Bruce Treadmill Max METS achieved
VO2Max calculated from Bruce Treadmill time
Maximum Heart Rate (during Aerobic Test)
Heart Rate -resting
Max cycle ergometer -maximum watts achieved
Overall Kinesiology Score
Age
Gender
Height (cm)
Weight (cm)
Waist Circumference (cm)
Blood Pressure (mmHg)
Triglycerides (mmol/l)
Cholesterol (mmol/l)
LDL Cholesterol (mmol/l)
HDL Cholesterol (mmol/l)
Glucose Fasting (mmol/l)
7pt. Functional Movement Screen
Deep squat
Hurdle Step Left
Hurdle Step Right
In-line Lunge left
In-line Lunge Right
Shoulder Mobility Left
Shoulder Mobility Right
Straight Leg Raise Left
Straight Leg Raise Right
Trunk Stability Push-ups
Rotary Stability left
Rotary Stability Right
7pt FMS Asymmetry score
Disease Codes:
414
DC0031
401
153
174

250
733
DC0043
440
272
429

Appendix D: Bruce Treadmill Test Stage Protocol and Metabolic Equivalent with and without Handrail Use

					METS Achieved	METS Achieved
Stage	Time (min)	Time (interval)	Speed (mph)	Grade (%)	Without Handrails	With Handrails
1	1	0-1:14	1.7	10.0	3.0	2.8
1	1.5	1:15-1:44	1.7	10.0	3.5	3.3
1	2	1:45-2:14	1.7	10.0	3.9	3.7
1	2.5	2:15-2:44	1.7	10.0	4.3	4.1
1	3	2:45-3:14	1.7	10.0	4.6	4.4
1	3.5	3:15-3:44	1.7	10.0	4.9	4.7
2	4	3:45-4:14	2.5	12.0	5.2	5.0
2	4.5	4:15:4:44	2.5	12.0	5.6	5.4
2	5	4:45-5:14	2.5	12.0	5.9	5.7
2	5.5	5:15-5:44	2.5	12.0	6.3	6.1
2	6	5:45-6:14	2.5	12.0	6.6	6.4
2	6.5	6:15-6:44	2.5	12.0	6.9	6.7
3	7	6:45-7:14	3.4	14.0	7.2	7.0
3	7.5	7:15-7:44	3.4	14.0	7.6	7.4

3	8	7:45-8:14	3.4	14.0	7.9	7.7
3	8.5	8:15-8:44	3.4	14.0	8.3	8.0
3	9	8:45-9:14	3.4	14.0	8.6	8.3
3	9.5	9:15-9:44	3.4	14.0	9.2	8.7
4	10	9:45-10:14	4.2	16.0	9.7	9.0
4	10.5	10:15-10:44	4.2	16.0	10.3	9.3
4	11	10:45-11:14	4.2	16.0	10.9	9.6
4	11.5	11:15-11:44	4.2	16.0	11.5	10.0
4	12	11:45-12:14	4.2	16.0	12.1	10.3
4	12.5	12:15-12:44	4.2	16.0	12.7	10.6
5	13	12:45-13:14	5.0	18.0	13.3	10.9
5	13.5	13:15-13:44	5.0	18.0	14.0	11.3
5	14	13:45-14:14	5.0	18.0	14.6	11.6
5	14.5	14:15-14:44	5.0	18.0	15.2	11.9
5	15	14:45-15:14	5.0	18.0	15.7	12.2

Appendix E: Office Blood Pressure Measurement

Measurement will always be performed according to the standards of the Canadian Hypertension Society and the Canadian Hypertension Education Program

Measurement of office BP will be done using the BpTRU automated blood pressure measurement unit (BpTru Medical Devices, Coquitlam Canada). With this device, the patient is seated with the back supported, feet on the floor and uncrossed, and arm supported with the appropriate-sized cuff applied to the upper arm at heart level. The BpTRU cycle will be set at the 1- or 2-minute setting, and the observer will watch the first reading then leave the patient alone in the room for the full cycle. After the BpTRU automatically discards the first reading, the average (of at least 3 BpTRU readings) will be recorded and used for measurement purposes.

Appendix F: Waist Circumference Measurement

Waist circumference will be measured following the National Institute of Health (NIH) method which follows this protocol below:

1. Remove any clothing and accessories from the clients/patients' abdomen
2. The client/participant is instructed to stand with feet hip width apart, arms crossed, and relaxed
3. The clinician will position self on right side of body of client/participant
4. The clinician will palpate for the upper right hip bone of the client and locate the uppermost lateral border of the iliac crest and mark it with a horizontal pen landmark at midline of the body
5. The clinician will position the tape measure around the abdomen, level with the landmark
6. The clinician will lower self-down to level of landmark, and using the cross handed technique with the tape measure, bring the tape measure together
7. Applying gentle tension, the waist circumference was measured to the nearest 0.5 centimetre.