EFFECTIVENESS OF PHYSICAL ACTIVITY INTERVENTIONS IN PRIMARY CARE SETTINGS: AN INTEGRATIVE LITERATURE REVIEW

by

George Wood

B.S.N. Medical College Magadan City, 1992
B.Sc. (Hons), Northern International University, 1997

PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF SCIENCE IN NURSING FAMILY NURSE PRACTITIONER

UNIVERSITY OF NORTHERN BRITISH COLUMBIA

March 2017

© George Wood, 2017
ABSTRACT

Physical inactivity and sedentary lifestyle is a significant problem affecting the overall health of Canadian adults, causing a substantial financial burden on healthcare. Primary care settings are an important component of a multifaceted approach to address this problem. Physical activity (PA) health benefits to improve population health are substantial, but initiating PA health promotion in primary care settings remains a challenge. Primary care providers need effective PA intervention clinical tools to succeed in fulfilling a key role in promoting PA. This integrative literature review explores extant evidence related to PA interventions’ effectiveness. Background knowledge of primary care, health promotion, and PA interventions’ content is presented along with an overview of relevant information on PA. A comprehensive search revealed 13 research articles for analysis. Key findings include evidence on the effectiveness of PA interventions and their components, as well as on the patients and providers’ characteristics associated with increased efficacy. As a result, the author develops a checklist to appraise effectiveness of PA interventions, and evaluates a clinical tool with suggested additional components to ensure increased efficiency. Finally, recommendations for clinical practice, education, and research are presented.

Keywords: behavioral change, counseling, exercise, family practice, general practice, health promotion, nurse practitioner, physical activity, primary care, primary health care
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>ii</td>
</tr>
<tr>
<td>Table of Contents</td>
<td>iii</td>
</tr>
<tr>
<td>List of Tables</td>
<td>v</td>
</tr>
<tr>
<td>List of Figures</td>
<td>vii</td>
</tr>
<tr>
<td>Acknowledgement</td>
<td>xi</td>
</tr>
<tr>
<td><strong>Chapter One</strong></td>
<td></td>
</tr>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Background</td>
<td>4</td>
</tr>
<tr>
<td>Primary Care and Health Promotion</td>
<td>4</td>
</tr>
<tr>
<td>Barriers to health promotion</td>
<td>7</td>
</tr>
<tr>
<td>Physical Activity Intervention’ Content</td>
<td>8</td>
</tr>
<tr>
<td>Physical activity intervention’ techniques</td>
<td>9</td>
</tr>
<tr>
<td>Theories as interventions’ components</td>
<td>10</td>
</tr>
<tr>
<td>Physical Activity</td>
<td>11</td>
</tr>
<tr>
<td>Physical activity prevalence</td>
<td>11</td>
</tr>
<tr>
<td>Health problems and economic burdens of physical</td>
<td>12</td>
</tr>
<tr>
<td>inactivity</td>
<td>12</td>
</tr>
<tr>
<td>Detrimental effects of sedentary behavior on health</td>
<td>13</td>
</tr>
<tr>
<td>Physical activity benefits and recommended doses</td>
<td>14</td>
</tr>
<tr>
<td>Safety considerations</td>
<td>17</td>
</tr>
<tr>
<td><strong>Chapter Two</strong></td>
<td></td>
</tr>
<tr>
<td>Methods</td>
<td>18</td>
</tr>
<tr>
<td>Problem Formulating Stage</td>
<td>18</td>
</tr>
<tr>
<td>Literature Search Stage</td>
<td>20</td>
</tr>
<tr>
<td>Preliminary search</td>
<td>20</td>
</tr>
<tr>
<td>Comprehensive computerized databases search</td>
<td>21</td>
</tr>
<tr>
<td>Additional search strategies</td>
<td>22</td>
</tr>
<tr>
<td>Data Evaluation Stage</td>
<td>23</td>
</tr>
<tr>
<td>Data Analysis Stage</td>
<td>25</td>
</tr>
<tr>
<td>Final Presentation Stage</td>
<td>26</td>
</tr>
<tr>
<td>Summary</td>
<td>27</td>
</tr>
<tr>
<td><strong>Chapter Three</strong></td>
<td></td>
</tr>
<tr>
<td>Findings</td>
<td>28</td>
</tr>
<tr>
<td>Effectiveness and Intensity</td>
<td>28</td>
</tr>
<tr>
<td>Components of Physical Activity Interventions</td>
<td>37</td>
</tr>
<tr>
<td>Theoretical Models as a Component of Interventions</td>
<td>40</td>
</tr>
<tr>
<td>Characteristics of Patients and Providers</td>
<td>42</td>
</tr>
<tr>
<td>Number Needed to Treat</td>
<td>46</td>
</tr>
<tr>
<td>Standardised/Designed by Experts Interventions</td>
<td>48</td>
</tr>
<tr>
<td>Summary</td>
<td>53</td>
</tr>
<tr>
<td>Section</td>
<td>Page</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Chapter Four</td>
<td></td>
</tr>
<tr>
<td>Discussion</td>
<td>56</td>
</tr>
<tr>
<td>Recommendations</td>
<td>67</td>
</tr>
<tr>
<td>Recommendations for Practice</td>
<td>68</td>
</tr>
<tr>
<td>Recommendations for Education</td>
<td>71</td>
</tr>
<tr>
<td>Recommendations for Research</td>
<td>73</td>
</tr>
<tr>
<td>Limitations</td>
<td>75</td>
</tr>
<tr>
<td>Conclusion</td>
<td>76</td>
</tr>
<tr>
<td>Bibliography</td>
<td>79</td>
</tr>
<tr>
<td>Appendix A</td>
<td></td>
</tr>
<tr>
<td>Suggested Evidence-based Components of Physical Activity Interventions</td>
<td>88</td>
</tr>
<tr>
<td>Appendix B</td>
<td></td>
</tr>
<tr>
<td>Footnotes for Table 2 and Table 3</td>
<td>89</td>
</tr>
</tbody>
</table>
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1</td>
<td>Inclusion criteria and Exclusion Criteria</td>
<td>20</td>
</tr>
<tr>
<td>Table 2</td>
<td>Physical Activity (PA) Intervention in Primary Care Evidence Based Recommendations List</td>
<td>69</td>
</tr>
<tr>
<td>Table 3</td>
<td>Physical Activity (PA) Intervention Effectiveness Appraisal Checklist</td>
<td>70</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Literature Search Strategy</td>
<td>21</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Extracted Themes</td>
<td>26</td>
</tr>
</tbody>
</table>
Acknowledgements

I would like to express my appreciation to Linda Van Pelt and Jennifer Beaveridge for their guidance during my years as a student. Without their valuable assistance, this work would not have been completed.

I am also indebted to the UNBC family nurse practitioner staff and students for their support and cooperation, as well to the knowledge and mentorship of clinical preceptors and faculty.

I would also like to acknowledge the love, care, and encouragement I received from my family and friends.

Finally, I would like to thank colleagues in Northern Health for their support.
CHAPTER 1

Introduction

Physical inactivity is a major contributor to non-communicable diseases that are the fourth leading risk factor for overall morbidity and mortality worldwide, causing an estimated 3.2 million deaths globally (WHO, 2016). According to a study presented in a World Economic Forum (WEF), the global cost of five most common non-communicable diseases will surpass $47 trillion over the next twenty years; some of these diseases include cardiovascular disease (CVD) that affect heart and blood vessels, diabetes, obesity, chronic respiratory disease, and cancer (WEF, 2011). Canada’s cost of physical inactivity is approximately 6.8 billion annually (Krueger, Krueger, & Koot, 2015; Li, 2014). Canadian Physical Activity Guidelines of 150 min of moderate-to-vigorous physical activity (MVPA) per week are not met in at least in four out of five Canadian adults (Statistics Canada, 2015b; Statistics Canada 2015c; Public Health Agency of Canada, 2016). Approximately 70% of Canadian adults do not achieve the well-known pedometer target of 10,000 steps a day (Statistics Canada, 2015a). Significant evidence exists to support the benefits of physical activity (PA) on at least 30 chronic diseases (Nunan, Mahtani, Roberts, & Heneghan, 2013). Recommended levels of PA decrease the risk of a hip or vertebral fracture and help control weight (WHO, 2016). PA can substantially improve population health as it is as potent ‘medicine’ as most pharmacological substances prescribed to treat most chronic diseases (Naci & Ioannidis, 2013; WHO, 2016).

Primary care providers such as family physicians and family nurse practitioners (NPs) play an important role in the diffusion of PA recommendations to a large segment of the Canadian population through PA interventions that are key elements of the multifaceted societal approach needed to address physical inactivity (Anokye et al., 2014; MacAuley, Bauman, & Frémont, 2016). Over 80% of Canadians visit their primary care providers every year and prefer to receive health information directly from them (Statistics Canada, 2014; Thornton et al., 2016). It is established that PA is effective in
primary prevention, secondary prevention, and in the treatment of many common diseases (Anokye et al., 2014; MacAuley et al., 2016). There are decades of epidemiological evidence, years of identifying the “potential” health gain and cost-effectiveness if primary care providers successfully implemented PA interventions and even efforts to medicalise inactivity by labelling it “sedentary death syndrome” (Anokye et al., 2014; MacAuley et al., 2016). The scientific rationale for providing PA intervention in primary care settings is well-established (Frémont, Fortier, & Frankovich, 2014). If a PA intervention in primary care is adopted at the population level, it can potentially increase PA by 10% in relatively inactive patients, which according to recent Canadian evaluations, can save approximately 2.6 billion dollars per year in healthcare (Bounajm, Dinh, & Theriault, 2014). Despite all of these well-studied benefits of PA, most primary care providers do not regularly provide PA intervention as a part of routine care (Lobelo, Duperly, & Frank, 2009; Thornton et al., 2016). Even when PA is discussed, few primary care providers provide specific recommendations, and many have little knowledge and confidence about the effectiveness of their advice (Anokye et al., 2014; Short et al., 2016). One of the main factors influencing this low acceptance of PA promotion in primary care is the lack of an effective structured PA intervention available for primary care providers (Frémont et al., 2014).

Exercise is Medicine Canada (EIMC) (2015) sees PA as an integral part of prevention and treatment of chronic diseases in Canadian primary care settings. EIMC (2015) recommends primary care providers to assess and counsel all healthy adults and those with stable chronic conditions who are physically inactive. These recommendations are reiterated in the Canadian Academy of Sport and Exercise Medicine’s (CASEM) recent position statement (Thornton, et al., 2016). The issue is that these recommendations are mostly based on the health benefits of PA, and little is known about the effectiveness of PA interventions, their components, and patient/provider characteristics to effectively increase levels of PA in primary care patients (Campbell et al., 2012; Conn et al., 2011; EIMC, 2015). Therefore, it is appropriate to conduct an integrative literature review on this topic (Whittemore &
An integrative review is the broadest type of research review methods that allows for the simultaneous inclusion of empirical (experimental and non-experimental) and theoretical research in order to more fully understand a phenomenon of concern or healthcare problem (Whittemore & Knafl, 2005).

This integrative literature review focuses on identifying, analyzing, and synthesizing the evidence related to the effectiveness of PA interventions in the primary care setting designed to increase PA levels of Canadian adults. Furthermore, this review attempts to help primary care providers to prioritize their efforts or maximize the impact of PA interventions in primary care settings. The paper also aims to highlight the importance of implementing routine PA interventions in primary care settings. The purpose of this literature review is to answer the following question: ‘What is the current evidence on the effectiveness of physical activity interventions in the primary care settings to increase physical activity levels of adults aged 18-65?’ This project does not explore the evidence of the cost-effectiveness of PA interventions in primary care as it belongs to a well-researched area of knowledge; in addition, this review does not explore evidence related to institutional or health policy levels (Anokye et al., 2014; MacAuley et al., 2016; Thornton et al., 2016). Prior to answering the research question, a discussion of the relevant background literature will be provided to briefly identify the significance of PA, leading to a linkage of the research concepts. The background will outline the concepts related to the health promotion in primary care, PA interventions’ content, physical inactivity, and the concepts related to PA benefits. The background is followed by project methods, findings from literature analysis, discussion of the findings, and recommendations for clinical practice and education. The result of this integrative literature review will be a set of recommendations that could be incorporated into clinical practice and education in order to improve PA intervention outcomes in primary care that is increased levels of PA of the Canadian adult population. The recommendations will be of use to any primary care providers such
as family physicians or family NPs as well as other health professionals within the primary care settings in Canada.

**Background**

Physical inactivity and sedentary behaviour is a major public health issue in Canada, contributing significantly to rising chronic diseases (Bounajm et al., 2014). Primary care settings can be an important medium to decreasing levels of physical inactivity and sedentary behaviour in Canada through routine PA health promotion (Thornton et al., 2016). The following sections of this chapter will identify concepts related to health promotion in primary care, the role of primary care providers, and barriers to health promotion in primary care. In addition, this chapter will discuss concepts related to the effectiveness of PA interventions such as PA interventions’ content to include behavioral change theories as a component of PA interventions and their role. Finally, PA prevalence, health problems and economic burdens associated with physical inactivity, negative effects of sedentary behavior on health, PA benefits and recommended doses of PA, and safety considerations of PA will be discussed.

**Primary Care and Health Promotion**

Primary care and primary health care (PHC) are terms that are often used interchangeably, as they represent overlapping concepts (Muldoon, Hogg, & Levitt, 2006). Comparing and contrasting these concepts is beyond the scope of this literature review. However, understanding these terms is essential in relation to the role of primary care providers in the provision of health promotion to their patients. Primary care is understood as the first level of care and usually the first point of contact that people have with the health care system. Primary care supports individuals and families to make the best decisions for their health (Muldoon et al., 2012). Primary care includes advice on health promotion and disease prevention, health assessments, diagnosis and treatment of non-emergent episodic and chronic conditions, and supportive and rehabilitative care (Muldoon et al., 2012). Primary care services are coordinated, accessible to all patients, and are provided by primary care providers who have the right
skills to meet the needs of individuals and the communities being served (Muldoon et al., 2012).

Primary care providers work in partnership with their patients in order to provide a continuity of services and facilitate the use of other health-related services when needed (Muldoon et al., 2012). Primary care is typically accessed through primary care office by a patient to see his/her primary care provider in Canada, either a family physician or family NP, or it is accessed through a walk-in clinic. While providing services on a personal and family (micro) level, primary care as a country-wide system affects the health of all Canadians through PHC philosophy on population (macro) and community (meso) levels (CNA, 2015).

In contrast, the Canadian Nurses Association (CNA) (2015) defined PHC as a philosophy and a principle-based approach that is integral to improving the health of all Canadians and the effectiveness of health service delivery on macro, meso, and micro levels in all care settings such as acute, community, long-term, rehabilitation, hospice, corrections, and primary care, among others. PHC focuses on the way services are delivered through policy and implementation into programs and practice while putting the people who receive those services at the center of care (CNA, 2015). Health in PHC philosophy has a broad understanding, emphasizing the importance of promoting healthy lifestyles to help prevent disease and injury, and the value of ongoing care for people with chronic conditions. The core principles of PHC were established in the World Health Organization’s Declaration of Alma-Ata in 1978 (WHO, 2008). These principles are accessibility, active public participation, health promotion, chronic disease prevention and management, the use of appropriate technology and innovation, and intersectoral cooperation and collaboration (WHO, 2008).

Therefore, for the purpose of this paper, primary care is understood as a system of the first point of contact of patients with Canadian health care, while PHC is understood as a basis philosophy of primary care in which health promotion is an integral part. While PHC philosophy is shared between all
health care professionals, the focus of this paper is primary care settings. Therefore, it is important to define primary care providers such as family physicians and family NPs.

Family physicians are medical doctors who provide continuing and comprehensive medical care as well as health maintenance and preventive services to each member of the family regardless of sex, age, or type of problem. This care can be biological, behavioral, or social and advocate in all health-related matters, including the appropriate use of consultants, health services, and community resources (AAFP, 2016).

Family NPs are advanced practice nurses who possess a graduate-level education as well as clinical training in family medicine. Family NPs work autonomously or in collaboration with other healthcare professionals to deliver family-focused primary care. Family NPs diagnose and treat complex health conditions of the body and mind as well as provide health promotion and disease prevention to direct care and counseling across the lifespan (Graduate Nursing Education, 2016).

In general, NPs are health professionals who have achieved the advanced nursing practice competencies at the graduate level of nursing education and who can function both independently and collaboratively in a variety of settings (CRNBC, 2016). NPs possess and demonstrate the competencies to autonomously diagnose, order, and interpret diagnostic tests, prescribe pharmaceuticals, and perform specific procedures within their legislated scope of practice, emphasizing holism, health promotion, and partnership with individuals and families, and communities (CRNBC, 2016).

Health promotion has been successfully delivered by NPs with consistent results on reducing smoking and alcohol use, shorter hospital stays, decreased hospital admissions, and more appropriate office visits (CNA, 2012). This implies that NPs are well-prepared for PA health promotion. Canadian NPs acknowledged high importance to providing PA health promotion (mean score 4.82 on a 6-point scale), which is consistent with the findings of a U.S. study in which 92% of NPs surveyed perceived
that PA health promotion was as valuable a component of their practice as the prescribing of medications (Lamarche & Vallance, 2013).

Primary care providers possess the attitudes, skills, and knowledge which qualify them to provide continuing and comprehensive medical care, health maintenance, and preventive services to each member of the family regardless of sex, age, or type of problem (e.g., biological, behavioral, or social) (Luquis & Paz, 2015). Due to their backgrounds and interactions with the family, they are best qualified to serve as each patient’s advocate in all health-related matters, including the appropriate use of consultants, health services, community resources, and health promotion (Luquis & Paz, 2015). Therefore, the primary care setting is an important place, if not the most important place, to health promotion given the full range of care that occurs in this environment (Hunter, Goodie, Oordt, & Dobmeyer, 2013).

**Barriers to Health Promotion in Primary Care.** Primary care providers report multiple barriers to provision of health promotion. These barriers include lack of time, complex comorbidities, perceived lack of patient engagement, perceived ineffectiveness of health promotion, lack of clinical tools, and lack of training or education (Frémont, Fortier, & Frankovich, 2014; Geense, van de Glind, Visscher, & van Achterberg, 2013).

The typical primary care provider in Canada sees 20-25 patients in a day, many with complex problems (Sarma, Hajizadeh, Thind, & Chan, 2013). The average length of a primary care provider visit in Canada is approximately 15 minutes during which time the average patient will discuss more than three health concerns in 37% of visits (Sarma et al., 2013). This implies that primary care providers including NPs and family physicians have little time to address health promotion along with other medical issues. In addition to a lack of time, primary care providers also report feeling underprepared for health promotion and wanting to have improvements in health promotion related training (Burfeind, Seymour, Sillau, Zittleman, & Westfall, 2014).
While diagnosing and prescribing are often take as substantial part of clinical training of family physicians and NPs, much less attention is usually given to teaching basic counselling for health promotion (Lamarche & Vallance, 2013; Rubio-Valera et al., 2014). Surveys of primary care providers show that only about a quarter of surveyed participants feel effective when counseling patients on smoking cessation, diet, PA, and weight management (Rubio-Valera et al., 2014). In a recent Canadian study, approximately 63% of NPs responded to a survey in which they reported they had not received formal education such as a course or a module within a course that specifically addressed health promotion (e.g., obesity prevention, PA, nutrition) in their undergraduate and NP education (Lamarche & Vallance, 2013). This survey result implies the need for a PA counseling curriculum within nursing education to equip future NPs to respond to the high prevalence of physical inactivity in Canada (Lamarche & Vallance, 2013). Survey findings of family physicians have similar results on the lack of formal training in health promotion (Dauenhauer, Podgorski, & Karuza, 2006; Polak, Pojednic, & Phillips, 2015).

The recommendations in this integrative literature review are intended for use by Canadian family NPs practicing in primary care. However, this review’s recommendations can be relevant to different primary care health care professionals such as family physicians, physician assistances, nurses, and medical office assistances in Canada and other Organization for Economic Cooperation and Development (OECD) countries. The Majority of data for this literature review originated in OECD countries including Canada.

**Physical Activity Interventions’ Content**

This paper explores evidence on PA interventions’ effectiveness. The effectiveness of PA interventions depends on their components which can include different behavioral change techniques and/or components that are based on behavioral change theories (Campbell et al., 2012; Conn et al., 2011). For more in depth information on the commonly used terminology related to promotion of PA,
including the PA intensity chart, please refer to Norton, Norton, and Sadgrove (2010). It is out of the scope of this paper to discuss this terminology in detail.

**Physical activity interventions’ techniques.** This section will present basic components and terminology related to PA interventions. A PA intervention may consist of one or more techniques—either cognitive and/or behavioral (Conn et al., 2011). An intervention is primarily directed in helping patients adopt new routines such as a regular PA, healthy food intake, or managing stress. Interventions determine which techniques are needed to build routines that result in specific outcomes (Anshel, 2014). Singer and Anshel (2014) defined an intervention as “the process by which [health care practitioners] attempt to influence the thoughts, emotions, or performance quality of [their clients]” (p. 170). In turn, health professionals are those who “intervene” by mediating themselves or their techniques between the patient and the environment or the situation to affect the client’s thoughts (e.g., positive self-talk), emotions (e.g., happiness, enthusiasm), and/or actions (e.g., PA) for the desired outcome (e.g., increased PA levels) (Anshel, 2014, p. 170).

Cognitive strategies consist of a person’s thoughts. A cognitive strategy: (1) improves cognition, that is, the processing of visual, auditory, and tactual input, or (2) favorably influences the client’s emotions such as reducing anxiety, improving attentional focusing, maintaining concentration, and coping with stress (Anshel, 2014). Different techniques are designed to improve performance quality and outcomes. It can be achieved by utilization of cognitive strategies such as anticipation or predicting future events that is anticipation of enjoyment and achieving fitness goals; cueing that is using external cues such as timers to initiate exercise or internal cues such as prolonged sitting and desire to move to initiate exercise; psyching up that is thinking about the exercise routine to increase excitation, energy, and feeling of challenge and engagement; a variety of coping skills; various relaxation techniques, and visualization or mental imagery of specific PA moves before performing an exercise; education on health topics; and provision of educational material (Anshel, 2014). On the other hand, improved
performance quality and outcomes can be achieved with behavioral strategies such as goal-setting, recording performance outcomes, developing and using a self-monitoring checklist, exercising with a friend and other forms of social support, receiving instruction or positive feedback, and exercise as therapy or PA prescription (Anshel, 2014).

**Theories as interventions’ components.** Numerous theories have been proposed over the years that relate to predicting and explaining health-related behaviors. These theories and models have seen limited success in promoting health behavior change with relatively low prediction for exercise behavior (Anshel, 2016).

To determine which interventions are most effective at improving health behavior, researchers and practitioners must examine their efficacy. Most of the existing published intervention research has been guided by various theories and models that explain and predict improved health outcomes (Anshel, 2016). Personal, environmental, and situational factors each influence these outcomes. The primary purpose of theories and models is to explain, describe, or predict behavior in the attempt to advance knowledge for practical, real-life application. Therefore, it is incorrect to think that theories have minimal value; however, they can have diminished or even detrimental effects in practice settings, especially during a brief primary care visit (Anshel, 2016; Conn, Hafdahl, & Mehr, 2011). For example, when a theory becomes a component of PA intervention, a theory brings additional measurements such as a stage of readiness for change or magnitude of self-efficacy (Anshel, 2016; Conn, Hafdahl, & Mehr, 2011). Moreover, it is easy for providers and patients to be overwhelmed with cumbersome approaches that sometimes arise from multiple theories. Likewise, these approaches also may require extensive training and require lengthy appointments as well as follow-up that are difficult to maintain in primary care settings (Anshel, 2016). It is beyond the scope of this paper to review the content of theories and models of behavioral change that were commonly used as components of PA interventions in the primary care settings.
In summary, theories and models, as Anshel (2016) noted, help: (a) to improve our understanding of the interrelationships between a person’s thoughts (also called cognitions), emotions (also called affect), and behaviors (or performance); (b) to help explain behavioral phenomena (that is, why certain actions occur under particular circumstances); (c) to predict future behavior; (d) to simplify complex and abundant information into a coherent and organized structure that improves our understanding of these processes; and (e) to test the effectiveness of interventions, often as part of research, that can improve certain predetermined outcomes. Nevertheless, theories and models for behavioral change have helped to conceptualize commonly used PA interventions’ techniques such as cognitive and behavioral.

Physical Activity

The final section of the background chapter will focus on PA prevalence, health problems and economic burdens associated with physical inactivity, negative effects of sedentary behavior on health, PA benefits and recommended doses of PA, and safety considerations of PA.

The term PA is understood in the following sections as a broad term that includes all bodily movements produced by the skeletal muscles that result in energy expenditure (Casperson, Powell, & Christenson, 1985; WHO, 2016). PA covers all types of activity that require movement. Common PA sub-types include sport, exercise, active transport, and occupational and lifestyle PA (WHO, 2016).

Physical activity prevalence. Globally, approximately 31% of adults (men 28% and women 34%) aged 15 years or more are insufficiently active (WHO, 2012). These estimates are consistent with Canadian data of insufficiently active adults—32% aged 18 to 39 and 18% ages 40 to 59 who do not meet Canadian PA guidelines measured either in minutes per week or steps per day (CSEP, 2015; Statistics Canada, 2015a, Statistics Canada, 2015b). These statistics mean that at least four out of five Canadian adults do not meet these PA guidelines (Statistics Canada, 2015b; Public Health Agency of Canada, 2016). The prevalence of physical inactivity is higher than that of all other modifiable
unhealthy behaviors in Canada such as tobacco use, obesity, high risk sexual behavior, and substance abuse (Statistics Canada, 2015a). Specific sub-populations are even less likely to engage in PA, including people from culturally and linguistically diverse communities, people with low socio-economic status, dependent children, those with lower education levels, and overweight/obese adults (Statistics Canada, 2015a).

**Health problems and economic burdens of physical inactivity.** Physical inactivity has been identified as the fourth leading risk factor for global mortality, causing an estimated 3.2 million deaths (6%) globally (WHO, 2012). In Canada, PA is ranked second (behind tobacco smoking) most important factor in disease prevention (CASHC, 2014; CSEP, 2015), and physical inactivity is ranked fourth in terms of the leading causes of disease burden (Statistics Canada, 2015a). For example, physical inactivity is a significant independent risk factor for, though not limited to, osteoporosis, obesity, and major chronic diseases, including CVD, colon and breast cancer, and diabetes (WHO, 2012). Physical inactivity is also associated with mental health problems such as depression and anxiety (Deslandes et al., 2009; Dunn, & Jewell, 2010). The health care cost of physical inactivity in Canada has almost doubled from 2000 to 2010 from approximately 2.5% ($5.3 billion) to 4% ($6.8 billion) of the total health care cost with a predicted continuation of this increasing trend (Krueger, Krueger, & Koot, 2015; Li, 2014). Finally, to date, there has been no published research on the cost of sedentary behavior in Canada (Bounajm et al., 2014).

**Detrimental effects of sedentary behavior on health.** Recent findings, independent from the research on the negative effects of inactivity, suggested the autonomous impact of a sedentary behavior on health was independent of PA level (de Rezende, Rodrigues Lopes, Rey-López, Matsudo, & Luiz 2014). For instance, sedentary lifestyle has been linked to an increased risk of obesity, developing chronic illnesses such as diabetes or CVD and total mortality (de Rezende et al., 2014). Sedentary behavior includes postures or activities that require very little movement such as prolonged sitting,
watching television, playing passive video or computer games, extended time spent on the computer (surfing the Internet or working), and motorized transportation (CSEP, 2015).

The Canadian Society for Exercise Physiology [CSEP] (2015) compiled two separate guidelines (for PA and for sedentary behavior) and recognized sedentary behavior as an important determinant of health aside from low PA levels. Thus, an effective intervention to increase PA also needed to focus on reducing sedentary behaviors. This suggests that interventions encouraging the accumulation of lifestyle PA throughout the day may help to simultaneously increase PA and reduce daily sedentary time (CSEP, 2015).

**Physical activity benefits and recommended doses.** PA benefits are well-known and well-presented in the literature. An in-depth discussion of PA benefits is out of scope of this paper. However, in their position statement, the Canadian Academy of Sport and Exercise Medicine (CASEM) has compiled the key messages for primary care providers regarding the effective dosage of PA for the prevention and treatment of chronic diseases (Thornton et al., 2016). These key points will be discussed in this section of the background chapter as they are related to the effective delivery of PA interventions.

The groundbreaking British Medical Journal large meta-epidemiological study (Naci & Ioannidis, 2013) compared the effects of medication versus PA in chronic diseases and showed solid evidence for similar or superior effects of PA health benefits. Specifically, PA were more effective than medications to treat stroke and had the same effectiveness as medications for the prevention of diabetes as well as secondary treatment of cardiovascular (CV) diseases (Naci & Ioannidis, 2013). The same effectiveness of PA as medications was reported for depression (Knapen, Vancampfort, Moriën, & Marchal, 2014). PA has a statistically significant effect on cognition in patients with Alzheimer’s disease (AD) or patients with non-AD dementia (Groot et al., 2016).

In patients who achieve 150 minutes of MVPA per week, the risk reductions of 25-50% or more in most major chronic diseases is confirmed by a number of high-quality systematic reviews (Pedersen
The dose-response effects of PA to overall mortality have been clearly demonstrated in a systematic review of nine cohort studies with a mean follow-up of 9.8 years (Hupin et al., 2015) and two recent studies on large population cohorts (661,137 adults in the USA and Europe and 204,542 adults in Australia, followed for 14 and 8 years, respectively) (Arem et al., 2015; Gebel et al., 2015). Each 10 min of MVPA accumulated per day led to approximately a 10% relative risk reduction in mortality and up to a 32–44% relative risk reduction at 150 min MVPA per week depending on the amount of vigorous activity as a part of the MVPA (Arem et al., 2015; Gebel et al., 2015; Hupin et al., 2015). The dose-response effect seems to plateau at a 50–60% reduction at 3-5 times the guidelines (i.e., 750 min/week) with no evidence of increased mortality at high levels of PA in generally healthy individuals.

For some people, especially those who are mainly sedentary, the target of 150 min/week can be difficult to achieve. However, even small amounts of PA show significant benefits. In particular, going from inactive to somewhat active (i.e., 75–90 min/week) results in a major positive change in health risk that is a 15% reduction in mortality risk (Stevens et al., 2014; Wen et al., 2011). Finally, because prolonged sedentary time is an independent predictor of adverse health outcomes (Biswas et al., 2015), just reducing this behavior alone results in short- and long-term health benefits (de Rezende et al., 2014; Wilmot et al., 2012). For instance, even small amounts of PA, including activities such as standing, are associated with lower CVD risk (Eijsvogels, Molossi, Lee, Emery, & Thompson, 2016).

**Safety considerations.** Prior to initiation of PA interventions, a primary care provider should be aware of safety considerations of PA. Gradual progression to regular MVPA is safe and recommended for all ages (Thornton et al., 2016). Light to moderate PA has very little risk and can be ‘self-administered’ (Bredin, Gledhill, Jamnik, & Warburton, 2013). For people with stable asymptomatic CV, metabolic or renal disease, medical clearance is needed only when they are inactive (Thornton et al.,
Despite the fact that these diseases are most common for primary care settings, primary care providers are often concerned with CV risk in patients with more serious conditions (Thornton et al., 2016).

Contraindications to PA can be determined through a history and physical examination (PE) (Thornton et al., 2016). Patients with unstable angina, uncharacterized arrhythmias, or decompensated heart failure are safe to perform vigorous exercise when their conditions become stable (Thornton et al., 2016). The focus of PE should be on significant clinical signs such as a heart murmur, pulmonary overload, or severe hypertension (resting blood pressure >200/110 mm Hg), which can indicate a potential risk (Orrow et al., 2012).

The prevalence of complications requiring hospitalization, during or immediately after a stress test, are for serious arrhythmias ≤ 0.2%, for acute myocardial infarction 0.04%, or sudden cardiac death (SCD) 0.01% (Myers et al., 2014). In regards to vigorous intensity PA, even for very active, life-long endurance athletes, the benefits of PA outweighs the risks of CV events (Eijsvogels et al., 2016). Thornton et al., (2016) concluded that gradual transition towards MVPA by sedentary patients with stable chronic conditions and a normal history and PE was associated with a very low rate of CV events. Therefore, a formal CV testing is not indicated for sedentary patients with stable conditions (Thornton et al., 2016). Moreover, according to the Canadian 2016 Hypertension Guidelines, both resistance and moderate intensity aerobic exercise such as walking, jogging, cycling, or swimming are safe for hypertensive and non-hypertensive individuals (Leung et al., 2016). There was a concern raised because of an acute increase in blood pressure (BP) and potential use of the Valsalva maneuver during weight training; specifically, this form of exercise could adversely raise BP levels, leading to an increased risk of hemorrhagic stroke or subarachnoid hemorrhage (Leung et al., 2016). However, a single large meta-analysis by Cornelissen et al. (2011) included in the Canadian hypertension guidelines identified no adverse events associated with resistance exercise (Leung et al., 2016). Moreover, RCTs meta-analyzed
in three large studies included in this review reporting adverse events identified no increase associated with PA interventions (Campbell et al., 2012, Conn et al., 2011, Orrow et al., 2012).

While the most relative PA safety concern is related to CV system, primary care providers may inquire about PA safety related to osteoarthritis, rheumatoid arthritis (RA) or other comorbidities (Thornton et al., 2016). According to the recent systematic reviews, the aerobic and resistance PA were not associated with increased pain or disability in patients with osteoarthritis (Brosseau et al., 2015; Fernandes et al., 2013; Juhl, Christensen, Roos, Zhang, & Lund, 2014; NICE, 2014; Singh et al., 2015). Moreover, according to the recent recommendations PA should be a part of osteoarthritis or RA management to reduce pain and increase function (Fernandes et al., 2013; Mcalindon et al., 2014; NICE, 2014; Singh et al., 2015). Regarding majority of other chronic diseases, CASEM position statement suggested that if a patient has one or two stable chronic diseases and is otherwise healthy, PA can be self-administered, with a gradual progression towards the adult PA guidelines (Thornton et al., 2016).

Finally, while these were the most relevant health concerns related to PA, some issues with PA can also be present. For example, when prescribing PA, providers and patients should be aware of the environment of workout facilities or homes. Exercise surfaces that are slick, sticky, or uneven may cause a patient to fall or trip, which can be serious for patients with osteoporosis (Griffin 2015). Sedentary patients have less flexibility and it take for them much longer to warm up in a cold room (Griffin 2015). For outdoor activities, clothing needs to be layered to adjust to cold and wind (Griffin 2015). Water intake needs to be encouraged, especially for older adults who have a lower proportion of total body water (Griffin 2015). For those with cardiovascular risks it can be unsafe in overheated room when performing an aerobic PA (Griffin 2015). PA that require quick footwork with rapid changes in direction demand high levels of coordination and dynamic stability and could result in falls, trips, or lower leg injuries for older adults (Griffin 2015).
Summary

In summary, the background chapter of this integrative literature review has addressed concepts that relate to PA interventions’ effectiveness in primary care settings to include definitions and the role of primary care providers in health promotion. Finally, PA prevalence, health problems and economic burdens associated with physical inactivity, negative effects of sedentary behavior on health, PA benefits and recommended doses of PA, and safety considerations of PA were also discussed. The next chapter focuses on outlining the methods utilized to complete this literature review.
CHAPTER 2

Methods

In this section, the methods utilized to complete this integrative review will be outlined. Whittemore and Knafl (2005) suggested identifying the choice of the research design. The choice of the research design that is integrative literature review was determined by the requirements for the completion of the UNBC NP master’s program. An integrative review permits simultaneous combination of diverse literature including randomized controlled trials (RCTs), systematic reviews of RTCs, meta-analysis, theoretical work, as well as clinical cases reports and or expert opinions pieces (Torraco, 2005; Whittemore & Knafl, 2005). This mixed knowledge approach allows a deeper understanding of a studied phenomenon. Therefore, integrative reviews present the state of the science contributing to theory development and have direct applicability to practice and policy (Whittemore & Knafl, 2005).

A five-stage approach, as described by Whittemore and Knafl (2005), was adapted for this paper. The stages included a problem formulation stage, a literature search stage, a data evaluation stage, a data analysis stage, and a presentation stage (Whittemore & Knafl, 2005 p. 549).

Problem Formulating Stage

The initial stage of any integrative review is a clear identification of the problem that the review is addressing and the review’s purpose (Whittemore & Knafl, 2005). The problem this review is addressing is the lack of knowledge about the effectiveness of PA interventions, their components, and patient/provider characteristics to effectively increase levels of PA in primary care patients. This integrative literature review focuses on exploring the evidence related to the effectiveness of PA interventions in the primary care setting designed to increase PA levels of adult Canadians. This project attempts to help guiding primary care providers to prioritize their efforts or maximize the impact of PA
interventions in primary care settings. This paper also aims to highlight the importance of implementing routine PA interventions in primary care settings.

The conceptualization phase of this review formed the foundations of the search strategy. To guide the search strategy, the variation of PICO—PISCO (i.e., population, intervention, setting, comparison [if appropriate], outcome) framework was utilized to form a research question (Pach, Massarella, & Sharma, 2016). The PISCO framework is suitable for mixed research methods such as integrative literature review (Pach et al., 2016). Based on the identified issue the following research question was formed, ‘What is the current evidence on the effectiveness of PA interventions [intervention] in the primary care settings [settings] to increase PA levels [outcome] of adults aged 18-65 [population]?’ Even though, comparison of PA intervention versus no intervention was present in the studies reviewed for this paper, no comparison was set to lead the search strategy as the ‘effectiveness’ is not an intervention but a quality on an intervention; therefore, it is a non-dichotomous phenomenon and comparison is not applicable.

The research question was considered within a PHC approach, particularly in the primary care setting within Canada. The area of focus for this literature review was thought for the use of PA interventions by family NPs in primary care settings. However, preliminary search of the literature identified the lack of literature on the PA interventions specifically designed for family NPs as there was no distinction between other primary care providers such as family physicians, capable to effectively deliver these interventions (Orrow et al., 2012).

During the preliminary stages of the review, eligibility (i.e., inclusion and exclusion) criteria were identified to ensure that the most relevant and current literature was selected. The eligibility criteria are listed in Table 1.
Table 1 Inclusion criteria and Exclusion Criteria

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. English language literature, published between January 2005 and December 2015.</td>
<td>1. Literature focusing exclusively on &lt;18 or &gt;65 years of age</td>
</tr>
<tr>
<td>2. Adults aged 18 to 65. This group was chosen as the</td>
<td>2. Non-English language publication</td>
</tr>
<tr>
<td>effectiveness of PA intervention depends on the</td>
<td>3. Unpublished dissertation, editorial, news article, or opinion statement</td>
</tr>
<tr>
<td>understanding of PA instructions and the ability to follow them. Majority of the</td>
<td>4. Clinical practice guidelines or recommendations involving no literature search and</td>
</tr>
<tr>
<td>effectiveness research done for this age group.</td>
<td>review of studies analyzing evidence</td>
</tr>
<tr>
<td>3. Articles addressing effectiveness of PA interventions in primary care,</td>
<td>5. Studies conducted in settings that were not generalizable to primary care,</td>
</tr>
<tr>
<td>components of PA interventions, and characteristics of the sample affecting</td>
<td>including inpatient care, emergency departments, or occupational settings</td>
</tr>
<tr>
<td>effectiveness</td>
<td>6. Exercise referral schemes, as intervention is mainly performed by a third-party</td>
</tr>
<tr>
<td>4. Articles addressing method and theoretical background of PA interventions in</td>
<td>service provider and may include supervised exercise training</td>
</tr>
<tr>
<td>primary care</td>
<td>7. Interventions that were delivered by specially trained professionals, including</td>
</tr>
<tr>
<td>5. Design either RTCs, meta-analyses, systematic reviews, literature review or</td>
<td>dietitians or nutritionists, physiotherapists or exercise professionals, health</td>
</tr>
<tr>
<td>mixed design to ensure the highest level of evidence.</td>
<td>educators, and psychologists. Specially trained professionals share with primary</td>
</tr>
<tr>
<td>6. Articles addressing health promotion, behavior change, adherence to PA, and</td>
<td>care providers the theoretical background of PA counselling. However, the specificity</td>
</tr>
<tr>
<td>counselling</td>
<td>of primary care settings dictates primary care interventions’ design that is a</td>
</tr>
<tr>
<td>7. Exercise/PA, including promotion and prescription</td>
<td>key element of the effectiveness of PA interventions</td>
</tr>
<tr>
<td>8. Studies done in primary care, PHC settings (used sometimes interchangeably)</td>
<td></td>
</tr>
<tr>
<td>involving primary care providers including nurse practitioners, physicians,</td>
<td></td>
</tr>
<tr>
<td>physician assistants, nurses.</td>
<td></td>
</tr>
<tr>
<td>9. Studies with any intervention performed or initiated in a primary care</td>
<td></td>
</tr>
<tr>
<td>setting with the goal of increasing the PA level or participation of sedentary or</td>
<td></td>
</tr>
<tr>
<td>insufficiently active adults</td>
<td></td>
</tr>
</tbody>
</table>

Literature Search Stage

Preliminary search. The literature review began with a Google Scholar database preliminary scoping search of relevant literature for the past ten years. This timeframe was chosen because newer high quality research have contributed in favor of increasing the level of evidence for inclusion of PA interventions in primary care settings, and recent meta-analyses have indicated the tendency of this increasing trend (Campbell et al., 2012; Lin et al., 2010; Orrow et al., 2012). Moreover, recent EIMC (2015) Canadian recommendations for primary care providers suggest routinely providing PA interventions to all healthy adults and those with stable chronic conditions. This recommendation is reiterated in the latest Canadian Academy of Sport and Exercise Medicine position statement (Thornton et al., 2016).
The 2005 studies were included as the original search was conducted in December of 2015. The initial Google Scholar database search employed the terms PA, counseling, and primary care, yielding 18,300 results. The first 200 titles were reviewed to scan for relevant articles and to develop a set of comprehensive and relevant search terms as well as inclusion/exclusion criteria.

Following the preliminary search, the three methods of searches, as suggested by Whittemore and Knafl (2005), were conducted. These searches are as follows: (1) comprehensive computerized databases search; (2) ancestry and descendancy searches from the citations of the key literature identified from computerized databases search; and (3) journal hand searching.

**Comprehensive computerized databases search.** Following the initial scoping search, a comprehensive search of computerized databases of the peer-reviewed literature was undertaken using PubMed, CINHAL (EBSCO) databases (Complete, Academic Search Premier, MEDLINE with full Text, PsycArticles, PsycINFO), MEDLINE (OVID), Web of Science, Cochrane EBM reviews (OVID) (See Figure 1).

*Figure 1. Literature Search Strategy.*
Based on preliminary scoping activity, important search terms were deduced at higher levels of abstraction for computerized databases search. The use of MeSH (Medical Subject Headings) identifiers resulted in a limited number literature sources relevant to the research question. In addition, the subject headings were either too narrow or too general to be used in the search specific to the effectiveness of PA interventions for primary care settings. Therefore, the computerized databases search strategy was developed using free text terms. These terms were related to behavior (PA, exercise, leisure activities), to interventions that offered counseling or assistance (counseling, patient education, behavioral change, health promotion), to terms related to primary care (primary care, PHC, general practice, family practice), and to the study design (RTC, meta-analysis, systematic review). This high level of evidence study design was the most common in studies related to the effectiveness of PA interventions.

The adults aged 18 to 65 were chosen for this study population as the most common age group in the selected literature related to the effectiveness of PA interventions. Populations aged younger than 18 and older than 65 were excluded due to developmental and age related changes, respectively, that can affect the outcomes of PA interventions that are the ability to recall and understand the advice and to follow PA counseling instructions (Campbell et al., 2012).

Final papers for the full text review were selected from computerized databases search results after a review of titles and relevant select abstracts, assessment of their relevance, and removal of duplicates (see Figure 3). As a result of this process, two standardized/designed by experts PA interventions available in Canada were captured. The selection of the literature was based on its relevance to the question’s scientific rigor and applicability to clinical practice.

**Additional search strategies.** Computerized databases are efficient and effective, but they can sometimes yield only 50% of the eligible studies (Whittemore & Knafl, 2005). To increase comprehensiveness of the search strategy, Whittemore and Knafl (2005) suggested using two or three
methods of search for integrative literature review such as computerized databases search, ancestry/descendancy searching, journal hand searching, networking, or searching research registries.

Ancestry and descendancy searching allows search citations from relevant studies to track down earlier (i.e., ancestors) and more recent studies (i.e., descendants) (Polit & Beck, 2014). To ensure a comprehensive search, ancestry and descendancy searching of existing reference lists identified in the comprehensive computerized databases search was conducted. In addition, journal hand searches were done. Additional search methods have not identified new (within the past ten years) RCTs, systematic reviews, or meta-analyses related to the evidence on the effectiveness of PA interventions. In addition, the evidence presented on the official websites of the Canadian standardized/designed by experts PA interventions was reviewed. This resulted in identification of three relevant studies. Moreover, the additional searches to the computerized databases search identified articles related to background, clinical practice recommendations, discussions, and recommendations for practice and research of this paper. In addition, while titles and abstracts from literature search were reviewed, important background papers and key authors were also captured. This ensured the synthesis and bridging of high quality empirical experimental data identified during computerized databases search and non-experimental data. This synthesis or bridging of the data gathered from different knowledge such as empirical and non-empirical is fostered by integrative literature review design, and it serves to the value-added purpose of this integrative literature review (Whittemore & Knafl, 2005).

**Data Evaluation Stage**

Integrative literature review can include diverse literature such as empirical, non-empirical, and theoretical (Whittemore & Knafl, 2005). Therefore, this diverse literature is evaluated differently than, for example, the literature that is evaluated for systematic reviews of RCTs (Whittemore & Knafl, 2005). Unlike systematic reviews of RCTs, integrative literature reviews are not designed to change clinical practice (Torraco, 2005; Whittemore & Knafl, 2005). The appraisal of evidence is commonly
based on the relevance to the focus of the integrative literature review that is graded either relevant or not relevant (Torraco, 2005; Whittemore & Knafl, 2005). This type of evaluation can be incorporated into the inclusion/exclusion process (Whittemore & Knafl, 2005). For example, systematic reviews, meta-analyses, and RCTs older than 2005 (older than 2005 studies were not included in this integrative review) had a low degree of evidence on the effectiveness of PA intervention in primary care, and notably, they were of a low quality characterized by limited generalizability and methodological limitations (Sanchez et al., 2015). Therefore, these papers were excluded from the review. Theoretical and non-experimental data (i.e., papers) were coded as either relevant or not relevant representing low quality. Irrelevant theoretical and non-experimental data was not included in this review.

For the similar sampling frame (e.g., searches from computerized databases search that consisted of a similar sampling frame and were used as primary sources), two scale quality scores can be used as suggested by Whittemore and Knafl (2005). For this purpose, the critical appraisal tool for RCTs, systematic reviews of RCTs, and meta-analyses were used from Davies and Logan (2012). Similar to Davies and Logan’s (2012) tool, the Critical Appraisal Skills Programme (CASP) tool can also be utilized for this type of sampling (CAPS, 2013).

A data evaluation scoring system for this integrative literature review was adapted from Whittemore and Knafl (2005). Due to diverse representation of data sources, papers were coded according to two criteria relevant to this review: methodological or theoretical rigor and data relevance on a two-point scale (high or average quality). No report was excluded based on this data evaluation rating system; however, the score was included as a variable in the data analysis stage. In general, papers of average rigor and relevance contributed less to the analytic process.

In summary, data evaluation criteria for this integrative literature review, as suggested by Whittemore and Knafl (2005) was used for the inclusion/exclusion process and as a variable in the data analysis stage.
Data Analysis Stage

Strategies for data analysis with integrative reviews are one of the least developed aspects of the integrative literature review process (Whittemore and Knafl, 2005). The goal of the data analysis stage is thorough and unbiased interpretation of primary sources (Whittemore and Knafl, 2005). The data analysis process for this integrative literature review was adapted from Whittemore and Knafl (2005) and consisted of data reduction, data display, and conclusion drawing.

In total, 13 papers resulted from the comprehensive search strategy that comprised RCTs, systematic reviews, meta-analyses, and non-experimental study. These primary sources contained the evidence related to the effectiveness of PA interventions suitable for primary care providers in primary care settings. Data from these primary articles were categorized and summarized. A full text review of the primary sources resulted in the data reduction that allows the reduction of primary sources to a single page with similar data extracted from individual sources (Whittemore and Knafl, 2005).

The next step in data analysis was data display using graphs or charts, which involves converting the extracted data from individual sources into a display that assembles the data from multiple primary sources around particular variables (Whittemore & Knafl, 2005). The data were conceptualized at higher levels of abstraction from each primary source that resulted in the grouping of extracted variables into themes that represent a comprehensive portrayal of the current evidence related to the effectiveness of PA interventions in primary care settings (See Figure 2).
In general, the final phase of data analysis is conclusion drawing that can comprehensively portray the topic of concern, completing the review process (Whittemore & Knafl, 2005).

Final Presentation Stage

Conclusions of an integrative literature review can be reported in tables or other diagrammatic forms (Whitemore & Knafl, 2005). The PA interventions’ effectiveness appraisal checklist and the brief PA interventions in primary care evidence based recommendations list will be presented as a result of this integrative literature review. This will represent a new way of thinking about the topic of the effectiveness of PA interventions. The formation of a new way of thinking about the topic is one of the forms of synthesis of data of integrative literature reviews as discussed by Torraco (2005); it is also known as an “alternative model or conceptual framework” (p. 363). In summary, the final presentation phase of an integrative literature review culminates in a contribution to a new understanding of the phenomenon of concern, implication for practice and research, and the statement of methodological limitations of the review (Whittemore & Knafl, 2005).
Summary

This chapter has elaborated on the five stages of the integrative literature review process such as problem identification, literature search, data evaluation, data analysis, and presentation. These stages were adapted from Whittemore and Knafl (2005). During the preliminary search of literature, this author identified the problem of the lack of evidence related to the effectiveness of PA interventions in primary care settings. During a preliminary search, important search terms as well as inclusion/exclusion criteria were formulated. The focused literature search was conducted using comprehensive computerized databases search, ancestry and descendancy searching, and hand searching. This resulted in empirical, non-empirical, and theoretical data acquisition. These data were analyzed and synthesized into a new evidence-based comprehensive understanding of the evidence related to the effectiveness PA interventions in primary care settings, implications for practice, and the background chapter.

In general, integrative literature reviews have the potential to present a comprehensive understanding of problems relevant to health care (Whittemore & Knafl, 2005). Integrative reviews include diverse data sources which enhance a holistic understanding of the topic of interest while portraying the complexity inherent in all health care problems (Whittemore & Knafl, 2005). The findings chapter of this integrative literature review will discuss in detail the content of the themes related to the effectiveness of primary care interventions suitable for primary care settings.
CHAPTER 3

Findings

This integrative literature review seeks to explore the current evidence on the effectiveness of PA interventions conducted in primary care settings by primary care providers to increase PA levels in Canadian population. Following a comprehensive search of the research literature, 13 key articles were selected and included in this review. Through an analysis of the literature, six major themes were identified, including effectiveness and intensity, intervention components, theoretical models as a component of interventions, characteristics of patients and providers, number needed to treat, and Canadian standardized/designed by experts brief PA interventions. These themes organize the presentation of findings and guide the discussion of this review.

Effectiveness and Intensity

The findings regarding the effectiveness of PA interventions and the intensity of these interventions were synthesized from five high-quality systematic reviews with meta-analyses (Campbell et al., 2012; Conn et al., 2011; Foster et al., 2005; Lin et al., 2010; Orrow et al., 2012;), and three systematic reviews (Sanchez, A., Bully, P., Martinez, C., & Grandes, 2015; Sørensen et al., 2006; Tulloch et al., 2006). The effectiveness of PA interventions in these studies were reported as an effect size of the most common in analyzed RCTs outcome measure that are the self-reported PA levels as steps per day and/or minutes per week. The intensity of interventions in these studies was understood in terms of the duration of the intervention in minutes or in terms of the use of additional materials or effort to brief PA interventions.

Campbell et al. (2012) in their systematic review with meta-analysis of RCTs regarding the effectiveness of PA interventions and the following meta-synthesis of qualitative and quantitative studies in adults 19 to 65 compared a brief PA intervention and usual care. Although, qualitative studies
also included quantitative survey data (Campbell et al., 2012). Qualitative studies were focused on barriers and facilitators, and of structural factors affecting effectiveness of PA interventions.

One of the main strengths of Campbell et al. (2012) study, was the large scope of literature covered. This high quality study was conducted to update and replace National Institute for Health and Care Excellence (NICE) 2006 guidelines on PA interventions in primary care. Moreover, NICE recommendations based on Campbell et al. (2012) are current (NICE, 2016). NICE (2016), based on Campbell et al. (2012) study, recommended screening all adults for physical inactivity, and offering a brief PA intervention for all physically inactive adults in primary care settings considering their personal circumstances with a 6 to 12 months follow up period. Most importantly, Campbell et al. (2006) study presented evidence on PA interventions’ components, which have not been adequately presented in earlier studies to draw any recommendations. For instance, this evidence was related to the length of PA interventions, the evidence on support materials, and the evidence to suggesting primary care providers to consider delivering more preventative brief PA intervention, as well as ensuring that patients were aware of both the benefits of PA and the current recommended levels. One of the main limitations of Campbell et al. (2012) study was the heterogeneity of the effectiveness studies examined in their meta-analysis. Despite meta-analytical effort and the desire to come to the most unbiased conclusion about the effectiveness, Campbell et al. (2012) felt it was useful to present so that readers could have an opportunity to draw their own conclusions. Nevertheless, the impact of heterogeneity was reduced with statistical methods.

Campbell et al. (2012) classed interventions as ‘brief’ if they were < 20 minutes in duration. Of note, “brief” PA intervention in other literature was also named as “low intensity”; therefore, “brief” and “low intensity” will be used interchangeably meaning that these interventions < 20-30 minutes in duration of a primary care provider-patient contact. Very brief interventions were defined as interventions that were < 5 minutes (Campbell et al., 2012). PA interventions had to comprise primary
care providers’ verbal advice, discussion, negotiation or encouragement, with or without written or other support or follow-up in primary care settings (Campbell et al., 2012). Campbell et al. (2012) defined the “usual care” as no intervention in the control group.

Meta-analysis of eight RCTs that reported continuous measures (i.e., self-reported PA) showed a statistically significant effect size favoring brief advice over usual care (standardized mean difference [SMD] 0.17 (95% CI 0.06 to 0.28) $I^2$ 69%) (Campbell et al., 2012). Meta-analysis of another nine RTCs with the dichotomous variable (i.e., meeting internationally recommended exercise levels or not) had a positive effect favoring brief advice over usual care (RR 1.30 (95% CI 1.12 to 1.50) $I^2$ 66%) (Campbell et al., 2012). The considerable heterogeneity in these nine RCTs may reflect the duration of follow up which varied from 4-6 weeks to 12 months (Campbell et al., 2012). Of note, the $I^2$ test quantifies inconsistencies across studies and gives an indication of the impact of heterogeneity on the meta-analysis (Higgins et al., 2011). A rough guide to interpretation of $I^2$ was suggested by Higgins et al. (2011) where 0% to 40% might not be important, 30% to 60% may represent moderate heterogeneity, 0% to 90% may represent substantial heterogeneity, and 75% to 100% considerable heterogeneity.

Campbell et al (2012) also explored the evidence on brief and very brief PA interventions (< 5 min). In particular, Campbell et al (2012) meta-analysis of four RCTs determined no statistical significance between the intervention groups of very brief PA interventions. In particular, very brief PA interventions did not increase self-reported levels of PA (SMD 0.24 (95 % CI -0.04, 0.51) $I^2$ 42%), nor increased a proportion of meeting recommended PA levels RR 1.30 (95% CI 0.99 to 1.72) $I^2$ 86%). In contrast, Campbell et al. (2012) found evidence from five RCTs that interventions of five minutes or longer (up to 20 minutes) were effective in increasing self-reported levels of PA (SMD 0.16 (95% CI 0.04 to 0.27) $I^2$ 78%, and the proportion meeting recommended PA levels RR 1.34 (95% CI 1.19 to 1.52) $I^2$ 84%). However, there was no evidence directly comparing brief versus very brief interventions, and overall the evidence regarding very brief interventions was inconclusive (Campbell et al., 2012).
The intensity was also understood as the use of additional materials or effort to a brief PA intervention. In this regards Campbell et al. (2012) has conducted a meta-analysis of five RCTs to compare a brief PA intervention and more intensive interventions ‘fortified’ by the additional use of behavioral counselling, additional written educational materials, vouchers, and methods of feedback. As a result, Campbell et al (2012) determined that there was no statistically significant difference between those receiving the brief PA intervention with these additional components over those receiving brief PA interventions alone in two self-reported PA data RCTs ((SMD 1.88 (95% CI -1.63 to 5.39)). This was also confirmed in two dichotomous data RCTs with no additional benefit of more intense interventions over brief advice ((RR 1.19 (95% CI 0.9 to 1.49) I^2 0%)) (Campbell et al., 2012). Specifically for educational material or health education about PA benefits provided by primary care providers, Conn et al. (2011) meta-analysis determined that provision of such information alone or in addition to a brief primary care PA intervention did not increase the effect size.

Campbell et al. (2012) findings were confirmed by Orrow et al. (2012) study, with a resultant statistically significant positive effect size of brief PA interventions. Furthermore, Orrow et al. (2012) suggested that briefer interventions “might achieve effects that are similar to those of more intensive interventions” (p. 5). This agrees with Campbell et al. (2012) conclusions that the addition of extra components to brief PA intervention did not show additional benefit.

The systematic review with meta-analysis of RCTs by Orrow et al. (2012) included 15 RCTs (n=8745) involving adults recruited in primary care, with minimum follow-up of 12 months. Most interventions were brief (i.e., < 30 min), verbal, person-to-person and delivered by primary care providers.

The Orrow et al. (2012) high-quality study had important strong points. It was the only study known to the authors and the only study presented in this literature review, that meta-analyzed the effectiveness of PA interventions over at least 12 months. Most studied PA interventions were delivered
in the primary care setting by primary care providers. The evidence analyzed took place in OECD countries with broadly comparable primary care services, enhancing the generalizability of the findings to these settings. Orrow et al. (2012) reduced the risk of bias by including only RCTs. There were also some limitations of Orrow et al. (2012) study that could introduce bias leading to overestimating and/or underestimating the effect size of the PA interventions from two third of RCTs reviewed.

Underestimation of the effect size could occur with incomplete outcome data reported in RCTs when, for example, a proportion of intervention participants could leave the study because they have increased their PA levels. The overestimation of the effect size could occur when participants in the included RCTs could have been more motivated to increase their PA than the primary care populations from which they were recruited. There were also RCTs with non-parametric data that did not require normal distribution which could affect the effect size results. However, the removal of that data from the meta-analysis retained statistical significance suggesting that retaining of non-parametric data in the main analysis, at worst, led to the underestimation of the pooled effect size. In addition, the PA interventions’ components in RCTs were poorly referenced that did not facilitate interpretations about the effective components of interventions. Most RCTs’ participants were Caucasians, and socioeconomic characteristics were poorly reported; therefore, it was not possible to make any conclusion regarding the applicability of Orrow et al. (2012) study to adults with different ethnic, social, and economic characteristics. Finally, despite a systematic search of literature with different search methods, Orrow et al. (2012) review had only one reviewer who screened titles and abstracts. This could have introduced publication bias by missing relevant papers. However, there was another independent expert who did not identify any additional studies (Orrow et al., 2012).

In 13 RCTs presenting self-reported PA versus no intervention, Orrow et al. (2012) determined small to medium positive intervention effects at 12 months (odds ratio 1.42, 95% CI 1.17 to 1.73; SMD 0.25, 0.11 to 0.38). Pooled meta-analysis of these 13 RCTs showed small to medium effects for
dichotomous data (odds ratio 1.42 (95% confidence interval 1.17 to 1.73); $I^2=43\%$ (0% to 70%); and for continuous data (SMD 0.25 (0.11 to 0.38); $I^2=70\%$ (27% to 83%)) (Orrow et al., 2012). The wide confidence intervals for $I^2$ indicated uncertainty about the true degree of heterogeneity (Orrow et al., 2012).

In addition, three RCTs of community exercise referral programs initiated by primary care providers without the provision of a verbal PA intervention through pooled meta-analysis showed small, non-significant effects on self-reported PA at 12 months (odds ratio 1.38 (95% CI 0.98 to 1.95), $I^2=0\%$ (0% to 73%); SMD 0.20 (-0.21 to 0.61), $I^2=76\%$) (Orrow et al., 2012). The exercise referral programs are interventions that are mainly performed by a third-party service provider and may include supervised exercise training such as referrals to gym (Orrow et al., 2012).

Another high quality large systematic review with meta-analysis of RCTs conducted by Conn et al. (2011), that computed results from 99011 adult participants with minimum 6 months follow-up data, confirmed a positive effect size of primary care PA intervention versus a control group with no intervention (estimated mean effect size 0.19, 95% CI 0.15 to 0.23; $I^2 = 52\%$). Conn et al. (2011) analyzed 358 RCTs by using random-effects analyses to synthesize data, and by using meta-analytic analogues of regression and analysis of variance to examine potential moderator variables. Conn et al. (2011) also explored moderator variable robustness and publication bias. These were the strengths of this study that meta-analyzed the effectiveness of multiple PA interventions’ components. The limitations of Conn et al. (2011) study were related to heterogeneity of the meta-analyzed studies and their varied quality. Treatment fidelity and allocation concealment—the quality aspects of the RCTs analyzed by Conn et al. (2012), were poorly reported and were not included in the moderator analyses. Though, heterogeneity, varied quality of RCTs, not-inclusion of the quality aspects of RCTs into meta-analysis could affect the overall or pooled effect size, but had no effect on the moderator analyses that were related to the comparison of different PA interventions’ components. The overall effect size of PA
was well presented by other high quality studies in this literature review, but Conn et al. (2011) study had the most comprehensive moderator analysis.

Lin et al. (2010) meta-analysis of the intensity of the PA interventions in 30 RCTs seemed to show that more intensive interventions (>30 min) have a greater impact at 6 to 12 months on the overall aggregated effect on PA level (SMD, 0.19 [95% CI, 0.12 to 0.27]; $I^2=49.9\%$; $k=17$; $N=6,808$). However, out of 11 RCTs regarding low-intensity PA interventions only four RCTs showed a benefit assisting Lin at al., (2012) to suggest that some low-intensity interventions might be effective. To avoid a type I error or overestimation of effect size a sensitivity analysis was conducted. It showed that the methods for calculating missing data for the meta-analyses in Lin et al. (2010) likely had little effect on overall results, and this effect was attenuated by effect size. In addition, the sensitivity analyses, for the same purpose, excluding small studies with large effects, still demonstrated a positive effect of PA interventions. Therefore, these were the reliable estimates that also in line with estimates of the pooled effect size of PA interventions reported by other high quality studies used for this integrative literature review. Nevertheless, Lin et al. (2010) study had not analyzed effective components of PA interventions except their intensity. In addition, low intensity interventions with different PA interventions components such as single face-to-face session and a session by mail alone were grouped together without differentiating them as different components that could differently affect the effect size. No effectiveness comparison between these components was also conducted. This also represented a weaker conceptualization of the PA interventions’ effectiveness than the themes’ conceptualization of this literature review that further be presented in the recommendations. However, Lin et al. (2010) mentioned that they were not able to extract data about different components of PA interventions to analyze due to the lack of the reported data. This could reflect the quality of earlier RCTs.

Lin at al., (2010) systematic review with meta-analysis was a study to upgrade US Preventive Services Task Force (USPSTF) physical activity 2002 counseling recommendations for primary care
settings. Updating the 2002 PA review, Lin et al., (2010) found evidence that contrasted with the results of the prior review, based on 28 new RCTs and two RCTs from 2002 review towards recommending PA interventions in primary care. This represented an important trend that newer RCTs had better design reporting, at least, the intensity of PA interventions. However, in Lin et al. (2010) study higher intensity PA interventions were mainly carried out by specialized professionals such as trained health educators, counselors, psychologists, exercise instructors, and physiologists excluding primary care providers limiting generalizability to primary care settings. Therefore, results of Lin et al., (2010) study has to be taken carefully when considering applicability to primary care settings. Moreover, these specialists are not a first point of contact with health care, require additional appointments, referrals, waiting and travel time, and, as noted by Campbell et al. (2012), could be unaffordable for many patients. Besides, Lin et al. (2012) noted that many of the high-intensity PA interventions RCTs required resources that were not covered by healthcare system.

Similar to Lin et al. (2010) conclusions, Tulloch et al. (2006) also pointed toward a higher effect size with more intensive interventions when primary care providers’ led interventions were longer and had multiple follow-up contacts, and when multiple intervention components were introduced. However, these findings related to more intensive interventions imply similar accessibility and applicability issues. The study included 19 RCTs out of which 7 involved primary care providers, 5 involved combined interventions with primary care providers and other health professionals such as psychologists, and 7 involved other health professionals. The association between PA interventions’ components and their effectiveness was not even conceptualizes, except for the intensity. The major limitation of this study was that it conducted descriptive summary of outcomes, and there was no information about how it was done.

Although, Sørensen et al. (2006) found little evidence to support higher effect size with more intensive PA interventions. The strength of Sørensen et al. (2006) study was an attempt to describe the
effectiveness components of PA interventions such as their intensity and PA prescription. Sørensen et al. (2006) conducted just a descriptive summary of outcomes and a pooled effect size. The major limitations of this study were the lack of information how the authors came up to the summary of outcomes and pooled effect size; there was lack of information on the quality of RCTs analyzed; many primary care providers in RCTs were volunteers with a positive attitude; only some RCTs had a random sample of primary care providers; patients’ acceptance of PA interventions was high. Therefore, it is difficult to generalize the results to primary care providers and their patients. However, PA prescription evidence from Sørensen et al. (2006) study is confirmed by other higher quality studies of this literature review.

Due to increasing quality of RCTs, the earlier average-quality reviews of by Tulloch et al. (2006) and Sørensen et al. (2006) were one of the first studies that described a positive effect size for PA interventions, both in the short (<6 months) and medium term (>6 months) for adults in primary care. This was a turning point in changing the recommendations toward including PA interventions into primary care settings.

Foster et al. (2005) conducted a Cochrane systematic review meta-analyzing 19 RCTs with 6-12 months follow-up (n =7598; adults) with the resultant positive and moderate effect size (pooled SMD random effects model 0.28 95% CI 0.15 to 0.41) of PA interventions in primary care of self-reported PA levels. Therefore, the authors concluded that PA interventions have a positive moderate sized effect on increasing self-reported PA levels at least at 12 months. This early high quality study attempted to investigate the effectiveness characteristics such as the intensity of PA interventions and their components. Mass media interventions were excluded. The interventions were compared with a no intervention control, attention control (receiving attention matched to length of intervention, e.g. general health check) and/or minimal intervention control group. The 19 RCTs included different types of PA interventions such as one-to-one or group, self-directed or prescribed by primary care practitioner,
supervised or unsupervised, home or facility-based, ongoing face-to-face support, telephone support, written education material, and self-monitoring. PA interventions were conducted alone by primary care providers or in combination with nurse, health educator, counsellor, exercise leader or peer. This represented a marked heterogeneity of the studies with limited reported data to run a moderator variables analysis. Therefore, any conclusions drawn Foster et al. (2005) study in regards of PA interventions’ components requires some caution.

Finally, recent systematic review by Sanchez et al. (2015) has confirmed that PA interventions in primary care have a significant positive effect size in favor of PA interventions to increase PA levels and to meet the recommended PA levels (SMD range: 0.17–0.28; RR/OR range: 1.22–1.42). The strength of this study was that it included in the analysis only high quality research (n=11) available for the past 15 years. Sanchez et al. (2015) review included three groundbreaking studies (Campbell et al., 2012; Conn et al., 2011; Orrow et al., 2012) in the area of the effectiveness of PA interventions in primary care settings. This provided some assurance to a possible publication bias of this integrative literature review. In addition, Sanchez et al. (2015) emphasized that the high-quality research related to the effectiveness was limited, but had grown for the past ten years to form a better conceptualization of the effectiveness of PA interventions. Therefore, Sanchez et al. (2015) study suggested important implications for future research. Nevertheless, the main limitation of Sanchez et al. (2015) study was that it provided the descriptive summary of outcomes with no meta-analysis. There was also no new knowledge added from high quality studies related to subgroup analyses of PA interventions’ components. The next section of findings will discuss the components of PA interventions related to their effectiveness.

**Components of Physical Activity Interventions**

Three high quality systematic reviews with meta-analysis conducted subgroup analyses regarding the association between PA interventions’ components and their effectiveness (Conn et al., 2011; Campbell et al., 2012; Foster et al., 2005). In addition, two systematic reviews were able to make
conclusion on one component of PA intervention—a PA prescription (Sørensen et al., 2006; Tulloch et al., 2006).

Sørensen et al. (2006) review of 12 RCTs concluded that the level of PA was significantly increased when a brief PA intervention conducted by primary care providers included PA prescription. This was confirmed also by Tulloch et al. (2006) review. Further, these findings were confirmed by three high quality meta-analyses (Campbell et al., 2012; Conn et al., 2011; Foster et al., 2005). For instance, Conn et al. (2011) robust meta-analysis showed that the studies including PA prescription reported larger effect sizes for PA (0.30) than did studies without prescription (0.17).

In Foster et al. (2005) review, the authors examined a potential modification of effects depending on particular participant groups or the following five categories of interventions: the nature of the first patient-intervention contact, degree of program supervision, frequency of intervention occasions, frequency of follow-up contacts, and type of follow-up contacts. Foster et al. (2005) described the nature of the initial patient-intervention contact as “the nature of direction” (p. 15). Foster et al. (2005) found three types of PA intervention: (1) self-directed only - where the participant is not directed in their choices and thinking about which physical activities to start by primary care provider; (2) self-directed plus professional guidance - where the participant can make a decision about their PA using a mixture of both self-direction and professional advice and guidance; and (3) prescribed by primary care provider only - the participant receives the advice and prescription of PA from the primary care provider. Due to the clinical and statistical heterogeneity of the studies, only limited conclusions could be drawn about these secondary analyses (Foster et al., 2005). Regarding intervention characteristics, results seemed to be more favorable when PA was self-directed with some professional guidance, PA was prescribed, and when there was on-going professional support (Foster et al., 2005).

Further exploring PA interventions’ components, Campbell et al. (2012) determined “top five” most common behavior change techniques in PA brief interventions as being used in over 50% of the
studies included (p. 184). These techniques were extracted from 19 RTCs and were included in meta-synthesis with recommendations around the links to these techniques and brief PA intervention in primary care. These behavioral techniques were prompt intention formation (74%), provision of information on consequences (68%), provision of general information on behavior-health link (68%), the use of follow up prompts (58%), and the use of prompt specific goal setting (53%)

Campbell et al. (2012) was not able to conduct an analysis of the association between “top five” most common behavior change techniques and effectiveness. There was, however, some evidence based on 3 RCTs that interventions which included prompt specific goal setting as a component of the intervention were associated with short term increases in PA (Campbell et al., 2012). Campbell et al. (2012) based on 10 RCTs suggested that more evidence needed to conclude which was the most effective type of PA goals that was either personal based or the use nationally recommended guidelines (Campbell et al., 2012). However, based on the effective “nature of direction” of PA interventions (Foster et al., 2015) the PA goals should be personalized while using nationally recommended guidelines. There was also a lack of evidence based on 13 RCTs around what information had to be provided when ‘providing general information on behavior links’ technique was used (Campbell et al., 2012). There was also a lack of evidence based on 13 RCTs around the type of information should be provided to participants when using ‘consequences’ technique (Campbell et al., 2012).

The large good quality systematic review with meta-analysis by Conn et al. (2011) presented meta-analytic findings on various moderator variables associated with greater effect size of self-reported PA levels presented in RCTs that studied brief PA interventions in primary care. Conn et al. (2011) reported a greater statistically significant effect size for PA interventions that were based exclusively on behavioral strategies (0.25) versus cognitive strategies (0.17). Behavioral strategies that showed greater effect size than cognitive included: goal setting, self-monitoring, PA behavior feedback, rewards, self-rewards, consequences, exercise prescription, contracting and cues (Conn et al., 2011). Cognitive
strategies included decision making, health education, and providing information (Conn et al., 2011). The joint moderator analyses of meta-analysis confirmed that the superiority of behavioral approaches was a robust finding, this was one of the strengths of this study (Conn et al., 2011).

Larger PA effect sizes were associated with interventions delivered directly to individuals face-to-face (0.29) versus mediated delivery of interventions (e.g., mail, phone, e-mail), mass-media mediated approaches (0.08), and community-wide interventions targeting entire communities, worksites, or ambulatory health care settings (0.09) (Conn et al., 2011). Conn et al. (2011) suggested that patients’ attention to the message could be higher in individually delivered face-to-face interventions, making the message seem more important to recipients. Besides, behavioral interventions such as PA interventions could be easier to deliver in individual face-to-face encounters (Conn et al., 2012). In addition, Conn et al. (2011) meta-analysis resulted in higher effect size in standardized/designe d by experts interventions (0.20) versus individually tailored interventions (0.04). These were the robust meta-analytical findings.

Theoretical Models as a Component of Interventions

Two large systematic reviews with meta-analyses (Campbell et al., 2012; Conn et al., 2011) and one systematic review (Bully, Sanchez, Zabaleta-del-Olmo, Pombo, and Grandes, 2015) have been selected in this review for the synthesis of information regarding the effectiveness of the theoretical models when included in primary care PA interventions design.

Bully et al. (2015) systematic review analyzed the effectiveness of theoretical models when included as components in the design of PA intervention in primary care by primary care providers to increase PA levels in adults. Bully et al. (2015) also analyzed the effectiveness of theories related to the interventions on diet, alcohol and tobacco in primary care settings. Bully et al. (2015) included only 30 good quality articles—26 were RCTs, three systematic reviews, and one observational study. Bully et al. (2015) study strength was in the rigor of conducting their systematic review that was carried out in accordance with the PRISMA declaration (Moher, Liberati, Tetzlaff, & Altman, 2009). The limitations
of Bully et al. (2015) study were related to the lack of information reported by analyzed studies. For example, this deficit related to reporting confounding factors, details related to randomization and blinding methods, or data collection procedures. In addition, in most of the studies, the outcomes measured were vaguely defined and self-reported, using heterogeneous instruments and methods to record data; therefore, the precision with which data were recorded could differ between studies. Finally, the heterogeneity of the interventions and the outcome measures influenced the authors’ decision against conducting a meta-analysis. Nonetheless, Bully et al. (2015) concluded that even without the meta-analysis there was sufficient evidence to provide knowledge and recommendations about the effectiveness of theoretical models when included in PA interventions as well in other interventions.

The most common theoretical models used in the RCTs meta-analyzed by Campbell et al. (2012) and Conn et al. (2011) were the Trans-theoretical model (TTM), namely, Stage of Change (SoC) and Social Cognitive Theory (SCT). The most recent systematic review by Bully et al. (2015) reported that among the theoretical models studied, TTM has been applied most often in recent years. Namely, only one component of the TTM, the "stages of change" had been used in the majority of RCTs reviewed, whereas interventions based on the TTM would be expected to include attempts to change self-efficacy and decisional balance via the processes of change (Bully et al., 2015; Campbell et al., 2012; Conn et al., 2011). The latter usually required a specially trained personal such as psychologists and multiple, longer than 30 minutes visits (Campbell et al., 2012). Similarly, SCT methods would require specially trained personal and extended longer visits to explore and help a patient to change both internal factors that were habits, motivations and goals, beliefs about capabilities (i.e., self-efficacy), knowledge and external factors that were social support and environmental influences (Bully et al., 2015; Campbell et al., 2012; Conn et al., 2011). Other theories such as Theory of Planned Behavior (TPB) and Health Belief Model (HBM) were reported too infrequently for the analyses (Campbell et al., 2012; Conn et al., 2011). At the
same time, Bully et al. (2015) in their systematic review found no evidence to establish the effectiveness of components of PA interventions based on TPB and/or HBM.

Conn et al. (2011) meta-analytical results showed that RCTs that did not use SCT reported significantly larger effect size (0.20) than did studies that used SCT (0.12). Studies without the TTM model reported larger effect size (0.21) than did studies with the model (0.15) (Conn et al., 2011). These findings that showed better outcomes among studies without SCT or TTM were robust in the joint moderator analyses (Conn et al., 2011). A comparison of effect size between RCTs using both SCT and TTM models did not reveal a statistically significant difference as well (Conn et al., 2011). Conn et al., (2011) after conducting multiple-degree of freedom analyses documented the largest effect size for RCTs that did not use SCT and/or TTM (0.23). Conn et al. (2011) concluded that this pattern of findings suggested that SCT was more detrimental to effect-size values than was the TTM. Campbell et al. (2012) systematic review with meta-analysis confirmed Conn et al. (2011) conclusions on detrimental effects of SCT and TTM in PA interventions and no clear evidence regarding the role of theories in designing effective PA interventions was found. Similarly, the limited scientific evidence of the effectiveness of theoretical models in primary care interventions was also reported in regards of other behavioral health risks such as poor diet, excessive alcohol and tobacco use (Bully et al., 2015).

**Characteristics of Patients and Providers**

The association between patient and provider characteristics and the effectiveness of PA interventions was synthesized from four systematic reviews with meta-analysis (Conn et al., 2011; Campbell et al., 2012; Lin et al., 2010; Foster et al., 2005) and two systematic reviews (Sanchez et al., 2015; Tulloch et al., 2006).

There was no strong statistical and meta-analytical evidence with respect to the association between patient characteristics (i.e., sex, race, baseline BMI, chronic conditions) and effectiveness of
PA interventions (Conn et al., 2011; Campbell et al., 2012; Lin et al., 2010; Foster et al., 2005; Sanchez et al., 2015).

Nevertheless, Campbell et al. (2012), based on two RCTs, suggested that the effectiveness of PA intervention was affected by patients’ current level of activity, where more active patients were more likely to comply with brief PA intervention than those who were categorized as insufficiently active or inactive (p<0.001). Based on four RCTs Campbell et al. (2012) suggested that PA intervention effectiveness was affected by patients’ ability to recall and understanding of PA advice. Campbell et al. (2012) qualitative meta-synthesis portion of their systematic review with meta-analysis, based on 3 qualitative studies, showed that patients felt they needed to receive more preventative advice (i.e., improve or increase PA levels) than advice linked to a presenting condition related to weight reduction, cardiac conditions or mobility issues. Campbell et al. (2012) analysis also suggested that patients were less receptive to brief PA intervention if they were unaware of PA recommendations. There was moderate evidence from five RCTs suggesting that brief PA interventions were less effective in increasing self-reported levels of PA amongst economically disadvantaged populations. Conn et al. (2012) systematic review and meta-analysis determined that the positive effect size of self-reported PA levels from the RCTs of healthy adults was smaller than the effect size reported for chronically ill adults. This can represent that patients with chronic conditions are more willing to engage in PA than healthy adults.

With the respect to primary care providers characteristics associated with the effectiveness of PA interventions Tulloch et al. (2006) review of 23 RCTs examined factors related to the type and appropriateness of the specific PA intervention provider. Tulloch et al. (2006) examined primary care providers and other health professionals such as health educators, exercise development officers, exercise physiologists, exercise specialists, exercise consultants, and dieticians/nutritionists. Tulloch et al. (2006) concluded that the effectiveness of PA interventions depended not on who performed the
intervention (i.e., primary care providers or other health professionals), but rather on the intensity of the intervention and the qualification and training of the intervention agent. It is out of scope of this literature review to discuss various types of training, but recommendations for education will be presented later in this review that relate to the findings. It is also important to understand that higher effectiveness (i.e., increased levels of PA) does not imply that different providers are equally accessible and/or affordable by patients, or covered by Canadian health care system. In addition, Tulloch et al. (2006) noted that the reviewed RCTs reported statistically significant positive effect size of PA interventions for both intervention agents—either primary care providers alone and/or other health professionals. Most importantly, this implies that the differences between primary care providers such as family NPs or family physicians should not affect the effectiveness of PA interventions.

Finally, a systematic review with meta-analysis and meta-synthesis by Campbell et al. (2012) reported primary care provider characteristics that could affect the effectiveness of PA interventions. In particular, based on two qualitative and three quantitative studies Campbell et al. (2012) suggested that perceived patient characteristics affect a primary care provider’s decision to discuss and/or prescribe PA. Campbell et al. (2012) noted that perceptions of a patient being overweight or having a high BMI were likely to increase delivery of PA intervention. These were stronger predictors of providing brief PA intervention than the actual level of PA (Campbell et al., 2012). Based on the evidence from eight qualitative and 10 quantitative studies Campbell et al. (2012) concluded that perceived likely uptake of advice, motivation to change, and receptiveness of patients affect primary care providers’ decision to discuss and/or prescribe PA that increased the effectiveness of PA interventions indirectly as they were offered more frequently in this case. Based on five qualitative and three quantitative studies Campbell et al. (2012) suggested that primary care providers behavior was influenced by perceived evidence for effectiveness of PA advice, as well as the perceived effectiveness of PA to improve health. Primary care providers who believed that PA would improve health were more likely to deliver brief PA intervention
Meta-synthesis of nine qualitative and nine quantitative studies conducted by Campbell et al. (2012) resulted in findings that primary care providers’ confidence and knowledge (including the need for further training/support) affected their ability to discuss and/or prescribe PA. Greater primary care provider confidence/knowledge, created through better training, increased the likelihood of delivery of brief PA intervention (Campbell et al., 2012). Meta-synthesis of nine qualitative, nine quantitative studies and one mixed methods conducted by Campbell et al. (2012) resulted in findings that primary care providers considered that time resources and conflicting priorities affected their ability to discuss and/or prescribe PA. Time acts as a “proxy” for related factors such as increased workload, resulting in conflicting priorities and a need to choose between PA intervention delivery and other factors that may be seen as more central to the primary care provider role (Campbell et al., 2012, p. 29). Time resources and conflicting priorities can indirectly influence effectiveness of PA intervention in a population-wide scale, as they can be offered less frequently (Campbell et al., 2012). Meta-synthesis of two qualitative and eight quantitative studies done by Campbell et al. (2012) resulted in findings that primary care provider willingness to discuss and/or prescribe PA could be influenced by their own activity level. More active primary care providers were more likely to provide brief PA advice (Campbell et al., 2012). Based on two qualitative and four quantitative studies Campbell et al. (2012) suggested that practitioner willingness to discuss and/or prescribe PA was influenced by whether they perceived this activity to be within their remit/role. Those who saw PA promotion as within their role were more likely to provide brief PA intervention (Campbell et al., 2012). Based on eleven qualitative and seven quantitative studies Campbell et al. (2012) suggested that primary care providers were more willing to discuss and/or prescribe PA where this was linked to the presenting condition, rather than as a preventative measure that was to provide curative rather than preventative advice. This can also influence PA intervention effectiveness as it can be offered less as a preventative advice. Campbell et al. (2012) meta-synthesis of three qualitative studies resulted in suggestion that how patients perceived the
role of primary care providers in promoting PA was dependent upon the appearance of the primary care provider, as well as the characteristics of the patient. In particular, patients with 13+ years of education were more likely to comply with exercise recommendations if the primary care provider had BMI between 19 to 24, who exercised, was a non-smoker, negotiated exercise programs, counseled patients, involved experts, and was the patients’ regular primary care provider (Campbell et al., 2012). Patients with higher incomes (20K +) were more influenced by the primary care provider with BMI between 19 to 24, who exercised, was a non-smoker, and referred to experts (Campbell et al., 2012). Female patients were more compliant with a well-groomed primary care provider, well dressed, and who could be contacted any time, and who listened (Campbell et al., 2012). Finally, patients who exercised themselves (p<0.05) believed that their primary care providers’ weight was influential in advice adherence when compared to non-exercising patients (Campbell et al., 2012).

**Number Needed to Treat**

The number needed to treat (NNT) data for brief PA interventions in primary care (30 min or less of a contact with a provider) was synthesized from two high-quality meta-analyses by Orrow et al. (2012) and Lin et al (2010). Brief PA interventions are more appropriate to primary care settings than longer PA interventions (Conn et al., 2011; Campbell et al., 2012; Lin et al., 2010; Foster et al., 2005; Sanchez et al., 2015); therefore NNT is presented for brief PA interventions.

The systematic review and meta-analysis of RCTs by Orrow et al. (2012) calculated the NNT for one additional sedentary adult to meet internationally recognized PA recommendations with 95% confidence intervals. Orrow et al. (2012) used the formula \[ \frac{\text{control event rate} - \text{CER} \times (\text{odds ratio} - 1) + 1}{\text{CER} \times (1 - \text{CER})} \] and the pooled odds ratio for nine RCTs in which this outcome was reported. The NNT with a brief intervention of PA promotion, compared with any control, for one additional sedentary adult to report meeting internationally recommended levels of PA at 12 months was
12 (95% confidence interval 7 to 33), based on the pooled odds ratio for the nine studies that reported this outcome.

Lin et al. (2010) reported NNT for brief interventions (<30 min) conducted by primary care providers for adults in primary care settings. Lin et al. (2010) analyzed three RTCs (n = 6, 288) reporting sufficient data to be included in the meta-analysis. This analysis showed that those in the intervention groups were 25 percent more likely to meet international PA recommendations at 6- to 12-month follow up than those in the control groups (pooled risk ratio [RR], 1.25 [95% CI, 1.11 to 1.41]; I²=0.0%; n=4,289). This represented an absolute risk difference of four percentage points, which translated to a number needed to treat of 25 for one additional person to meet PA guidelines. Therefore, brief PA interventions’ NNT for one additional insufficiently active adult to meet internationally recognized PA recommendations ranged from 12 to 25 (Lin et al., 2010; Orrow et al., 2012).

Lin et al. (2010) study also determined that participants in more intensive interventions (i.e., > 30 min) interventions had a 22 percent greater chance of meeting PA guidelines after 6 to 12 months, compared with control participants (pooled RR, 1.22 [95% CI, 1.07 to 1.40]; I²=59.0%; k=6; N=4,183). This difference translated to an absolute risk difference of seven percentage points and a number-needed-to-treat of 14 to 15 for one additional person to meet physical activity guidelines. However, more intensive PA interventions in the RCTs, analyzed by Lin et al. (2010), were conducted not by primary care providers, but by specially trained personal. The meta-analytical rigor of NNT for PA interventions was in favor of Orrow et al. (2012) study compared to Lin et al. (2010) study. However, these were both high quality studies; therefore, both values of NNT were relevant and sufficiently robust to include in the recommendations of this review. Besides, Orrow et al. (2012) calculations of NNT were included as highly important and relevant in the latest Canadian Academy of Sport and Exercise Medicine position statement related to the recommendations of PA interventions for Canadian primary care providers (Thornton et al., 2016).
Standardized/Designed by Experts Interventions

The literature search in this integrative literature review resulted in identifying two standardized/designed by experts PA interventions available for primary care providers in Canada that are Physician based Assessment and Counselling for Exercise (PACE) Canada and Exercise is Medicine Canada (EIMC) Exercise Prescription and Referral (EPR) Tool (EIMC, 2015; PACE Canada, 2015). Standardized/designed by experts interventions is one of the central effectiveness characteristics of this study (Conn et al., 2011; Campbell et al., 2012; Orrow et al., 2012). These two standardized/designed by experts PA interventions will be evaluated for their effectiveness based on the findings of this literature review.

PACE Canada includes both a Tool Kit and Counseling Guide and is the Canadian adaptation of PACE that started in 1990 in San Diego State University. PACE Canada was launched at the Family Medicine Forum in 2000. It is also available in Japan, The Czech Republic, Portugal, The Netherlands, Russia and Brazil. A PACE Canada Online Training is available for primary care providers.

PACE Canada addresses major barriers to primary care provider PA counseling in that it requires only two to five minutes of providers' time to administer and focuses on moderate intensity activities that are safe, effective, and familiar to the patient (PACE Canada, 2015). PACE consist of four steps that are selection and informing patient, administering assessment, counseling patient, and follow-up with patient. The assessment can be transferred to the chart or electronic medical record (EMR). The patient is given the "What's Your PACE?" assessment booklet to complete while in the waiting room (approximately 2-3 minutes). This form assesses current PA habits, readiness to make changes (TTM model) and risks for participation in activity. It also directs the patient to complete a one-page tailored protocol appropriate to their stage of change. On the basis of the patient’s assessment responses, the primary care provider delivers one of three PACE Physical Activity Counseling Protocols targeted to his or her current level of activity, risk assessment, and motivation for change (PACE Canada, 2015).
These three counseling protocols can be administered within 5 minutes and are the Not Ready for Change - Rethinking Your Lifestyle protocol, Ready to change - Planning the First Step protocol, and the Active Meets Guidelines - Keeping the PACE protocol (PACE Canada, 2015).

Risk assessment for PA in PACE Canada is done with modified for PACE Canada the Physical Activity Readiness Questionnaire (PAR-Q) and a patient chart assessment for cardiovascular risk factors and information regarding other problems (i.e., obesity, respiratory illness, or musculoskeletal problems) (PACE Canada, 2015). For patients who have had positive responses to the PAR-Q, the Physical Activity Readiness Medical Examination (PARmed-X) or PARmed-X PREGNANT is administered to demine absolute and relative contraindications, and to conduct physical examination, and PA advice depending on the patient’s limitations (PACE Canada, 2015). These quick assessment tools were developed in early 90s for adult populations aged 15 to 69 and validated in Canada in 2002 by Minister of Public Works and Government Services Canada (2002).

In partnership with Health Canada, the College of Family Physicians of Canada (CFPC) embarked on a Physical Activity and Health Strategy, "Getting active about physical inactivity!", to help Federal, Provincial and Territorial Ministers reach their goal to reduce physical inactivity among Canadians by 10% by the year 2003 (PACE Canada, 2015). The Pace Canada was a central part of this project. The purpose of this Strategy was to successfully reach primary care providers to help them help their patients to build PA into their daily lives (PACE Canada, 2015).

As a healthy lifestyle initiative, PACE Canada aims to provide knowledge with the help of primary care providers to inactive people about how to pursue an active healthy lifestyle, and increase the consistency of messages provided to the public about PA by using the PACE intervention tools (PACE Canada, 2015).

The review of evidence for PACE Canada program revealed that prevailing majority of evidence cited was from 1990 to 2005 that is available at PACE web-site. The content of the research was mostly
focused on the positive effects of PA of various populations. Only one effectiveness of PA interventions study was cited – a 14 year old systematic review (Kahn et al., 2002). This review did not include any research focusing on primary care PA interventions. Kahn et al. (2002) review was mainly focused on the effectiveness of community-wide campaigns, school-based physical education, social support in community settings, and individually-adapted health behavior change and creation of or enhanced access to places for PA combined with informational outreach activities. Therefore, this review did not meet inclusion criteria for this literature review to be used for any recommendations. Two Canadian studies validated PACE Canada, one quasi experimental study (Spink et al., 2005) and one small RCT of 90 primary care patients with 22 months follow-up (Spink, 2005). Both studies resulted in a small short-term increase of self-reported PA levels (p < 0.05). One non-Canadian RCT for PACE PA intervention effectiveness in Dutch primary care patients was included in the evidence citations (Van Sluijs EMF et al., 2005). This RCT reported an increase in PA and a borderline significant decrease in body weight at the 1-year follow-up. The major weakness of these studies was a small sample size and there was no analysis of the effectiveness of components of the tool. In addition, these studies were not conducted during routine primary care conditions reducing their generalizability.

It was noted that PACE Canada required only two to five minutes of primary care providers' time (PACE Canada, 2015). However, PACE Canada included multiple documents such as a 28-pages step-by-step guide, four counselling approaches denoted to one of four stages of change (TTM), separate Green Prescription script, multiple assessments tools such as “What's Your PACE?” booklet, PAR-Q, PARmed-X, PARmed-X PREGNANT, and multiple educational materials. Calculating stage of change is a major detrimental factor to the effect size of PA intervention that requires additional fallow-ups, training and complicated content of TTM (Bully et al., 2015; Campbell et al., 2012; Conn et al., 2011).

In addition, Campbell et al. (2012) large systematic review with meta-analysis and meta-synthesis analyzed multiple research regarding the PACE intervention. Campbell et al. (2012) noted that
the actual structure of PACE intervention could be problematic. For example, the time needed to discuss and prescribe exercise using a Green Prescription, particularly where patients presented with multiple problems or conditions, and a lack of publicity and public support for Green Prescriptions. In addition, patients’ ability to understand the actual intervention process could be problematic (Campbell et al., 2012). For example, Campbell et al. (2012) noted the problems with the PACE intervention that included not understanding how to stage oneself; too much text on the protocols; not able to comprehend the text; and difficulties understanding the language.

The second standardized/designed by experts PA intervention selected for this review was the Exercise Prescription and Referral (EPR) tool. The tool consists of a single double-sided page with a prescription pad format on its front and key messages and definitions on the back. Developed by a multidisciplinary working group, it was based on a belief in the great potential of all primary care providers to improve patient health through PA prescription (EIMC, 2015). The central idea to create EPR tool was to expect primary care providers to prescribe PA in their day-to-day practice because the efficacy and safety profile of PA was comparable to any drugs or any intervention and that a brief advice in primary care was a cost-effective intervention (Anokye, Lord, & Fox-Rushby, 2014; Frémont, Fortier, & Frankovich, 2014). This efficacy of PA was confirmed, as pointed by Frémont et al. (2014), in a recent large systematic review with meta-epidemiological analysis study (Naci and Ioannidis, 2013).

EPR was designed through the FITT (frequency, intensity, type, and time) format of personalized PA goal-settings (Frémont et al., 2014). EPR also facilitates a referral process to a qualified exercise professional such as a kinesiologist as a synergistic co-intervention (Frémont et al., 2014). Kinesiologist referral, as pointed by Frémont et al. (2014) was a cost-effective approach to improving PA for most patients (Hogg et al., 2012). Nonetheless, the effectiveness study of the referral to kinesiologist was not conducted, as well cost-implications to patients were not considered. The essential purpose of using the EPR tool in primary care is to promote the routine assessment and careful consideration of PA at each
encounter (Frémont et al., 2014). Moreover, PA should be assessed as the exercise vital sign (EVS) and should be prescribed at the periodic health evaluation and at every opportunity (Frémont et al., 2014). Routine PA levels assessment was supported by other findings of this literature review (Campbell et al., 2012; Conn et al., 2010).

The evidence for validating EPR was presented in one peer-reviewed article (Frémont et al., 2014). The paper met inclusion criteria for this review as it was highly relevant (Whittemore and Knafl, 2005) to the studied phenomenon of the effectiveness of PA interventions. Frémont et al. (2014) suggested that the experts (n=30) from various fields including clinical exercise sciences, behavioral science, nutrition, rehabilitation, sports medicine, and family medicine, after multiple face-to-face consultations and consensus have designed EPR tool. Consensus was reached after five iterations.

EPR tool was initially presented at Family Medicine Forum in November 2013 (Frémont et al., 2014). The tool was subsequently tested with primary care providers (n = 20) registered to be surveyed with a 2-month follow-up (Frémont et al., 2014). The response rate was 25%. Responded primary care providers had been in practice for 7 years or more. Respondents reported that EPR tool was taking up to 5 minutes to administer during routine primary care conditions. All responders agreed or strongly agreed that the tool was applicable to their patient population, the tool was easy to use in their practices, the tool was easy for their patients to understand, using the tool was an effective use of their clinical time with patients, and that they would recommend the tool to their colleagues (Frémont et al., 2014).

In addition, one author of Frémont et al. (2014) paper—Pierre Frémont shared his personal observations after six months using EPR tool on a regular basis in routine primary care settings. Dr. Pierre Frémont found that patients were receptive to the tool, and that it was taking up to 5 minutes to be completed for patients with no acute or unstable condition to be managed (Frémont et al., 2014). The major strength of Frémont et al. (2014) EPR tool presented data, including that author’s personal experience was that these data and personal observations were obtained through a routine primary care
conditions. Finally, Frémont et al. (2014) reported no conflict of interests. The studies regarding the effectiveness of EPR tool or its components have not been conducted.

Based on the findings of this review, the analysis of EPR tool revealed that this tool was superior to PACE Canada tool in terms of the PA intervention effective components. EPR tool consists of a single double sided page compared to PACE Canada multiple documents, complicated texts, and steps to administer. EPR tool does not include any theory based extra assessments that require multiple follow-up and training, which are not recommended to be included in PA intervention in primary care (Bully et al., 2015; Campbell et al., 2012; Conn et al., 2011). Moreover, the EPR tool included important effective components such as PA prescription, standardized/designed by experts’ format, brief around 5 minutes delivery, FITT (frequency, intensity, type, and time) format of personalized/based on recommendations PA goal-settings, brief PA recommendations, follow up prompts, modeling of PA behavior, and current PA guidelines.

However, EPR tool does not include some important behavioral techniques such as self-monitoring, consequences, cues, self-rewards, and contracting. Campbell et al. (2012) noted that effective components of PA interventions work synergistically. Therefore, adding these effective behavioral techniques to EPR tool can increase the effectiveness of this tool by improving primary care providers’ awareness of the effectiveness concept presented in this literature review. This literature review has sufficient evidence from high quality research to recommend EPR tool over PACE Canada. Finally, EPR tool consists important evidence based PA intervention components that can increase primary care providers’ confidence in the effectiveness of this standardized/designed by experts PA intervention.

Summary

The syntheses of data for this integrative literature review was based on 13 original studies that were critically apprised. From the analysis, the data was presented according to the six extracted themes.
The themes of the effectiveness of PA interventions are the effectiveness and intensity; intervention components; theoretical models as a component of interventions; characteristics of patients and providers; number needed to treat; and Canadian standardized/designed by experts brief PA interventions.

The data synthesis for the effectiveness and intensity of PA interventions was resulted from eight studies, five systematic reviews with meta-analyses (Campbell et al., 2012; Conn et al., 2011; Foster et al., 2005; Lin et al., 2010; Orrow et al., 2012;), and three systematic reviews of RCT’s (Sanchez et al., 2015; Sørensen et al., 2006; Tulloch et al., 2006). These studies confirmed that PA interventions were effective (Campbell et al., 2012; Conn et al., 2011; Foster et al., 2005; Lin et al., 2010; Orrow et al., 2012; Sanchez et al., 2015; Sørensen et al., 2006; Tulloch et al., 2006).

Three large high quality systematic reviews with meta-analysis (Conn et al., 2011; Campbell et al., 2012; Foster et al., 2005) were used for the data synthesis regarding PA intervention components and effectiveness.

The data related to the effectiveness and theoretical models components of PA interventions was synthesized from two robust systematic reviews with meta-analyses (Campbell et al., 2012; Conn et al., 2011) and one systematic review (Bully et al., 2015).

The association between characteristics patients and providers and the effectiveness of PA interventions was synthesized from four systematic reviews with meta-analysis (Conn et al., 2011; Campbell et al., 2012; Lin et al., 2010; Foster et al., 2005) and two systematic reviews (Sanchez et al., 2015; Tulloch et al., 2006).

Providers’ characteristics that were associated with the effectiveness of PA intervention were also reported by these studies with no clear association between effectiveness and specific primary care providers’ characteristics (Conn et al., 2011; Campbell et al., 2012; Lin et al., 2010; Foster et al., 2005; Sanchez et al., 2015; Tulloch et al., 2006). However, large high quality study identified a number of
primary care providers’ characteristics that were affecting PA interventions’ effectiveness (Campbell et al., 2012).

The NNT data for brief PA interventions was synthesized from two high-quality meta-analyses (Orrow et al., 2012; Lin et al., 2010).

Finally, the evidence for the effectiveness of two brief standardized/designed by experts PA interventions—PACE Canada and EPR tool was reported in one systematic review (Kahn et al., 2002), one quasi experimental study (Spink et al., 2005), two RCTs (Spink, 2005, Van Sluijs EMF et al., 2005) and one peer reviewed article for EPR tool (Frémont et al., 2014). These two tools were analyzed based on the findings and EPR tool showed superior to PACE Canada effectiveness characteristics.

The next discussion section will explain principal findings, any links and correlations of the data presented in the findings, followed by implications for practice, limitations, and unanswered questions and future research and conclusion.
Chapter 4
Discussion

Physical inactivity and sedentary behaviour is a major public health issue in Canada (Bounajm et al., 2014). Primary care settings are a part of a multifaceted societal approach needed to address physical inactivity and sedentary behavior that can lead to at least 2.6 billion dollars per year in Canadian healthcare savings (Anokye et al., 2014; Bounajm et al., 2014; MacAuley et al., 2016). Physical activity’s (PA) benefits to prevent and treat many chronic conditions are well-known (Pedersen & Saltin, 2015; Stevens et al., 2014; Warburton et al., 2010; Tremblay et al., 2011), and PA is effective or sometimes more effective than medications prescribed to treat and prevent chronic conditions (Groot et al., 2016; Naci & Ioannidis, 2013). Orrow et al. (2012) noted that based on the findings of a meta-analysis of cohort studies to include almost one million individuals, achievement of a portion of the recommended PA levels in insufficiently active adults could reduce mortality by approximately one fifth (Woodcock et al., 2011). Primary care providers should be aware that even a small increase of PA is beneficial for health such as simple standing of previously sedentary patients decreases CVD risk (Eijsvogels et al., 2016). Being confident in PA effectiveness is one of the central primary care providers’ characteristics affecting the effectiveness of PA interventions (Campbell et al., 2012). Moreover, PA interventions in primary care are cost-effective (Anokye et al., 2014; Garrett et al., 2011; GC et al., 2015; MacAuley et al., 2016; Thornton et al., 2016). Therefore, PA is recommended by the Canadian Academy of Sport and Exercise Medicine (CASEM) to be routinely prescribed by primary care providers to all adults without or with stable conditions who are sedentary or insufficiently active (Thornton et al., 2016). Furthermore, prescribing PA is safe as long as chronic conditions are stable (Bredin et al., 2013; Cornelissen et al., 2011; Eijsvogels et al., 2016; Leung et al., 2016).

Primary care is the first level of care and usually the first point of contact for Canadians with the health care system to receive medical care to include health promotion (Muldoon et al., 2012). Primary
care services are covered under the universal Canadian health care system (Government of Canada, 2016). Referrals for PA promotion to other health care providers or PA specialists can be unaffordable for many patients (Campbell et al., 2012; Lin et al., 2010; Thornton et al., 2016). Primary care providers, including family nurse practitioners, have all the skills necessary to disseminate PA promotion when effective PA interventions suitable for primary care settings are deployed (CAN, 2012; Elley et al., 2004; Makoul, 2001; Lamarche & Vallance, 2013; Thornton et al., 2016; Tompkins, Belza, & Brown, 2009). However, the presence of necessary skills with the lack of educational curricula containing effective components of an intervention can result in a counterproductive effort. Finally, the findings of this literature review suggested that the effectiveness of PA interventions was independent of a type of a provider - either it was a nurse practitioner or family physician (Conn et al., 2011; Campbell et al., 2012; Lin et al., 2010; Foster et al., 2005; Sanchez et al., 2015; Tulloch et al., 2006).

There are barriers to providing PA interventions to which lack of time is a universal proxy suggesting that brief PA interventions are the most appropriate for primary care settings (Sanchez et al., 2015; Campbell et al., 2012). It is important to note that time is a main proxy to barriers related to integrating and maintaining PA intervention recommendations in practice (Sanchez et al., 2015; Campbell et al., 2012; Thornton et al., 2016). While this represents general concepts of integrating PA interventions into practice, very little is known about the components of PA interventions as well as patient and provider characteristics related to the effectiveness that is increased levels of PA. Therefore, this integrative literature review was conducted to explore the current evidence related to the effectiveness of PA interventions to increase PA levels of adult patients.

Campbell et al. (2012) suggested that PA interventions’ components and patient/provider characteristics related to their effectiveness should be considered together rather than in isolation in order to facilitate positive changes in PA intervention delivery and increased PA uptake. Therefore, in regards to the concepts related to the effectiveness of PA interventions that are their components, the
characteristics of patients and providers should be understood as a whole as they synergistically influence the effectiveness of PA interventions. Moreover, when these components are combined, they can have an additive effect (Campbell et al., 2012). It is understandable that each component of the effectiveness can have a varied calculated weight or impact on effectiveness, but it is out of the scope of this literature review to conduct a quantitative study. Nonetheless, the effective components of PA interventions were derived from the highest currently available evidence that was presented in the findings in order to draw conclusions leading to recommendations for practice. Besides, these effective components can form a new understanding (Whittemore & Knafl, 2005) of the effectiveness of PA interventions in primary care practice. The evidence presented in the findings of this review is supported by the recent PA intervention recommendations for Canadian primary care providers. The conclusions related to the effectiveness in this chapter will be linked to the recommendations to clinical practice.

Further, these recommendations will be presented in the recommendations section as the Physical Activity (PA) Intervention Effectiveness Appraisal Checklist (see Table 2), the Brief Physical Activity (PA) Intervention in Primary Care Evidence Based Recommendations List (see Table 3), and suggested additional to EPR tool’s evidence-based components that can be considered to achieve cumulative synergistic effect (see Appendix A).

The likelihood of offering PA intervention by primary care providers depends on their confidence in the effectiveness of these interventions (Campbell et al., 2012). This is one of the central characteristics of a provider related to the effectiveness (Campbell et al., 2012). Therefore, primary care providers should be aware of the effectiveness of these interventions, their effective components, and patient/provider characteristics related to the effectiveness. To quantify their confidence, primary care providers should be aware of the number needed to treat (NNT) of brief PA interventions that is approximately 12-25 (Lin et al., 2010; Orrow et al., 2012). A recent review by Sanchez et al. (2015) and the current position statement by the Canadian Academy of Sport and Exercise Medicine (Thornton et
al., 2016) emphasized the clinical significance of Orrow et al.’s (2012) findings regarding NNT of brief PA intervention, comparing it favorably to the NNT of 50-120 for smoking cessation advice discussed in Cochrane’s systematic review of Stead et al. (2008).

Primary care providers should be aware that brief PA interventions are effective to increase PA levels in adults according to high quality current research (Campbell et al., 2012; Conn et al., 2011; Foster et al., 2005; Lin et al., 2010; Orrow et al., 2012; Sanchez et al., 2015). Therefore, from the perspective of the findings and in accordance with the latest Canadian Academy of Sport and Exercise Medicine (CASEM) recommendations, PA interventions should be prescribed to all inadequately active or sedentary patients with or without chronic conditions as a part of routine primary care (Thornton et al., 2016). The findings of this literature review suggest targeting all physically inactive adults as there was no association between effectiveness and patients’ characteristics such as sex, race, baseline BMI, or type of chronic condition except for the disadvantaged populations (Conn et al., 2011; Campbell et al., 2012; Lin et al., 2010; Foster et al., 2005; Sanchez et al., 2015). Nevertheless, it would be inequitable to exclude a disadvantaged population from providing a brief PA intervention in primary care. Perhaps NNT for this population could be larger. Furthermore, based on their meta-analysis, Conn et al. (2011) suggested that the presence of chronic illness might cause patients to be more responsive to PA interventions. This finding can indirectly support the use of such behavioral techniques as consequences. In addition, meta-synthesis of qualitative/quantitative studies conducted by Campbell et al. (2012) determined that the likelihood that brief PA intervention would be acted on was affected by the patient’s current activity level, recall and understanding of advice, if the advice was preventative advice or linked to a specific condition, awareness of PA recommendations, and if the patient felt he or she was heard.

Beside patients’ characteristics to assess the effectiveness of PA interventions, primary care providers have to be aware of their own characteristics affecting PA interventions’ effectiveness.
Important primary care providers’ characteristics noted in the research could influence effectiveness of PA interventions by increasing the frequency of their offering and better uptake. These characteristics were noted in the current NICE (2016) primary care guidelines based on the Campbell et al. (2012) study that is highly regarded by Canadian primary care recommendations (Thornton et al., 2016). Campbell et al. (2012) concluded that the likelihood that brief PA intervention would be delivered was affected by primary care providers’ characteristics related to how the primary care providers perceived patients’ characteristics, perceived likely uptake of the intervention by the patients, and perceived effectiveness of PA intervention. In addition, primary care providers’ confidence and knowledge about PA, primary care providers’ activity levels, PA interventions if seen as within their remit/role, if the intervention was linked to the presenting condition, and primary care providers’ characteristics such as their BMI, smoking status, grooming, and dressing were other characteristics that these providers have to be aware. Moreover, the Canadian Academy of Sport and Exercise Medicine (CASEM) recommended that primary care providers lead by example and integrate PA into their own lives for their own health and well-being while providing credibility and empathy for their patients (Thornton et al., 2016). This recommendation relates to primary care providers’ characteristics that affect the effectiveness of PA interventions, implying that their own well-being directly correlates with the well-being of their patients.

Targeting all insufficiently active primary care patients implies a routine screening for inadequate PA levels. Therefore, to support the routine screening of inadequate PA levels, this literature review recommends utilising CASEM’s recent recommendations that define PA level monitoring through exercise vital signs (EVS). The importance of EVS was emphasized in one study (Frémont et al., 2014) included in the analysis for this literature review. The routine PA monitoring can be conducted by asking two simple questions: (1) ‘On average, how many days/week do you engage in moderate or
greater physical activity (like a brisk walk)?’ and (2) ‘On those days, how many minutes do you engage
in activity at this level?’ (Frémont et al., 2014; Thornton et al., 2016).

There is a recent call from Canadian and international guidelines for a routine use of PA vital
sign in clinical practice (Sallis, Baggish, Franklin, & Whitehead, 2016; Thornton et al., 2016). Vital
signs such as blood pressure, heart rate and tobacco use inform clinicians about the likelihood of future
disease and the presence and severity of acute and chronic illness (Sallis et al., 2016). They provide
temporal trends that can show subclinical disease or the favorable effect of lifestyle and/or
pharmacologic intervention. They also represent distinct quantitative measurements that can be used for
education and engagement of patients in the therapeutic process (Sallis et al., 2016). Common use of a
smoking status vital sign, for example, played a key role in the successful reduction of smoking
prevalence from approximately 50% to 19% in Canadian adults (Corsi et al., 2014; Janz, 2015; Sallis et
al., 2016).

PA prescription is one of the central effective components of PA interventions suggested by this
review according to the findings (Campbell et al., 2012; Conn et al., 2011; Foster et al., 2005; Sørensen
et al., 2006; Tulloch et al., 2006). The recent position statement by the Canadian Academy of Sport and
Exercise Medicine recommended the use of PA prescription as it was an effective and important
therapeutic agent for all ages and cost less than relying on the alternatives alone in primary, secondary,
and tertiary prevention of chronic diseases (Thornton et al., 2016). A written prescription (which
comprises exercise and lifestyle goals) was a crucial element to signal that PA and exercise can be
therapeutic (Thornton et al., 2016). This possibly increases the strength of the PA advice in primary care
settings resulting in statistically significant effect size of brief PA intervention that incorporated PA
prescription.

Primary care providers should also be aware of how long the effect of PA intervention could last.
The effect of even a single brief PA intervention conducted in primary care can last from six to 12
months (Campbell et al., 2012; Conn et al., 2011; Foster et al., 2005; Lin et al., 2010; Orrow et al., 2012; Sanchez et al., 2015). This also confirmed by Gagliardi et al.’s (2015) systematic review which concluded that even a single brief PA intervention delivered by a primary care provider may result in increased PA at 12 months, and that follow-up counselling may sustain increased PA beyond 12 months. Gagliardi et al.’s (2015) study was not included in the data analysis as it did not analyse PA interventions components and/or related patient/provider characteristics. Moreover, follow-up prompts are an effective behavioral technique component of PA interventions according to the findings of this review (Campbell et al., 2012; Conn et al., 2011). These follow-up intervals for brief PA interventions were also suggested by the latest recommendations of the National Institute for Health and Care Excellence (NICE) (NICE, 2016). Therefore, this review recommends using follow-up prompts every 6-12 months.

Based on the findings (Campbell et al., 2012; Conn et al., 2011; Foster et al., 2005; Lin et al., 2010; Orrow et al., 2012; Sanchez et al., 2015), this literature review suggests that brief (five minutes), standardized/designed by experts PA interventions are the most suitable for primary care settings. Less intensive or brief PA interventions (5-20 min) achieve similar effect size to more intensive interventions (>20 min or multiple follow ups) (Campbell et al., 2012; Conn et al., 2011; Foster et al., 2005; Lin et al., 2010; Orrow et al., 2012). More intensive PA interventions (>20 min) in the majority of reviewed studies tend to involve specially trained and/or additional professionals or patients’ resources. Therefore, more intensive interventions are less generalizable to routine primary care settings and can be unaffordable for patients or not covered by health care (Campbell et al., 2012; Lin et al., 2010; Sanchez et al., 2015). In addition, it is too early to recommend very brief interventions (<5 min) as there was a lack of current evidence (Campbell et al., 2012; Sanchez et al., 2015). Moreover, based on the findings, this review does not suggest the additional use of behavioral counselling (e.g., motivational interviewing, decision-making counselling), additional written materials, vouchers, and methods of
feedback as these additions to brief PA intervention did not demonstrate a statistically significant positive effect size (Campbell et al., 2012; Conn et al., 2011).

After analysis of standardized/designed by experts PA interventions (i.e., another key effectiveness characteristic) available in Canada and the analysis of the effective components of PA intervention, this literature review suggests using the Exercise Prescription and Referral (EPR) tool. The tool is freely accessible at Exercise is Medicine Canada-EIMC (2015). This tool is also recommended by the Canadian Academy of Sport and Exercise Medicine and Exercise is Medicine Canada—the current Canadian recommendations for primary care providers on the subject of PA interventions (EIMC 2015; Thornton et al., 2016). Based on the findings, behavioural techniques (first page of EPR) should be used over cognitive (second page of EPR) techniques (Campbell et al., 2012; Conn et al., 2011; Orrow et al., 2012; Sanchez et al., 2011). Some cognitive messages were shown to be effective; therefore, provision of a short message of the current PA recommendations that is present on the first page of EPR is recommended (Campbell et al., 2012; Conn et al., 2011; Orrow et al., 2012; Sanchez et al., 2011). This review also recommends adding a pedometer target of 10,000 steps a day to that message as a commonly accepted alternative. For the suggested evidence-based components, see Appendix A

A cognitive message about PA being as effective as drugs can be placed before the PA prescription portion of the EPR tool because these concepts are closely related and can represent a semantic correlation between messages that can be measured (Hoffman, Ralph, & Rogers, 2013). Moreover, the concept of PA being a medicine is part of the key messages developed by Canadian Academy of Sport and Exercise Medicine based on recent high quality research (Naci & Ioannidis, 2013; Thornton et al., 2016; WHO, 2016). Therefore, the author suggests having such message next to the prescription of PA in a standardized/designed by experts PA interventions (See Appendix A).

According to the findings, this literature review confirms the effectiveness of the EPR tool behavioral technique components such as PA prescription; personalized/based on recommendations of
PA goal-settings laid out as a frequency, intensity, time and type (FITT); follow up prompts; and modeling of PA behaviour presented as PA examples (Campbell et al., 2012; Conn et al., 2011; Orrow et al., 2012; Sanchez et al., 2011). In addition, based on the findings (Campbell et al., 2012; Conn et al., 2011; Orrow et al., 2012; Sanchez et al., 2011), in order to achieve a synergistic effect (Campbell et al., 2012; Michie et al., 2015), the following effective behavioral techniques can be considered: negative consequences of physical inactivity, self-monitoring, individualised cues, contracting, rewards, and self-rewards (see Appendix A).

Follow-up prompting is a well-researched, effective behavioral technique component of PA interventions (Campbell et al., 2012; Conn et al., 2011). The content and a format for PA interventions’ follow-up visits are under-researched (Campbell et al., 2012). It would be essential to record self-monitored data of PA levels in order to monitor progress of prescribed PA during a follow-up visit. Moreover, NICE (2016) recommendations that were based on Campbell et al.’s (2012) study suggested that the follow-up could consist of a conversation about what PA someone has been doing, progress towards his or her goals, or achievement of the PA guideline goals.

In the Canadian Academy of Sport and Exercise Medicine’s position statement, Thornton et al. (2016) recommended that for self-monitoring, as alternative for using journals, mobile phones’ apps and wearable technology can monitor steps and/or minutes of PA activity as tracking could be simple and automatic. The convenience of uploading and displaying data from mobile phones and wearable technology can be time-saving during a follow-up visit (Thornton et al., 2016). However, it is important to note that most available technologies related to this effective behavioral change technique target physical activity levels, but it is important to also target sedentary time (Sanders et al., 2016). Therefore, self-monitoring is recommended to include journals, apps, and wearable devices that records both sedentary time and PA levels in steps or in minutes.
The use of rewards such as vouchers, self-rewards, and feedback is inconclusive based on two studies (Campbell et al., 2012; Conn et al., 2011); therefore, these types of behavioral techniques as a component of a standardized PA intervention can be used as optional. Another behavior technique, contracting, was uncommon in PA intervention studies (Campbell et al., 2012), and there was no specific moderator analysis performed for this technique (Conn et al., 2012). Nonetheless, it is a behavioral technique that showed effectiveness in a moderator analysis versus cognitive techniques (Conn et al., 2012). Therefore, contracting to achieve a synergistic effect (Campbell et al., 2012; Michie et al., 2015) can be added to a standardized PA intervention as optional.

The referral with name and contact section of the first page of the EPR Tool (see EIMC, 2015) should be used with caution as the referral schemes did not demonstrate a positive statistically significant effect size, and referrals to exercise classes of PA specialists raised a concern about the cost to the patients (Campbell et al., 2012; Orrow et al., 2012). Nonetheless, Tulloch et al. (2006) discussed an issue of a multidisciplinary approach to PA interventions and proposed an interdisciplinary model in which primary care providers use their credibility and existing relationships with their patients to provide PA interventions. They also offer referrals to other health professionals for specialized treatment. Therefore, using the referral part of the EPR tool for patients who have resources and/or desires to be referred depending on their goals is recommended. For example, Tulloch et al. (2006) noted that specific to obesity, a multidisciplinary approach that addresses the individual needs of the patient (e.g., nutrition or PA counseling) offers a better chance for long-term effectiveness. Moreover, emphasizing Tulloch et al.’s (2006) findings and primary care philosophy, the use of the referral part of the EPR tool that can have additional referral to community resources such as free yoga classes component (see Appendix A), won’t likely impact the effects size negatively or can have a positive additive effect (Campbell et al., 2012; Michie et al., 2015). Moreover, exercising with a friend and other forms of social support are behavioral techniques (Anshel, 2014; Conn et al., 2011) that are generally
regarded as effective (Campbell et al., 2012; Conn et al., 2011). Therefore, referrals, especially to free community resources, and social support components of standardized PA interventions are recommended as long as patients’ cost/resources implications are considered. Finally, primary care providers who lead by example, which was recommended by CASEM (Thornton et al., 2016), can organize and lead free weekly or monthly PA classes for their clients depending on their personal PA knowledge. The result will be improving their own as well as their patients’ well-being.

Based on the findings, to maintain brief duration the second page of the EPR tool that consists of cognitive techniques such as educational material that did not show a statistically significant positive effect size can be counselled during an office encounter for patients who are lacking such information (Campbell et al., 2012; Conn et al., 2011; Orrow et al., 2012). Nevertheless, the second page is provided by default of a single, double-sided EPR tool. Moreover, the second page of the EPR tool’s educational material is directly related to the effective behavioral techniques such as personalized goal setting explaining intensity of PA. However, how the knowledge about intensity increases PA effect size is unknown. It is important that primary care providers be aware that PA interventions that were based exclusively on behavioural techniques had positive statistically significant effect size versus no statistical significance of the effect size of PA intervention based on cognitive technique (health education and providing information) (Campbell et al., 2012; Conn et al., 2011). This knowledge can have a positive impact on the overall duration of PA intervention by not engaging in ineffective PA interventions’ components. Nonetheless, related cognitive and behavioural techniques can have an additive effect (Campbell et al., 2012; Michie et al., 2015) considering that the other PA characteristics such as its lengths in minutes are not affected. Particularly, Michie et al. (2015) noted that “the links between behavior and health was effective if combined with either setting goals or with providing information on the consequences of the behavior and using follow-up prompts” (Michie et al., 2015, para. 21).
Finally, there have been no effectiveness studies conducted on the EPR tool reflecting the effect size of increased, self-reported PA levels. However, the author of this review, based on the findings, confirmed the effectiveness of EPR tool components and made recommendations on additional components to achieve synergistic effect (Campbell et al., 2012; Michie et al., 2015) (See Appendix A). The next section of the discussion chapter will present further data reduction and synthesis resulting in recommendations for practice, education, and research.

**Recommendations**

The purpose of this integrative literature review was to explore current evidence related to the effectiveness of PA interventions that could guide primary care providers to facilitate the impact of these interventions for all adults with or without stable chronic conditions through primary care in Canada. Most importantly, one of the main goals, as noted by Whittemore and Knafl (2005), of an integrative literature review is to provide a new, deeper understanding of a studied phenomenon; this paper attempts to accomplish this goal. As part of this review, six major themes of the effectiveness of PA interventions were identified at higher levels of abstraction. These themes were the effectiveness and intensity, intervention components/design, theoretical models as a component of PA interventions, characteristics of patients and providers, the number needed to treat, and Canadian standardized/designed by experts brief PA interventions. These themes were further synthesized and linked to practice as well as validated through current Canadian guidelines and the wider body of literature. This review has not explored the implication for practice on the institutional and policy levels as the main phenomenon studied was the effectiveness characteristic of PA interventions in primary care. In addition, cost-effectiveness of brief PA interventions in primary care was not explored as there is a wide body of evidence reflected in the current Canadian guidelines speaking for its cost-effectiveness (Anokye et al., 2014; Garrett et al., 2011; GC et al., 2015; MacAuley et al., 2016; Thornton et al., 2016). Following this process, recommendations were identified for practice, research, and education. Based on the findings of the review, the
recommendations for practice resulted in the development of the Physical Activity (PA) Intervention Effectiveness Appraisal Check List (See Table 2) and the Physical Activity Intervention in Primary Care Evidence Based Recommendations List for clinical practice and education (See Table 3). As a result, the author of this review to achieve a synergistic effect suggested evidence-based components of PA interventions that can potentially be added to Exercise Prescription and Referral (EPR) tool (See Appendix A). The length of the checklist is comparable to other clinical tools such as appraisal checklists for the different research designs used for this literature review. Integrating these recommendations has the potential to increase PA levels in the Canadian population and continue to drive education and research initiatives to further build on the development of strategies to effectively deliver PA interventions in primary care. These recommendations will also help to form a new understanding of the effectiveness of PA interventions. Recommendations for practice, education, and research will now be presented.

**Recommendations for Practice**

Based on findings and specifically for clinical practice, the author of this review has developed the Physical Activity Intervention in Primary Care Evidence Based Recommendations List (See table 2). The author has also proposed evidence-based PA interventions’ components that can be used along with the effective components of the Exercise Prescription and Referral (EPR) tool to achieve a synergistic effect without much impact on the overall length of a standardized PA intervention. For these components refer to Appendix A. These recommendations are intended for primary care providers in Canada, but they are applicable to other health providers in Canada or elsewhere.

Further synthesizing and analyzing the current literature, the author of this review has compiled the Physical Activity (PA) Intervention Effectiveness Appraisal Checklist. This checklist can help primary care providers to evaluate the potential efficacy of PA interventions for which they are considering for use in primary care settings (See Table 3). First and foremost, this checklist is intended
to be utilized as an active learning tool to help generate a new and deeper knowledge of the effectiveness of PA interventions. This can potentially lead to significant reconceptualization of this topic while facilitating focused research and integration of an effective PA tool into primary care in order to increase PA levels of Canadians and their general well-being.

Table 2

**Physical Activity (PA) Intervention in Primary Care Evidence Based Recommendations List**

1. **KNOW** the ABCDE* of the current evidence on the effectiveness of PA interventions in primary care.

2. **ASSESS** physical inactivity at every visit except for acute or unstable condition as the exercise vital sign (EVS) by asking:
   a) ‘On average, how many days/week do you engage in moderate or greater physical activity (like a brisk walk)?’ and
   b) ‘On those days, how many minutes do you engage in activity at this level’?

3. **CHECK** eligibility for a brief PA intervention or PA intervention follow-up visit (6-12 months):
   a) All insufficiently active patients with or without stable conditions, and
   b) Patients who are able to understand and follow PA intervention instructions, and
   c) Patients who have not had PA prescription for the past 12 months (PA prescription can be added to electronic medical record (EMR) along with other prescriptions for an easy access).

4. **ASSESS CONTRAINDICATIONS IF NEEDED**:
   a) Use chart, EMR record, patient history for unstable angina, uncharacterized arrhythmias or decompensated heart failure as vigorous exercise can be contraindicated before patients’ conditions stabilize.
   b) If needed, perform physical examination to focus on significant clinical signs, such as a heart murmur, pulmonary overload or severe hypertension (resting blood pressure >200/110 mm Hg) representing unstable condition.

5. **DEPLOY** Exercise Prescription and Referral (EPR) tool and consider other effective PA intervention components for synergistic effect (See Appendix B):
   a) Go through or counsel patient with the first page of EPR. Educate yourself on the recommended FITT goal settings and how to quickly individualize FITT based on patients’ abilities and preferences. Educate yourself on EPR first page’s behavioral techniques
   b) Offer second informational page of EPR tool if patients desire so or are lacking this information.

6. **ENGAGE** in recommended regular PA to improve your own health and well-being, and to provide continuous credibility and empathy for your patients. Involve in the support of community resources related to PA, lead free classes.

* ABCDE
A. A single brief PA intervention (5 min duration) is effective at least at 12 months following the intervention.
B. Beyond 12 month effect of PA intervention can be sustained with a follow-up PA intervention
C. Cost-effectiveness is well known and the applicability to primary care settings of brief PA intervention is ensured by its short duration (~5 min).
D. Data on Number needed to treat (NNT) of a brief PA intervention = 12-25 compared favorably to NNT of a brief smoking cessation intervention = 50-100.
E. Effects of PA are same or sometimes better than effects of medications to prevent and treat many chronic conditions. Any increase of PA reduces health risks in any patients including overweight or obese.

Note: For the citations refer to “Effectiveness of Physical Activity Interventions in Primary Care Settings: An Integrative Literature Review” by G. Wood, 2017. For footnotes refer to Appendix B.
Table 3  
Physical Activity (PA) Intervention Effectiveness Appraisal Checklist

<table>
<thead>
<tr>
<th>Physical Activity Intervention Components Domain</th>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Can this PA intervention be delivered within 5 minutes?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) Is this PA intervention standardized designed by experts?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) Is this PA intervention delivered face-to-face versus delivered via e-mail or telephone or via television or newspaper?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4) Does this PA intervention target an individual versus community?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5) Is this PA intervention exclusively based on behavioral techniques?**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) PA prescription</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Goal-setting - individualized / based on PA recommendations (e.g., frequency, intensity, type, and time FITT principle)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Self-monitoring (e.g., journals, apps, or wearable devices for recording minutes per week and/or steps per day of PA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) Follow up (e.g., to record self-monitored data, update PA goals)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) Consequences (e.g., 1-3 sentences on physical inactivity consequences)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) Cues - help with finding individual cues: external e.g., alarms, driving to home after work; internal – desire to move after sitting a prolonged time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g) Contracting (e.g., a patient signs a contract to walk 20 minutes a day)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h) Modeling of PA behavior (requires a knowledge from primary care provider to e.g. demonstrate modified PA exercises depending on the physical abilities of a patient)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Social support (e.g., a workout friend)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6) Does this PA intervention include current PA recommendations?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7) Does this PA intervention include additional behavioral counselling done by primary care provider (e.g., additional motivational interviewing)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8) Is this PA intervention NOT solely based on cognitive techniques (e.g., PA education, PA educational material, decision making)? **</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9) Do cognitive techniques such as PA educational material and/or health education offered when a patient lacks it or desires to have it (i.e., not offered routinely)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10) Does this PA intervention NOT include theoretical models (e.g., Trans-theoretical model or Stage of Change Theory, Social Cognitive Theory etc.) components (e.g., stage of change, self-efficacy measurements)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11) Does this PA intervention include referral to community resources (e.g., free yoga)? ***</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Characteristics of Patients Domain

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Does a patient NOT belong to a disadvantaged population?****</td>
<td></td>
</tr>
<tr>
<td>2) Is a patient able to recall and understand a PA advice?</td>
<td></td>
</tr>
</tbody>
</table>

Characteristics of Providers Domain

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Are you aware that PA effects are similar or even stronger than the effects of drugs to prevent and treat many chronic conditions?</td>
<td></td>
</tr>
<tr>
<td>2) Are you aware that even a small, regular increase of PA reduces health risks (e.g., form sedentary lifestyle to intermittent standing)?</td>
<td></td>
</tr>
<tr>
<td>3) Are you aware that a brief PA (5 min) intervention in primary care can increase PA levels up to 12 months?</td>
<td></td>
</tr>
<tr>
<td>4) Are you aware of the number needed to treat of a brief (5-10 min) PA intervention?</td>
<td></td>
</tr>
<tr>
<td>5) Are you aware of the number needed to treat of a brief (5-10 min) smoking cessation intervention?</td>
<td></td>
</tr>
<tr>
<td>6) Are you confident and knowledgeable (including the need for further training/support) in providing PA intervention?</td>
<td></td>
</tr>
<tr>
<td>7) Do you think that time resources and conflicting priorities in your practice would NOT prevent you from providing a brief (5 min) PA intervention on a regular basis?</td>
<td></td>
</tr>
<tr>
<td>8) Are you physically active and/or adherent to Canadian PA recommendations?</td>
<td></td>
</tr>
<tr>
<td>9) Are you aware that patient perception of provider fitness, grooming, BMI and smoking status impact the effectiveness of PA interventions?</td>
<td></td>
</tr>
<tr>
<td>10) Do you think that providing brief PA interventions is within your remit/role?</td>
<td></td>
</tr>
<tr>
<td>11) Would you prescribe PA as a preventative measure rather than advice linked to the presenting condition?</td>
<td></td>
</tr>
</tbody>
</table>

Note. For the citations refer to “Effectiveness of Physical Activity Interventions in Primary Care Settings: An Integrative Literature Review” by G. Wood, 2017. For footnotes refer to Appendix B.
Recommendations for Education

All health practitioners, including primary care providers, are expected to maintain continuing education and stay current with their knowledge and skills by accessing current guidelines and following clinical recommendations in practice. Physical activity promotion is as important as any other aspect of primary care for improving or maintaining health and wellness. Additional education regarding practical health promotion strategies should be added to entry to practice education as well as continuing education. Considering the valuable role of sport and exercise medicine (SEM) physicians who are particularly well suited for the role of PA prescription, a collaborative educational effort shared with their primary care colleagues such as NPs would be beneficial where available.

Primary care providers, and particularly SEM primary care providers, have an important opportunity to make PA an integral component of the prevention and treatment of chronic disease. The SEM diploma is not available for family nurse practitioners as this Objective structured clinical examination (OSCE) type of certification is only available for physicians (CASEM, 2015). However, considering the importance of dissemination of PA through primary care such specialized certification should be available for nurse practitioners. The Canadian Academy of Sport and Exercise Medicine (CASEM) recommends that all SEM and primary care providers include PA assessment and prescription as part of routine healthcare for patients, and this should be a priority for training and education at every level of medicine (Thornton et al., 2016).

In particular, as noted by Tulloch et al. (2006), there was no association on who performed PA intervention (either a nurse practitioner or family physician), but the content of the intervention as well as qualities of the provider needed to fulfill this role. This does not imply that other health care settings or PA services are equally covered and/or accessible for Canadians. Furthermore, Campbell et al. (2012) noted that giving primary care providers training in using proven brief intervention protocols could overcome barriers such as time and conflicting priorities. Moreover, education that is based on protocols
such as the EPR tool, especially those protocols that are continually updated with effective components of PA interventions, can potentially increase the educational effort. Basic kinesiology education related to PA can be gained both through life-long personal PA experiences and a formal brief education. This can potentially help in setting personalized PA goals that are an effective component of PA intervention. CASEM recommended that primary care providers lead by example and integrate PA into their own lives for their own health and well-being as well as to be able to provide further credibility and empathy for the challenges that patients face (Thornton et al., 2016).

This project seeks to acknowledge how the evidence related to the effectiveness of PA interventions is important in maximizing an effort to increase PA levels in the general adult population through primary care. Primary care philosophy inherently mandates patient-centered health promotion that was mandated by the Alma Ata Declaration (Braid et al., 2014). Patient-centered health promotion emphasizes the principles of holistic healthcare that focuses on the mind-body connection, stigma reduction, and enhancement of patients’ physical and psychological strength and resilience (Braid et al., 2014). In raising awareness of this inherent mandate of primary care through education, there is the potential to improve the outcomes of the patient-centered care in disadvantaged populations.

It is the aim of this author to communicate this literature review’s findings, future research recommendations, and proposed additional elements as well as changes to the EPR tool with the experts who designed this tool. Finally, another aim is to communicate the outcomes of this integrative review with the Northern Health Authority Regional Program Lead – Physical Activity about the possibility of integrating the EPR tool in EMR software and adopting the findings of this integrative literature review into a brief educational protocol. Moreover, a discussion regarding the possibility of conducting implementation trials will be pursued.
**Recommendations for Research**

Despite lack of research on the effectiveness of PA interventions, the evidence of the efficacy of PA interventions in the primary care setting is growing. This growth is reflected in the latest Canadian Academy of Sport and Exercise Medicine’s recommendations (Thornton et al., 2016). In regards of the effectiveness of PA interventions, as noted by Sanchez et al. (2015), future research has to be focused on implementation trials that occur under routine primary care conditions in order to provide knowledge about factors that affect external validity such as determinants of practice and context-related information. Implementation trials are focused on designing specific strategies to enhance the population outcomes and encourage the adoption and implementation of evidence-based interventions in routine practice (Sanchez et al., 2015). It is important to conduct these types of trials as they can provide data on both the process and results of PA interventions. Particularly, implementation trials can be conducted on the EPR tool as many of its components are effective and would reveal the process and the results of the EPR tool in real primary care conditions. The inclusion of other behavioral techniques to the EPR tool such as self-monitoring, contracting, and the consequences as well as the effectiveness of cognitive techniques of the EPR tool (i.e., the second page) can be researched in implementation trials as well. Specifically, Campbell et al. (2012) noted that the ineffectiveness of educational materials (i.e., cognitive techniques) could relate to the quality of the content of these messages. The content quality of educational cognitive messages can be researched by psychologists who specialize in the psychology of advertisement.

Future research can explore the effectiveness of the content of different components of PA interventions. For example, it was unclear what content was in consequences in the studies meta-analyzed by Campbell et al. (2012). Furthermore, research on the effectiveness of different types of self-monitoring such as mobile phones with apps and wearable technology is warranted. Other technology can be researched within the EPR tool. For example, the FITT principle of PA personalized goals can be
integrated with different intensity PA programs on video and electronic applications that are gaining increasing popularity as they usually require no gym or equipment, and they can be competed at home within 10 to 30 minutes.

Further studies are warranted on comparing effectiveness of brief and very brief (i.e., < 5 min interventions) PA interventions as there is a potential of completing the EPR tool in less than five minutes. In addition, the research on the type of PA intervention and its effective components during a follow-up visit is necessary as the content of the follow-up visit is under-researched.

Further study is also warranted regarding effective PA interventions and their long-term impact on disadvantaged populations. Many PA interventions evaluated in the literature selected for this integrative literature review have been stopped after a trial ended. It is possible that there were difficulties of integrating them within routine primary care delivery services. The time is the main proxy of barriers related to integrating PA intervention in primary care practices (Campbell et al., 2012). Further studies must be conducted on strategies for a successful and cost-effective integration of, for example, EPR tool into primary care delivery services as it is an effective intervention that can be delivered within five minutes and consists of only one double-sided page. Psychology experts in semantics and advertisement can be included in the expert panel of updating the EPR tool’s key messages and its visual design that can significantly affect an uptake of PA recommendations. Studies on attitudes of primary care patients toward the EPR tool can also contribute to increased efficacy of this tool.

Finally, as suggested by Michie et al. (2015), the proposed paradigm by Collins, Murphy, and Strecher, (2007), known as the MOST approach (the Multiphase Optimization Strategy approach), can be deployed to test combinations of behavioral technique components for optimizing interventions. Using fractional factorial designs, Collins et al. (2007) advocated selecting combinations of behavioral techniques for testing based on both theory and accumulated evidence. These methods have an
advantage in that they not only provide evidence of effective combinations, but they also efficiently test theoretical propositions about the synergistic effects of constructs (Michie et al., 2015).

**Limitations**

Combining data for the purpose of this review was met with some limitations in the literature review process. For example, only English studies which were electronically indexed and available via databases were included in the research collection. In addition, the literature search was conducted by one author which possibly introduces publication bias or the omission of current relevant papers. However, additional search methods did not identify additional relevant papers. High quality research such as systematic reviews was selected for this study to obtain creditable evidence on the effectiveness of PA interventions. It was outside of the scope and length of this study to review multiple single RCTs to obtain credible evidence related to the effectiveness of PA interventions. Besides, most primary studies selected for this review had a certain degree of heterogeneity which was reduced with statistical methods. These methods are unavailable for a literature review design. Many research papers evaluated were not specific to NP primary care practice nor were they conducted under routine primary care conditions, though the majority of papers carried wide relevance to that practice. In some cases, selected samples were not representing the primary care population with a possible selection bias of a motivated population to be engaged in PA intervention trials.

The author of this review has had 10 years of competitive sports experience with continuous fitness engagements and fitness coaching. Such experience may have introduced some bias in the interpretation of the literature and the following conclusions. In addition, the author of this review has five years of experience in psychology and related research in semantics as well as psychology of advertisement. Despite this personal experience, the author of this review has been focusing on unbiased interpretation of primary sources as suggested by Whittemore and Knafl (2005).
The evidence in primary studies of this literature review combined studies conducted in the United States, Australia, New Zealand, Switzerland, Spain, Canada, Sweden, Italy, Germany, and the Netherlands. The applicability of evidence from studies conducted outside Canada must be considered carefully, especially where health care systems (and primary care in particular) differ in terms of access, costs, and remit. However, these countries, as noted by Campbell et al. (2012), belong to The Organization for Economic Cooperation and Development (OECD) countries, which gives some external validity in terms of applicability to the Canadian population. In addition, most of the studies were conducted relatively recently, meaning that the cultural attitudes to increasing physical activity, as noted by Campbell et al. (2012), should not have significantly influenced generalizability. Finally, after a careful review, recent Canadian PA guidelines are based on the mix of the studies from OECD countries which suggests generalizability of the findings to Canada.

**Conclusion**

Physical inactivity is the largest contributor to a leading threat to global health of non-communicable diseases (WHO, 2008). In Canada, four out of five adults do not meet Canadian Physical Activity Guidelines (Statistics Canada, 2015b; Public Health Agency of Canada, 2016). Primary care providers play an important role in the propagation of PA recommendations with PA interventions conducted in primary care to a broad segment of the Canadian population (Thornton et al., 2016). PA benefits are well studied, and primary care recommendations suggest implementation of PA interventions in primary care. However, these recommendations lack the evidence on the effectiveness of PA interventions. This integrative literature review attempted to synthesize recent evidence that can help to develop a new and a deeper understanding of PA interventions’ effectiveness as a phenomenon that is under-researched and under-represented in the current PA guidelines. A comprehensive search of the contemporary literature was undertaken, and 13 studies were selected for this review. The evidence was critically appraised on the basis of the strengths of the evidence, its relevance to the research
question, and to the Canadian health care context. Key findings from this integrative review included the evidence that brief, five-minute PA interventions in primary care are effective, and the effects of even from a single encounter can last up to 12 months. These interventions should be conducted on a regular basis considering NNT = 12 to 25. More intensive interventions are less suitable to primary care settings and can incur cost-implications to patients; PA prescription is an important and effective therapeutic agent. A simple referral to PA specialists, gyms, or community resources without prescribing PA and considering other effective components that work synergistically has poor effectiveness. In addition, to maximize the effect of PA promotion, targeting a specific population would result in the overall decrease of the effect as the association of effectiveness of PA intervention is independent of patient characteristics such as sex, age, or chronic condition. Recommendations for practice were presented as an evidence-based Physical Activity (PA) Intervention Effectiveness Appraisal Checklist that can be used both as an active learning tool and a tool that can inform practice facilitating the effort of promoting PA through primary care. Two Canadian PA interventions were appraised based on the findings. As a result, the Exercise Prescription and Referral (EPR) tool was considered the most effective tool available in Canada. This finding is reflected in the recent Canadian Academy of Sport and Exercise Medicine recommendations, though without the appraisal of the effectiveness of this tool. In addition, practical applications of the data synthesis of this review related to primary care routine practice were presented along with recommendations on utilizing the EPR tool with suggested other effective components.

Finally, recommendations for further research that builds upon gaps in the existing literature and examines long-term outcomes were presented. The recommendations for education included the need for primary care providers to build upon their knowledge, follow clinical guidelines, practice recommendations, and lead by example with empathy. In conclusion, this review shows that nurse practitioners in primary care have the capacity to facilitate and improve PA levels for their adult
populations with or without underlying chronic conditions. This literature review adds to the current literature regarding PA promotion in primary care and indicates important concepts related to the effectiveness of PA interventions in primary care settings. It also shows that primary care providers play an important role in PA promotion, and with the use of effective PA intervention, brief protocols can maximize their effort of promoting PA in the Canadian population while increasing their confidence in their remit and role of the interventions they are using. This is particularly important in light of the epemics of non-communicable diseases such as cardiovascular diseases, cancer, diabetes, and obesity related to low PA levels and sedentary lifestyles in Canada.
References


Appendix A

Suggested Evidence-based Components of Physical Activity Interventions

Cognitive Techniques Components

1. “Exercise is prescribed because it is as effective and sometimes more effective than drugs to prevent and treat many chronic diseases such as heart disease, hypertension, diabetes, osteoporosis, anxiety disorders and depression!” message can follow PA prescription behavioral technique

2. “There is an alternative pedometer target of 10,000 steps a day” note can be added to “Canadian Physical Activity Guidelines for Adults 18 Years and Older” message

Behavioral Techniques Components

1. Negative consequences of physical inactivity: It increases your risk of developing high blood pressure, coronary heart disease, feelings of anxiety and depression, colon, breast, lung, and endometrial cancers. Physical inactivity decreases your chances of living longer! If you are overweight or obese, physically inactivity significantly increases your risk for many chronic diseases.

2. Examples of physical activity have to be understood as a behavioral technique component that is modeling of physical activity behavior

3. Self-monitoring technique has to cover both sedentary time and exercise time in minutes or in steps. It can be recorded using journal logs, mobile apps or wearable devices

4. Individualized cues technique can be discussed with a patient. Consider discussing external cues to initialize physical activity such as alarms or driving to home after work, or internal cues to initialize physical activity such as desire to move after sitting a prolonged time.

5. Contracting technique with a patient’s signature. For example, to increase physical activity levels, a 10-minute walk every other day for 1 month or to reduce sedentary risks an intermittent standing for 40 seconds every hour using a timer for 1 month can be contracted with a patient.

6. Follow up technique can be deployed every 6 -12 months. During a follow-up visit physical activity prescription can be refilled, physical activity goals, progress, updates on self-monitoring data can be discussed and recorded. A standardized/designed by experts follow-up visit would most likely be time-efficient and suitable for primary care.

7. Referral for additional assessment, counseling, and community resources can be offered during physical activity intervention encounter if there is a coverage and/or personal resources and/or preferences present.

8. Rewards, self-rewards, social support (e.g., a workout friend) behavioral techniques.
Appendix B

**Footnotes Table 2**

** Add exercise vital sign (EVS) to paper or electronic medical record (EMR) program along with other vital signs. EVS assessment can be done in a waiting room by a medical office assistant (MOA). The EVS results can be populated in an EMR.

*** Safety considerations: Gradual progression in PA by a sedentary patient with stable chronic conditions and a normal history and physical is associated with low rate of CV events that further formal CV testing is not indicated. Other possible side-effects/barriers of PA are not directly related to PA and could require additional counselling to a brief PA intervention. This additional counselling in primary care has lack of evidence of increasing PA levels. Remember that number needed to treat of a brief PA intervention = 12-25 implying a population-wide approach. PA would not be a universal option to treat and prevent chronic diseases to all patients; therefore, other options can be considered such as medications, or referrals to other health care providers such as kinesiologists or other PA specialists. Patients’ cost implications have to be considered.

**Footnotes Table 3**

* Behavioral techniques such as physical activity (PA) prescription, goal-setting, self-monitoring, follow up, consequences, cues, contracting, modeling of PA behavior and social support have a synergistic additive effect

** Cognitive techniques are those that target knowledge, attitudes, or beliefs (e.g., PA education, PA educational material). Short cognitive messages related to behavioral techniques can work synergistically increasing effectiveness of interventions.

*** Referral to PA specialists (e.g., kinesiologists or supervised exercises) instead of PA intervention does not increase PA levels in primary care patients. Referrals to PA specialists or gyms can be offered in primary care if a patient has resources or asks to be referred. Free community resources can have no cost impact to patients.

**** It does not imply that disadvantaged population should be excluded from the provision of PA interventions in primary care. Perhaps, number needed to treat would be larger.