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Barriers to Prescribing Exercise in Clinical Practice to Treat Mild-to-Moderate Depression

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A thesis submitted in partial fulfillment of the requirements for the Master of Science degree in Health and Rehabilitation Sciences

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Abstract

The benefits of incorporating physical activity to moderate the effects of various chronic diseases have been well documented; however, some settings of clinical practice fail to utilize these benefits to treat conditions such as mild-to-moderate depression. To improve the integration of physical activity as a prescribing practice to treat depression, a better understanding of patient attitudes towards physical activity is needed. Various barriers exist when attempting to prescribe exercise for patients diagnosed with depression. Due to the symptoms of depression, patients often report various barriers and difficulty to engaging in exercise such as deficits in motivation, low energy levels and fear of injury. This scoping review will address these barriers to facilitate the development of effective exercise strategies, thereby increasing exercise adherence rates for patients looking to manage their mild-to-moderate depression without the use of pharmacotherapy; as the safety and efficacy of these drugs have been heavily debated when attempting to treat mild- to-moderate depression.

Keywords: *Exercise, physical activity, depression, barriers*

*This thesis is dedicated to my mother – Manal Hanna – who 's never stopped believing in me
and has been one of my biggest inspirations throughout my life.*

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Table of Contents

Abstract	i
Table of Contents	iv
List of Figures	vi
List of Appendices	vii
Chapter 1	1
1 Background	1
1.1 Defining Exercise and Physical Activity	5
1.2 Efficacy of Antidepressants & The Irving Kirsch Meta-Analysis	6
1.3 Evidence for Treating Mild to Moderate Depression with Exercise:	9
1.4 Barriers and Facilitators to Prescribing Exercise in Clinical Practice	12
1.5 Limitations Associated with Exercise Prescriptions and Physician Behaviors	15
1.6 Exercise Prescriptions to Treat Depression	16
1.7 Addressing Gaps in Literature and Defining the Research Purpose	19
Chapter 2	22
2 Methods	22
2.1 Scoping Review Methodologies	22
2.2 Citation Management	24
2.3 Eligibility Criteria	24
2.4 Title and Abstract Relevance Screening	25
2.5 Data Classifications	25
Chapter 3	27
3 Results	27
Chapter 4	29
4 Discussion	29

4.1 Mental Symptoms of Depression.....	30
4.2 Time Related Barriers.....	32
4.3 Barriers Associated with Self-esteem and Self-efficacy.....	34
4.4 Motivation.....	35
4.5 Barriers Associated with Environmental Access and Resources.....	37
4.6 Barriers Associated with Fatigue and Low Energy Levels.....	38
4.7 Barriers Relating to Social Support	39
4.8 Understanding and Combating Fear of Injury	41
4.9 Barriers Associated with Poor Health and Physical Symptoms of Depression	42
Chapter 5.....	45
5 Conclusion	45
References.....	51
Appendices.....	63
Curriculum Vitae	81

List of Figures

Figure 1: PRISMA Article Procurement Summary	79
Figure 2: Summary of Data Extraction and Article Analysis	80

List of Appendices

Appendix A: Summary of Exercise Recommendation for General Health Including Mental Health Recommendations for Adults 18-64 years old.....	63
Appendix B: Depression Specific Recommendations for Prescribing Exercise in Clinical Care.....	65
Appendix C: Summary and Analysis of Articles including Primary Data Results	66
Appendix D: Database Specific Search Strategies Summary.....	78

Chapter 1

1 Background

Depression is a common cause of morbidity and mortality worldwide. According to the World Health Organization (WHO), it is estimated that approximately 350 million people worldwide are afflicted with depression (Kessler & Bromet, 2014). Furthermore, by 2020, the global burden of depression is predicted to be the second most disabling illness worldwide, following ischemic heart disease (Mala, Karkou, & Meekums, 2012). Depending on severity, depression can dramatically reduce quality of life, while negatively impacting both physical and mental health (Gm et al., 2013). The severity of the disorder is categorized using the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-V) and is divided into one of seven severity descriptors: mild, moderate, severe, with psychotic features, in partial remission, in full remission, or unspecified (Uher, Payne, Pavlova, & Perlis, 2014). This literature review will focus exclusively on studies that included patients who were diagnosed with mild to moderate depression, and will therefore not include patients who were diagnosed with the other six severity identifiers.

The DSM-V outlines the disorder as one or more major depressive episodes without a manic or hypomanic episode (Uher et al., 2014). Manic episodes refer to the unusual mood changes that occur in patients with bipolar disorder. Manic episodes are characterized by periods where a patient will express an extremely abnormal amount of elation and hyperactivity, that may lead to irrational behaviors, irritability, trouble

sleeping and impaired impulse control (Strober, 1992). Hypomanic episodes refer to a manic episode where a patient expresses symptoms typical to a manic episode, however, the intensity of the episode is less severe (Hasson, Caldwell, & Emmerik, 2009; Strober, 1992). The DSM-V guidelines help differentiate major depressive disorder from bipolar disorder by highlighting the fact that the combination of manic and depressive episodes are distinctive to bipolar disorder, whereas those with major depressive disorder will not have manic episodes (Uher et al., 2014).

The DSM -V describes major depressive episodes as complying with five of the nine symptoms of depression throughout a two-week period, of which potential symptoms may include: subjective or observed depressed mood, loss of interest or pleasure (anhedonia), changes in weight or eating habits, insomnia or hypersomnia, psychomotor retardation or agitation, fatigue or loss of energy, worthlessness or excessive guilt, impaired concentration or indecisiveness, thoughts of death, as well as suicidal ideations or attempts (Uher et al., 2014). Notably, symptoms of depression exist on a spectrum that ranges from transient – relatively brief feelings of sadness – to severe – symptoms that dramatically impair quality of life (Rosenthal, 2008). Furthermore, it is mandatory that a patient exhibits either anhedonia (loss of interest) or depressed mood throughout the minimum two-week period for a diagnosis to be made (Uher et al., 2014). This literature review will classify depression according to the severity parameters set by the DSM-IV, in conjunction with the updated criteria of the DSM-V for mild depression (five or more symptoms of depression with minor functional impairment), moderate depression (five or more symptoms with moderate impairment) and severe depression (most symptoms are present and interfere with daily functioning) (NICE, 2009). The guidelines used also

correspond to the International Classification of Diseases (ICD)-10th edition, for categorizing mild-to-moderate depression (Baldwin et al., 2015).

Depression is considered a heterogeneous disease due to the fact that the severity of the disorder is determined by both the nature of symptoms as well as the degree of functional impairment expressed by the patient (National Institute for Health and Care Excellence, 2009). Depression is associated with cognitive impairments, increased risk of coronary artery disease, functional impairments, increased risk of substance abuse, and suicide (Sui et al., 2010). Depression is one of the leading causes of disability worldwide, however, most depressed patients do not actively seek out treatment – which can be detrimental to an individual's health – as it pervades every element of one's life (Busch et al., 2016). Symptoms of depression can dramatically hinder quality of life, as such, its impact may extend into a patient's personal or professional life. Symptoms such as sleep disturbance, psychomotor agitation or retardation, excessive fatigue, lethargy, feelings of worthlessness, combined with a reduced ability to concentrate on tasks can dramatically influence job performance, school expectations and social behaviors (Blumenthal, Smith, & Hoffman, 2012).

Antidepressants are commonly prescribed to treat depression and are often accompanied with psychotherapy, such as cognitive behavioral therapy (CBT) (Pedersen & Saltin, 2015). Recently, despite the prevalent use of antidepressants, there has been growing concern regarding both efficacy and side-effects of these drugs, resulting in numerous patients exploring alternative treatment methods to increase their quality of life (Pedersen & Saltin, 2015). Physical activity as a viable treatment option has emerged near the forefront of these discussions. For example, a prospective epidemiological study of

cardiovascular fitness and depression symptoms in men and women revealed that regular exercise was correlated with a lower incidence of depression, independent of other clinical risk predictors (Sui et al., 2010). Furthermore, in 2015, *the American Journal of Epidemiology* released a statement encouraging those at risk of depression to increase their levels of physical activity, after a prospective study discovered low physical fitness to be strongly associated with elevated depressive symptoms (Becofsky et al., 2015). For decades, researchers have been aware that a relationship between physical exercise and mental health exists, and research in this area has demonstrated that even a single bout of exercise can positively impact mood, enhance cognition, reduce stress and alleviate various symptoms associated with depression (Yeung, 1996). Conventional clinical practice in Canada has primarily focused on treating depression with antidepressant medications – especially in child and adolescent populations (Beck et al., 2005). Because antidepressant medications have been indicated as a potential standard for clinical practice, they have become one of the most prescribed classes of medication for patients with depression, following only those drugs used in treating attention deficit and hyperactivity disorder (ADHD) (Rotermann, Sanmartin, Hennessy, & Arthur, 2014). In 2013, The Organization for Economic Co-operation and Development (OECD) ranked Canada third for consumption of antidepressants among the 23 developed countries that were surveyed, with an average of 86 doses administered daily per 1000 people (OECD, 2013). The high prevalence and physician reliance upon antidepressant medications would theoretically be a positive indicator of the drugs' efficacy in treating depression; however, several studies, including the seminal Irving Kirsch Study (Kirsch et al., 2008), have suggested otherwise.

1.1 Defining Exercise and Physical Activity

Exercise, physical activity and physical fitness are all terms that describe various types of bodily movement, however, these terms are not synonymous. The WHO defines physical activity as any bodily movement produced by skeletal muscles that requires energy expenditure (Cecchini, Fernández-Río, Méndez-Giménez, Carriedo, & Arruza, 2017). Exercise, is defined as a planned, structured, repetitive movement of the body designed to enhance or maintain physical fitness (Ceria-Ulep, Tse, & Serafica, 2011; Insel, Roth, Irwin, & Burke, 2011). Skill-related fitness is defined as physical abilities that contribute to performance in a sport or activity, including speed, power, agility, balance, coordination and reaction time (Insel et al., 2011). The similarities between exercise, physical activity and skill-related fitness include: bodily movement requiring muscle contractions, heat generation and energy expenditure, and both positively increase physiological adaptations (Caspersen, Powell, & Christenson, 1985). However, exercise differs from physical activity due to the planned, repetitive and structured nature of movements during exercise. It is also important to note that the primary objective of exercise is to improve or maintain a specific physical fitness component such as aerobic capacity, muscular endurance and muscular strength, whereas every day physical activity does not address such a goal (Caspersen et al., 1985; Seth, 2014). This paper will include articles that used either physical activity or exercise as interventions to ensure that the current literature is adequately represented and a broad scope of literature is reviewed.

1.2 Efficacy of Antidepressants & The Irving Kirsch Meta-Analysis

Antidepressants were placed under the spotlight following the Irving Kirsch's 2008 publication, which suggested that the therapeutic impact of antidepressant medications may be attributed to the placebo effect (Kirsch et al., 2008; Moncrieff & Kirsch, 2005; Penn & Tracy, 2012). Kirsch and his colleagues conducted a meta-analysis of six antidepressant medications, accounting for the majority of commonly prescribed antidepressants at the time (Kirsch et al., 2008). By utilizing the Freedom of Information Act and requesting all publically releasable information about the clinical trials for efficacy of the following medications: fluoxetine, venlafaxine, nefazodone, paroxetine, sertraline and citalopram, the meta-analysis revealed that when all 35 randomized controlled trials were included and accounted for – including four previously unpublished trials – the medications failed to show any statistical significance over placebo alternatives (Kirsch et al., 2008; Moncrieff & Kirsch, 2005). The placebo effect is characterized as a physiological response after administration of a pharmacologically inert medication (Finniss, Kaptchuk, Miller, & Benedetti, 2010). The study avoided publication bias by evaluating a dataset that included the complete data set from all trials for each medication and specifically analyzed the data submitted to the Food and Drug Administration for licensing agreements (Kirsch et al., 2008). Meta-analysis for all FDA approved antidepressants between 1983 and 2008 indicated that, 82% of the time, a substantial amount of the relief patients were experiencing could be attributed to the placebo effect rather than to the medications themselves (Kirsch et al., 2008; Penn & Tracy, 2012). This analysis suggests that these antidepressant medications fail to show any clinically significant advantage over inert placebo, which may be concerning when

considering the fact that these medications have an extensive side effect list (Kirsch, 2013). Due to the psychoactive nature of antidepressants, Kirsch (2013) highlighted that misdiagnoses and over-prescription of these medications may have dire consequences for patients; patients who do not meet the criteria for antidepressant use may develop a biological vulnerability due to the neurochemical changes caused by the drug, which would actually increase their risk of developing depression in the future (Kirsch, 2013; Penn & Tracy, 2012). Additionally, use of antidepressants are often accompanied with a plethora of side effects including, but not limited to: sexual dysfunction, long-term weight gain, nausea, diarrhea, drug dependency, insomnia, and – perhaps most disturbingly – suicidal ideation (Moncrieff & Kirsch, 2005).

A later meta-analysis conducted by Walsh et al. (2015), examined the impact of the placebo effect on antidepressant medication and found that as public knowledge of antidepressants increased, the response to the medications – as well as the impact of the placebo effect – for depression also increased, for the 75 trials included in the study (Walsh, Seidman, & Sysko, 2015). The researchers concluded that patients' beliefs about the effectiveness of a medication can influence the effect of prescribing it on the patient. (Scott, 2012).

The potential severity of antidepressant side effects is something that was addressed in 2004 when the FDA issued a mandatory black box warning label on all antidepressant medications (Friedman, 2014). This practice was an attempt to ensure that patients were aware of the fact that the drugs were known to be associated with an increased risk of

suicidal behaviors and ideations, especially in adolescent populations (Friedman, 2014). While this decision was highly debated within the medical community, the FDA continues to believe that these warnings should remain on the prescription drug labels, as they are designed to call attention to serious or life-threatening risks (FDA, 2012). Over the past decade, the rise in the use of antidepressant medications as a first line treatment for depression may be attributed to the influential endorsements of various governing bodies. The National Institute for Health and Clinical Excellence (NICE) advocated that antidepressants – specifically selective serotonin reuptake inhibitors (SSRI) – be used as a first line treatment for moderate to severe depression, however, patients with mild depression are encouraged to seek self-help programs such as computerized cognitive behavior therapy or physical activity as a first line treatment (NICE, 2009). This recommendation has been widely accepted by clinicians worldwide (Moncrieff & Kirsch, 2005). Furthermore, throughout the 1990s, the Defeat Depression Campaign across North America contributed to the 253% rise in the number of antidepressant prescriptions over a 10-year time span (Moncrieff & Kirsch, 2005). This rise in annual prescriptions may be concerning as various SSRIs have been linked to an increased risk of suicidal behaviors, especially in adolescent populations (Nischal, Tripathi, Nischal, & Trivedi, 2012). As such, many believe that antidepressants should not be used as a first line of treatment for mild-to-moderate depression, but rather, they should only be used when all other interventions such as cognitive behavior therapy or exercise have been exhausted or failed to show a significant reduction in depressive symptoms (Moncrieff & Kirsch, 2005; Pedersen & Saltin, 2015; Walsh et al., 2015). Cognitive behavior therapy is defined as a form of psychotherapy that combines two

therapeutic approaches – cognitive and behavior therapy – and is used to treat various psychiatric disorders such as depression and anxiety (Hofmann, Asnaani, Vonk, Sawyer, & Fang, 2012).

1.3 Evidence for Treating Mild to Moderate Depression with Exercise

The efficacy and safety concerning the use of antidepressant medications as a means of treating mild-to-moderate depression has been highly debated over the last decade (Carek, Laibstain, & Carek, 2011b). The ambiguity and uncertainty regarding the use of antidepressants as an effective medication has left many patients diagnosed with depression searching for alternative forms of treatment. Since the early 1900s, researchers have been interested in the association between physical activity and its ability to alleviate symptoms of clinical depression (Craft, Perna, Freund, & Culpepper, 2008). Various medical authorities, such as the Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM) have endorsed the notion of prescribing physical activity to the general population in order to reduce the risk of chronic diseases, including depression (Peluso & Guerra de Andrade, 2005). One study revealed that, at best, exercise should be used as a potential treatment for depression and, at the very least, physical activity should be recommended as a complimentary treatment for depression to help reduce depressive symptoms and the risk of relapse (Blake, 2012). Furthermore, a correlational study found that regular exercise is negatively associated with the risk of developing or expressing depressive symptoms, which suggests that individuals who exercise regularly are at a substantially lower risk of being diagnosed with depression (Josefsson, Lindwall, & Archer, 2014)

Recently, a Cochrane systematic review examined 37 trials that focused on reducing depressive symptoms via exercise and concluded that exercise is more effective than a control intervention for reducing depressive symptoms. Additionally, the review revealed that exercise is also comparable to both psychological and pharmaceutical interventions; however, further research incorporating larger sample sizes is required in order to make definitive conclusions (Gm et al., 2013).

Emphasis on the importance of aerobic exercise in the treatment of depression has been documented (Scully, Kremer, Meade, Graham, & Dudgeon, 1998). Many scientists believe that the “runner’s high” (a phenomenon caused by cerebral and/or peripheral endorphin release eliciting the sensation of euphoria and an opiate-like pain relief) may be the underlying mechanism of action regarding why aerobic exercise is so beneficial for the treatment of depression. However, the exact mechanistic effect of exercise on depression pathology remains heavily debated amongst researchers (Craft & Perna, 2004; Gm et al., 2013; Pedersen & Saltin, 2015). Experimental studies have shown a therapeutic benefit for aerobic and resistance exercise in the treatment of depression, with no statistically significant difference with regards to efficacy between either intervention (Fox, 1999; Sharma, Madaan, & Petty, 2006). Nevertheless, emergent research has found that the role of neurogenesis may be pertinent in the treatment of depression and exercise may enhance the function of the hippocampus, a region of the brain that is greatly reduced among those diagnosed with depression (Blake, 2012). Exercise-induced changes in neurochemistry is further supported by the monoamine hypothesis which states that exercise leads to a considerable increase in the availability of various brain

neurotransmitters such as dopamine, serotonin and norepinephrine – neurotransmitters that are often reduced in patients with depression (Craft & Perna, 2004).

Epidemiological studies have indicated that those who engage in regular physical activity are at a substantially lower risk of being diagnosed with depression or expressing symptoms of depression (Hassmén, Koivula, & Uutela, 2000; Pedersen & Saltin, 2015; Professional Associations for Physical Activity, 2010) Furthermore, regular exercise has been associated with enhanced psychological well-being, and there also appears to be a strong correlation between sedentary behavior and rates of depression (Hassmén et al., 2000; Pedersen & Saltin, 2015). A direct correlation has yet to be established between exercise and depression, as such, various critics have proposed that it may be a case of reverse causation suggesting that exercise does not reduce depression, rather depression, may reduce exercise adherence (Godwin, 2003). However, large scale studies and meta-analyses continue to reinforce the notion that exercise has a substantial positive impact on mood, cognition and depressive symptoms (Cooney et al., 2013; Josefsson, Lindwall & Archer, 2014; Ellis, Randall & Punnett, 2013).

The National Institute of Clinical Excellence (NICE) outlines several treatment recommendations for patients with mild-to-moderate depression, as well as those with chronic, sub-threshold depressive symptoms; such recommendations include: individual guided self-help cognitive behavioral therapy (CBT), online or computerized CBT, and structured group exercise regimens (NICE, 2009). These guidelines further recommend that the aforementioned treatment options be combined in conjunction with one another

to increase the treatment success rate (Searle et al., 2011a, 2012, 2014). With regards to pharmaceutical interventions – specifically antidepressants – the recommendations dictate that antidepressants should not be used habitually to treat patients with sub-threshold depressive symptoms or mild-to-moderate depression due to the limited efficacy and risk-benefit ratio (Searle et al., 2014). Nevertheless, antidepressant therapy should be used for patients that fail to show a response to non-pharmacological therapies, which suggests that the patient may be exhibiting symptoms more commonly associated with severe depression (Daskivich et al., 2015).

1.4 Barriers and Facilitators to Prescribing Exercise in Clinical Practice

A sizable and considerable body of evidence has shown the benefits of exercise for those afflicted with depression as both a preventative and treatment intervention (Gm et al., 2013; Mina et al., 2012; Pedersen & Saltin, 2015). Based on the current literature, patients with depression should have access to exercise support and programming, however, exercise prescriptions remain underutilized in patient care (Mina et al., 2012). Common barriers to the implementation of exercise prescriptions in clinical practice include, but not limited to, lack of education, limited resources and requiring more time to address patient needs (Mina et al., 2012).

Physical activity practices among physicians have also been correlated with perceived importance of the benefits of exercise, as well as the likelihood of prescribing exercise to their patients (Holtz, Kokotilo, Fitzgerald, & Frank, 2013; Mckenna, Naylor, & Mcdowell, 1998; Ng & Irwin, 2013). However, a study conducted across medical schools in Canada found that only 64% of medical students adhere to a regular physical activity

program that met the recommended moderate-to-vigorous physical activity requirements set by Health Canada and of those physicians surveyed, only 25% discussed physical activity counseling with their patients, as such, physician's own personal activity habits appears to impact willingness to prescribe exercise (Ng & Irwin, 2013). McKenna and colleagues (1998) found that physicians who are in the action or maintenance stage of modifying their own physical activity behaviors were up to three times more likely to regularly promote their experiences and encourage their patients to engage in such behaviors. The study concluded that readiness to change in medical professions with regards to exercise prescription is heavily influenced by personal physical activity behaviors (Mckenna et al., 1998).

A growing body of evidence suggests that both physical activity and exercise may be instrumental in treating and preventing depression; however, it is important to note that limitations exist when adhering to exercise prescriptions (Josefsson et al., 2014; Pedersen & Saltin, 2015; Searle et al., 2014). Currently, patients afflicted with depression are often referred to an exercise program without any additional support systems. As such, recent evidence indicated that there was little support for the effectiveness or impact of these exercise interventions due to: low levels of adherence to such programs, inconsistent levels of motivation, and lack of social support when prescribed for overall health outcomes (Busch et al., 2016; Schuch et al., 2016a; Searle et al., 2012; Taylor, Sallis, & Needle, 1985). These obstacles all present complications when attempting to prescribe exercise as a means of treating depression (Schuch et al., 2016b; Searle et al., 2014). Clinicians have noted that addressing such barriers to physical activity are likely

to be multifactorial, with both patients and physicians perceiving low motivation levels and lack of confidence to be substantial barriers for depressed patients looking to engage in a new treatment regimen (Cheifetz, Dorsay, & MacDermid, 2015; Searle et al., 2014). Regardless of these barriers, however, patients with depression continue to view exercise as an alternative coping mechanism to help keep their depressive symptoms in remission, following initial stabilization with medication (Searle et al., 2014).

Adherence to behavioral interventions such as exercise has been a growing concern for both depressed and non-depressed patients (Krogh, Lorentzen, Subhi, & Nordentoft, 2014). As such, clinicians may remain hesitant to prescribing exercise for patients with mental illness due to the difficulties associated with treatment adherence. Various studies which analyzed patient attendance rates suggested that plausible explanations for patients' failure to comply with treatment plans included a myriad of factors, such as: complications to access appropriate resources, financial limitations, and various side-effects associated with prescribed medications to treat their condition (Crone, Johnston, Gidlow, Henley, & James, 2008; Krogh et al., 2014). A possible explanation for these findings is that current practice does not adequately consider the patient's social network and support – among other factors – which may be essential to ensure that physical activity programs are successful (Crone et al., 2008). As such, clinicians should consider these factors prior to prescribing exercise as a form of treatment in order to increase the likelihood that patients will experience positive results (Krogh et al., 2014).

1.5 Limitations Associated with Exercise Prescription and Physician Behaviors

The benefits of exercise to treat chronic disease has been well documented, however, experts in the field believe that several factors must be considered by clinicians to ensure that prescriptions are tailored to the individual needs of the patient (Holtz et al., 2013; Malt, 2008; Ng & Irwin, 2013). A major limitation with regards to exercise prescription appears to be a lack of education and focus during undergraduate studies for medical students, however, physician attitudes towards lifestyle counselling may have a greater impact on exercise prescription rates and willingness to advocate for the use of exercise to treat mild to moderate depression. A survey of undergraduate medical students at the University of British Columbia examined the lifestyle counselling attitudes and practices among fourth year medical students to address future physician prospective about exercise. The study found that 76% of students felt that discussing the benefits of exercise to patients is important in their own personal practice, however, 69% of students felt that they only receive a modest amount of training on the subject (Holtz et al., 2013). Additionally, 80% endorsed that physicians should adhere to a healthy personal lifestyle to successfully encourage their patients to do so and 90% believed that their credibility would increase if they personally were physically fit (Ng & Irwin, 2013). Creating and implementing strategies for physicians to utilize may be the key to increasing exercise adherence rates following a prescription (Holtz et al., 2013). As such, medical schools should address this gap in education to equip future physicians with the necessary resources to adequately prescribe exercise as a treatment for depression. However, there are efforts in place to address this problem such as the Exercise is Medicine (EIM) movement, an organization managed by the American College of Sports

Medicine (ACSM). EIM is growing across Canada with the ACSM mandate to help increase exercise prescription rates across Canada and provide resources for physicians to use to increase efficacy and specificity of exercise prescriptions as a form of treatment for various chronic disease.

1.6 Exercise Prescriptions to Treat Depression

A gap with regards to mortality exists between patients with depression and the general population, with studies suggesting that those suffering from the disorder have an estimated 17-year decrease in life-expectancy (Nordentoft et al., 2013). The reduction in life expectancy was generally believed to be the result of higher rates of suicide and accidents associated with mental illness. However, recent research has shown that those with depression have an increased prevalence of medical co-morbidities compared to the general population, such as, but not limited to, higher rates of cardiovascular disease, cancer and diabetes (Nordentoft et al., 2013). Furthermore, researchers have identified various lifestyle and behavioral similarities among depressed populations in terms of diet, smoking rates and levels of physical activity (Krogh et al., 2014). Low levels of physical activity and exercise are associated with an increased risk of cardiovascular disease, diabetes, metabolic diseases as well as all-cause mortality; coupled with the fact that patients with depression are less likely to engage in physical activity, it is not surprising to find that this population will have higher rates of chronic disease (Krogh et al., 2014). A meta-analysis conducted by Luppino and colleagues found a reciprocal relationship between depression and obesity, suggesting that body composition, as well as body-image related disorders, may have a considerable impact on depressive symptoms (Luppino et al., 2010). Moreover, the study found that depression was associated with an

18% increased risk for obesity, suggesting that depression may be predictive of developing obesity (Luppino et al., 2010). Furthermore, antidepressant medications have been associated with changes in body weight – primarily weight gain – which may impact the benefits of the medication due to the link between body composition and developing depression (Serretti & Mandelli, 2010). As such, interventions that incorporate physical activity to treat depression may be an essential component of treatment for those at risk of developing obesity, especially in pediatric and adolescent populations, as being overweight is often associated with higher rates of depression, anxiety, peer isolation, discrimination, low self-esteem, low self-concept, low social cooperation skills and poor health related quality of life (Xie et al., 2010). These studies confirm the importance of incorporating physical activity programs into depression treatments, regardless of whether or not the patient is given pharmacotherapy or alternative treatment.

Unlike traditional pharmacotherapy prescriptions, exercise prescriptions do not have a standardized dosage that can be easily administered to patients. Nevertheless, there are guidelines that exist which allow physicians to prescribe exercise as a means of treating depression—guidelines which also have the potential to ensure that these prescriptions are patient specific. The American Journal of Preventative Medicine published a study that examined the relationship between the ‘dose’ of exercise prescribed, and the impact that this dose had on patients’ depressive symptoms (Dunn, Trivedi, Kampert, Clark, & Chambliss, 2005). The goal of the study was to determine whether or not increasing the total amount of exercise per week would have a higher therapeutic effect in reducing

symptoms of depression for those with mild-to-moderate depression (Dunn et al., 2005). The study was conducted over three years (1998-2001) using two subject groups. One group followed the ACSM recommended 'public health dose' of exercise per week (i.e., 150 minutes of moderate to vigorous physical activity). The other intervention group – aptly named the 'low dose' group – followed a modified recommendation; their exercise dose was approximately half that of the 'public health dose' recommended by the ACSM (Dunn et al., 2005). Appendix A highlights the recommendations for physical activity by ACSM, as well as other governing authorities in health and sports medicine. The researchers found that those who completed the recommended public health dose were able to see a substantial reduction in symptoms of depression, and therefore concluded that exercise could be seen as a viable treatment for mild-to-moderate depression. However, the study found that participants in the 'low dose' group did not show any improvements, in fact, their results were similar to the non-exercise interventions, suggesting that there is a minimum dose of exercise that a patient must abide by in order to observe a substantial reduction in depressive symptoms (Dunn et al., 2005). While several observational and interventional studies have evaluated the relationship between physical activity and depression, the optimal dose of physical activity required to prevent depression is not well known (Cecchini et al., 2017).

Adhering to general physical activity recommendations such as the 150 minutes of moderate-to-vigorous physical activity allows patients to receive overall health benefits, such as reduced risk of cardiovascular disease, metabolic disease and the benefits associated with mental health such as reducing symptoms of depression and anxiety,

however, when attempting to treat depression specifically, exercise prescriptions should be utilized. Research has shown that both aerobic and strength training can alleviate various symptoms of depression and anxiety (Kjellman, Martinsen, Taube et al., 2010). Furthermore, duration and intensity appears to play a major role in prescribing exercise for depression, suggesting that training sessions should be a minimum of 20 minutes, with optimal amounts between 30-40 minutes per session. (Kjellman, Martinsen, Taube et al., 2010).

1.7 Addressing Gaps in Literature and Defining the Research Purpose

The beneficial effects of exercise as an alternative treatment for mild-to-moderate depression are well known in the scientific community. Numerous studies have shown positive correlations between exercise engagement and a reported alleviation of depressive symptoms by patients; the majority of these studies have demonstrated that regular exercise engagement can result in positive outcomes for patients looking for an alternative to traditional pharmacotherapy as a means of treating mild-to-moderate depression (Blumenthal et al., 2007; Carek, Laibstain, & Carek, 2011a; Dunlop & Self, 2008; Gm et al., 2013; Pedersen & Saltin, 2015). These studies have also documented the most common barriers that patients report to engaging in exercise on a regular basis. To date, this is the first scoping review that examines these patient-reported barriers specifically; as such, this review attempts to address the gaps in the literature and thoroughly examine these reported barriers and possible solutions, thereby making exercise prescriptions a more viable option in treating mild-to-moderate depression. Understanding these reported barriers and creating strategies to overcome them will

allow physicians to cater exercise prescriptions to the specific needs of individual patients, while simultaneously allowing them to overcome patient resistance (Goldberg, 2008).

Exercise prescriptions can affect change in patients, in particular, patients who are the most motivated to change (Senter, Appelle, & Behera, 2013). However, despite the potential positive outcomes, many physicians do not incorporate exercise prescriptions into their practice (Senter et al., 2013). One study revealed that primary care physicians often failed to assess physical activity levels, nor did they monitor patient willingness to change when engaging in exercise, and often offered minimal support at best to help patients adhere to their prescribed exercise regimens (Senter et al., 2013). Taking all these factors into account, it becomes apparent that physicians need to take a proactive role in promoting and prescribing exercise if more patients are to benefit from receiving an exercise prescription; physicians must highlight that the benefits of exercise which extend beyond physical health and chronic disease (Chakravarthy, Joyner, & Booth, 2002).

Furthermore, studies have shown that physicians' personal physical activity levels appear to play an important role in their willingness to fully engage with patients when prescribing an exercise regimen as a means of treating mild-to-moderate depression. Another study revealed that female doctors who adhered to the CDC/ACSM physical activity recommendations were more likely to prescribe exercise and behavioral counselling (Lobelo, Duperly, & Frank, 2008). As such, lack of training and personal engagement seems to be a major factor for physician reluctance to prescribing exercise. One study found that medical students are interested and receptive to the importance of physical activity counselling, however, the study found that changes are needed within

current physician counselling behaviors to ensure that adherence and efficacy of these prescriptions are not compromised due to the lack of training physicians receive during their undergraduate years (Ng & Irwin, 2013). Furthermore, an additional study found that most primary care physicians inquired about their patients physical activity levels, however, only a few physicians actually prescribed physical activity or referred patients to the proper resources (Petrella, Lattanzio, & Overend, 2007). This furthers the notion that a lack of training, resources and confidence to prescribe exercise remains a major barrier to implementing physical activity as a treatment for mild to moderate depression.

Due to the complexity and multifactorial nature of depression, understanding barriers that cause patients to avoid physical activity may be a crucial step to increase the rates of exercise in this population. While numerous studies have shown the benefits of exercise in reducing symptoms of depression, to date, no study has classified and addressed the barriers that patients with depression report when attempting to engage in physical activity. Patients afflicted with depression would greatly benefit from regular, routine bouts of exercise to reduce symptoms of depression, improve mood, improve cognition while also benefitting from the secondary benefits of exercise in reducing cardiovascular disease and metabolic disorders, which appears to be present at higher rates amongst this population (Blumenthal et al., 2007; Gm et al., 2013; Pedersen & Saltin, 2015). As such, the current paper aims to address the various barriers to engaging in exercise commonly reported by patients following an exercise prescription or intervention.

Chapter 2

2 Methods

2.1 Scoping Review Methodologies

This scoping review was conducted using the Arksey and O'Malley methodology, the Levac et al. additions to the Arksey and O'Malley methodology and elements from the Joanna Bridge Institute (JBI) methodology (Briggs, 2015; Daudt, van Mossel, & Scott, 2013; Levac, Colquhoun, & O'Brien, 2010). One of the main reasons behind electing to conduct a scoping review over a traditional systematic review in this study was that a scoping review offered the ability to map key concepts of a specific research area in order to disseminate findings and identify gaps in the literature, thereby granting this study the ability to identify areas of research in this field that have not been comprehensively reviewed before (Wilson, Lavis, & Guta, 2012). Unlike systematic reviews, which are made to answer a specifically defined research question, scoping reviews are exploratory projects; they have the ability to map and gain a comprehensive grasp on a specific subject, identify key concepts and evidence, and – most importantly in this study – can be used to find gaps in a broad thematic area where little research or literature exists.

Furthermore, scoping reviews require systematic selection, collection, and summaries of existing literature in order to identify where there is sufficient need for researchers to conduct a full systematic review, or to address the fact that further primary research would be required in a specific area before a scoping review could be adequately

conducted (Pham et al., 2014). That being said, this scoping review was conducted with the same rigorous methodologies used in the systemic review process – it is simply the depth and types of analysis that differs.

In addition, scoping reviews offer researchers the opportunity to address and evaluate where research on a specific topic is lacking or inadequate; as such, scoping reviews often precede a systematic review due to the fact that they allow researchers to examine existing literature that is already available in the wider field (Briggs, 2015; Colquhoun et al., 2014). To ensure that this scoping review was conducted with adequate rigor, the six principles proposed by Levac et al (2010) were implemented which includes: 1) Identifying the research question by clarifying and linking the purpose of the study; 2) Investigating the feasibility of the review with the breadth and comprehensiveness of the topic; 3) Utilizing a team approach to selecting the appropriate studies; 4) Gathering and extracting data; 5) Incorporating a numerical summary and thematic analysis, reporting results and considering implications of the studies findings to practice and research; and 6) Incorporating consultation with stakeholders and translating the knowledge of the study (Daudt et al., 2013; Levac et al., 2010).

The search strategy was peer-reviewed, as well as completed and approved with the guidance of an experienced Health Sciences librarian to ensure key concepts – exercise, physical activity, mild-to-moderate depression and barriers – were linked according to the requirements of each database that was accessed. Appendix D illustrates the breakdown and individual search strategies used for each database. The search was conducted using

the following databases: PsychINFO, PubMed, Cochrane, and CINAHL. Articles gathered from the search were identified by screening search yields in the aforementioned databases, to ensure relevant literature was included. The study included sources from published articles. Both practical and methodological screening methods were applied. Practical screening methods were completed using the following criteria: date of publication (within the last decade), publication language (only materials written in English), age of participants (adults 18 years or older). Articles and studies from the same center were identified to avoid data set duplication and overlap. In such cases, the most recent and/or most extensively reported version of the study was included.

2.2 Citation Management

All citations were imported into the software-based bibliographic manager Mendeley (Elsevier, Amsterdam, Netherlands) and duplicated citations were removed manually by the student researcher. Citations were then imported into the web and mobile-based systematic review software Rayyan (Qatar Computing Research Institute, Doha, Qatar) for title and abstract relevance screening as well as data characterization of full articles. Rayyan is a systematic review software that allows multiple reviewers to collaborate and overlook articles by allowing researchers to accept or reject papers.

2.3 Eligibility Criteria

The relevance of studies identified in the search were examined using a two-stage screening process. Studies qualified for inclusion if they largely described either a barrier to prescribing exercise to treat depression. Due to limited accessibility for translation resources, only papers published in English were included. When the same data were

reported in more than one publication – such as the case in a journal article and electronic report – only the article reporting the most comprehensive data set were included. To ensure that the data collected included the most recent papers, only papers published within the decade were considered. Only studies that used adult subjects were considered. Studies that included pregnant women were excluded.

2.4 Title and Abstract Relevance Screening

Initial screenings were completed using the title and abstract of citations to ensure that resources were efficiently utilized in procuring articles that met the minimum inclusion criteria. Secondary screening was conducted by the primary researcher to screen both included and excluded articles individually and were reviewed individually by two reviewers. Title and abstract relevance screening protocol was developed and reviewed by the research team. Assigned reviewers – from the University of Western Ontario Health and Rehabilitation Sciences Department – congregated throughout the screening process to resolve conflicts, disagreements and consider any ambiguities related to the study selection as outlined in the Levac et al. scoping review methodology recommendation. Figure 1 illustrates the flow chart for the study selection process.

2.5 Data Classifications

Following initial screening, all citations considered relevant were procured for additional review of the full-text article. For articles that could not be attained through institutional holdings that were available to the author, efforts were made to contact the source author or journal for support in acquiring the article. Consistent communication between the research team was implemented to confirm relevance of papers gathered and

to extract study characteristics including: type of publication, year of publication, country, type of study, methods for data collection, outcome measures, study objectives, age of participants, sex, number of participants and findings. Studies were excluded if they were found to not meet eligibility criteria and disputes were addressed and resolved to ensure consistency amongst the research team.

Chapter 3

3 Results (n= 15)

After careful consideration, a total of fifteen studies were included in this scoping review; 10 of the studies included were quantitative, with the remaining 5 being qualitative. The various study characteristics and findings are illustrated in Appendix C. The main outcomes and barriers of each study examined were categorized into groups in order to then highlight and translate common themes that were then carefully considered and approved for further consideration by the research team. After an initial analysis of the fifteen articles selected, the themes and barriers to exercise presented in each were then classified into the following categories: early-life physical activity experiences, comorbidities, poor health, motivation, self-esteem or efficacy, psychosomatic complications, physical symptoms of depression, mental symptoms of depression, time, social support, environmental access/resources, confidence, fear of injury, enjoyment, and finally, deficits in energy and convenience.

Motivation, self-esteem, efficacy, time and environmental access/resources were the most common barriers reported to engaging in exercise; each factor was reported in seven different studies. Mental symptoms of depression – such as mood changes and self-deprecation – had the second highest number of occurrences and was reported in six studies. Poor health and deficits in energy or high levels of fatigue were reported in five studies. Fear of injury and lack of social support were, in turn, mentioned in four studies. Negative attitude towards exercise or lack of enjoyment, low levels of confidence and

physical symptoms of depression – such as body aches and physical pain – were reported in three studies. Two studies mentioned convenience and self-consciousness as barriers to engaging in exercise. Finally, early-life physical activity, comorbidities and psychosomatic complications were factors that were mentioned once. Figure 2 summarizes the main findings.

Chapter 4

4 Discussion

This scoping review revealed that there were many various barriers that were addressed throughout some, or all, of the 15 studies examined, including: motivation, self-esteem, efficacy, time and environmental access/resources available, symptoms of depression, poor health, fatigue, fear of injury, lack of social support, negative attitudes, convenience, self-consciousness, early-life physical activities, comorbidities, and psychosomatic complications. Given the fact that many of these barriers were highly prevalent throughout this scoping review, it becomes apparent that it is essential that both researchers and clinicians address these barriers to increase exercise adherence, especially when attempting to prescribe exercise in clinical practice as an alternative treatment method for mild-to-moderate depression. Thus, it is essential that researchers and healthcare practitioners have a thorough understanding of patients' perspectives and attitudes towards exercise adherence; the fact that these patients are diagnosed with depression requires a high level of empathy and compassion when understanding any difficulties that they may encounter when attempting to adhere to an exercise regimen. Clinicians must understand both the physical and mental symptoms that add an extra layer of difficulty to exercise adherence in this population; for patients diagnosed with mild-to-moderate depression, engaging in exercise may be an even more difficult task. However, if healthcare practitioners and clinicians can find ways to address and overcome these barriers and utilize exercise as a legitimate treatment for mild-to-moderate depression – if they can find ways to substantially increase adherence to a

prescribed exercise regimen – then it may be possible for exercise prescriptions to be used as a first-line treatment for mild-to-moderate depression. The possibility of using exercise as a first-line treatment method over traditional pharmacotherapy is both theoretically and practically attractive because it may help to reduce – or eliminate altogether – the risk of unwanted side effects typically associated with the use of antidepressant medications in patients that may not necessarily require pharmacotherapy to treat their depressive symptoms. However, further studies are required before more definitive conclusions can be made.

4.1 Mental Symptoms of Depression

Mental symptoms of depression such as guilt, loneliness, worry, and a constant condition of somatosensory amplification where psychological distress magnifies dysphoric physical sensations (Von ScD & Von Korff, 1996) – which often results in physical pain – were frequently cited as a common barrier to engaging in prescribed exercise regimens; they were included in about half of the studies examined. Lethargy in particular was a symptom of depression that frequently recurred in each of the studies examined in this scoping review, which is somewhat unsurprising given the fact that exercise adherence would require at least a moderate degree of energy and vigor – something that many patients diagnosed with mild-to-moderate depression are often lacking (Busch et al., 2016). Furthermore, a study conducted in 2014 reported low positive outcome expectations as being another major barrier to patients adhering to a prescribed exercise regimen; according to the study, patients who possessed negative preconceived notions regarding the efficacy of exercise treatments may be less likely to fully engage in the recommended exercise prescription, as they often did not believe that such treatments

would be effective in relieving their depressive symptoms (Krämer, Helmes, Seelig, Fuchs, & Bengel, 2014). Low positive outcome expectations, then, were identified as a major barrier to exercise adherence in patients. Additionally, a study conducted by Knapen et al. in 2007 revealed that patients with mild-to-moderate depression were often lacking any conceptualization of an internal locus of control concerning their mental health (Knapen et al., 2007). This concept of an ‘internal locus of control’ was initially brought to light in the 1950’s by Julian Rotter; which means, essentially, a person with an internal locus of control believes that they may have an influence on events and their outcomes – someone with an external locus of control, on the other hand, believes that exclusively external and environmental factors have the ability to influence events and their outcomes. As such, the study conducted by Knapen et al. (2007) revealed that patients diagnosed with mild-to-moderate depression often believed that their mental health and wellbeing was something that was entirely out of their control, which is also somewhat unsurprising given the fact that many patients afflicted with mild-to-moderate depression often experience feelings of hopelessness, and that their symptoms – or, more generally, events in their daily lives – are out of their control (Knapen et al., 2007). The designation of ‘low priority’, on the other hand, is something that is a little more surprising: often, clinicians simply do not consider exercise to be a viable, legitimate intervention for patients with mild-to-moderate depression (Azar, Ball, Salmon, & Cleland, 2010). Rather than considering exercise treatment methods as ‘low priority’ interventions, clinicians should instead emphasize to patients the importance of engaging in exercise in reducing depressive symptoms. In fact, research has previously shown that regular exercise may be as effective as CBT or antidepressant medications for patients

diagnosed with mild-to-moderate depression (Gm et al., 2013). Given the broad scope of the aforementioned factors, it becomes apparent that it may be difficult to find a simple solution when addressing the various mental symptoms of depression and the barriers that they create regarding patient exercise adherence. These symptoms – and by extension, these barriers presented – are both vague and complex in nature, and furthermore, they tend to overlap with many other barriers and symptoms, such as fatigue.

4.2 Time Related Barriers

Time is another factor that was cited quite frequently – in about half – of the studies examined. Often, time was a factor that was reported as a barrier to engaging in exercise in studies examining depression, as well as a myriad of other chronic diseases that are known to respond to exercise (Pedersen & Saltin, 2015). However, this specific barrier may be combated if physicians are able to take the time to emphasize the importance of adherence to a prescribed exercise regimen to patients; if they are able to convince patients that exercise is a legitimate, viable treatment for mild-to-moderate depression, then patients may allocate a greater amount of time adhering to their exercise regimen, thereby making it a more effective treatment for their depressive symptoms (Patel, Schofield, Kolt, & Keogh, 2011; Searle et al., 2012). This is something that was demonstrated in a 2009 study that revealed that as patients' knowledge of and attitude toward the benefits of exercise increased, they were more likely to find the time to engage in physical activity during their leisurely hours (Rosqvist et al., 2009). It was also revealed that older individuals, in particular, may benefit from physician recommendations and education about exercise as a treatment method, as one study found that many older patients simply did not possess the proper knowledge base

regarding the importance of exercise and adhering to a recommended level of physical activity as determined by age group; they were, however, open to dedicating more time to engaging in exercise following a consultation with a physician (Rosqvist et al., 2009). A substantial level of education regarding the importance of exercise is, in particular, especially important for older populations because they are also at a higher risk for depression – the upside, however, is that they typically have more leisure time, and thus more time to dedicate to their prescribed exercise regimen (Rosqvist et al., 2009). Furthermore, a survey revealed that physicians believe that time-related barriers would, in reality, have a fairly limited impact on adherence to exercise prescriptions, if such prescriptions were made in consultation with and recommended by a patient's physician; in other words, physician emphasis on promoting exercise as a *bona fide* treatment would have a positive effect on patient adherence to a prescribed exercise regimen (Searle et al., 2011b, 2012). For women in particular, however, studies have revealed that 'procrastination' and 'making excuses' were reasons why women were not adhering to their prescribed exercise regimens; they revealed that some women with depressive symptoms often engaged in a number of other time-demanding activities as opposed to participating in physical activity – others described viable reasons as to why they were unable to follow their exercise regimens (childcare, busy schedule, expectation of domestic labor in the home, etc.) (Craft et al., 2008). While it is difficult to assess whether or not these women purposefully chose to dedicate time to activities other than physical activity, or whether their time was simply already dedicated to other responsibilities, it is important to acknowledge that, often, the time-consuming work that women perform is by and large invisible to society at-large; factors such as childcare and

domestic labor are often expected rather than asked of women and, as such, the time these tasks require are often not taken into account when assessing the demands and reality of women's lives. As such, women may require additional support in adhering to exercise prescriptions due to the overwhelming, yet often unacknowledged, responsibilities associated with being a woman or a mother.

4.3 Barriers Associated with Self-esteem and Self-efficacy

Self-esteem and self-efficacy were factors that were, once again, reported in almost half of the studies examined; this may have a correlation with the mental symptoms often present in cases of mild-to-moderate depression, such as motivation and intention (Searle et al., 2011b). In particular, women with depression often reported that their lack of self-esteem was related to having a previous negative experience engaging in physical activity as a child or adolescent (Azar, Ball, Salmon, & Cleland, 2011). As such, these women tended to avoid situations that involved physical activity or sports altogether; the majority of women in the study spoke directly to their lack of confidence when engaging in physical activity – as well as the fact that symptoms of depression (i.e.: fatigue, stress, generally feeling unwell) of depression played a major role in their lack of exercise engagement (Azar et al., 2011).

One of the studies examined attempted to further understand the correlations that exist in intention formation in the way that they relate to both motivation and self-efficacy. The study revealed that patients with depression exhibited a significantly reduced level of self-efficacy compared to the control population (non-depressive group) (Krämer et al., 2014). This study, therefore, confirms what other studies have previously revealed – that

a notable self-efficacy deficit exists in people diagnosed with mild-to-moderate depression. One thing of note when examining the barrier of self-efficacy specifically is that it may be strongly influenced by outcome expectation; numerous studies have determined that patients diagnosed with mild-to-moderate depression are more likely to report negative outcome expectation, as well as having a decreased positive outcome expectation compared to the outcome expectations exhibited by the non-depressive control groups (Krämer et al., 2014; Searle et al., 2011b; Stanton, Franck, Reaburn, & Happell, 2015).

4.4 Motivation

Lack of motivation is another barrier worth noting, as throughout this scoping review it became apparent that motivation to exercise is actually one of the largest barriers with regards to any behavior intervention that incorporates exercise; as such, many studies were conducted in order to determine various methods to increase motivation to exercise among patients with mild-to-moderate depression. One such study examined the correlates of reduced physical exercise among depressive patients in comparison to a non-depressive control group; it compared and contrasted deficits in motivation as well as deficits in intention formation (or volitional deficits) and revealed that patients with depression did suffer from a motivational deficit. What this means, essentially, is that depressed patients – on average – showed significantly lower motivation when attempting to engage in exercise in comparison to the level of motivation exhibited by the non-depressive control group (Knapen et al., 2007). Addressing this lack of motivation for patients with depression may be difficult for practitioners due to the intrinsic nature of

motivation, however, it remains a crucial barrier to overcome to increase exercise engagement.

Another study examined barriers to prescribing exercise for people with mild-to-moderate depression reported by general practitioners; what it revealed was that 90% of depressed patients reported low levels of motivation as a primary reason for not engaging in their prescribed exercise regimen (Stanton & Reaburn, 2014). A further study conducted by Shor & Shalev (2014) identified various side effects of antidepressant medications, condition-related symptoms, as well as an assortment of comorbidities present in the patient group examined as potential factors that impacted patients' motivation to exercise. Thus, it becomes apparent that when prescribing exercise to patients with mild-to-moderate depression, identification of individual motivational factors must be taken into consideration, while simultaneously determining and identifying strategies to overcome these motivational barriers. Taking the additional time and consideration in identifying such barriers may be significantly more effective than a conventional, less specified approach to exercise prescriptions (Stanton et al., 2015). A study conducted by Sinnott et. al (2014) also revealed that many patients with mild-to-moderate depression cited barriers related to motivation when attempting to adhere to their prescribed exercise regimen. What is interesting about this study in particular, is that several participants reported the impact of their depressive symptoms was so great, that they were considerably unmotivated to adhere to their exercise prescription – in essence, for these patients, their depressive symptoms impacted them so profoundly, that taking care of their health held little importance in their minds. As a potential remedy or solution

to this particular issue, many of these participants were of the opinion that persistent encouragement from healthcare professionals was essential, especially when considering that the benefits of exercise in alleviating their depressive symptoms was not immediate (Sinnott, Quigley, & Morris, 2014).

4.5 Barriers Associated with Environmental Access and Resources

The barrier of environmental access or resources is different from many of the other barriers present in this scoping review in that it is quite difficult to recommend simple solutions for this barrier in particular, as it is impacted by a myriad of factors including, but not limited to: socioeconomic status, neighborhoods, accessibility, etc. However, physicians are still able to prescribe exercise regimens that are – financially accessible to low-income families by prescribing activities that do not require a lot of extra equipment, or any kind of gym/activity center membership (e.g running, walking, outdoor tennis courts, etc.).

A study conducted by Busch (2016) revealed that women reported a lack of environmental access twice as often as their male counterparts, which may suggest that women perceive additional environmental barriers to engaging in exercise, such as neighborhood safety or comfort levels in exercise facilities. This notion of additional environmental barriers for women with depression was reiterated in a study conducted by Azar et al. (2011); the study reported that several depressed women expressed that there was nothing in their physical environment that could aid them in engaging in exercise. Furthermore, both women with and without depression also mentioned that they would prefer to see more facilities such as walking tracks, dog parks, and community initiatives

(such as free gym memberships or boot camp trials) to relieve these perceived environmental barriers and help them engage in exercise on a more frequent basis (Azar et al., 2011). Needless to say, cost was a huge factor for many of these women, and as such, a greater need for affordable exercise facilities – in particular, local facilities/gyms – was mentioned throughout this study. Also, high costs were also identified as a barrier to exercise engagement in a study conducted by Sinnott et al. (2014); it is important to recognize that due to a myriad of social factors (e.g., sexism, gender pay gap, expectation of childcare responsibility), women are less likely to have a greater disposable income. As such, when considering the barrier of environmental access, it is important to consider how both healthcare practitioners and community partners can work together to ensure that there are financially accessible, local options for women with a smaller amount of disposable income when encouraging and enabling them to adhere to their prescribed exercise regimens.

4.6 Barriers Associated with Fatigue and Low Energy Levels

Fatigue, or tiredness, is a commonly reported barrier to exercise due to the fact that – unsurprisingly – fatigue is one of the most commonly reported side effects associated with mild-to-moderate depression (Gm et al., 2013). This particular barrier presents a difficult problem because fatigue is integral to both depression and antidepressant medications (Knapen et al., 2007). Additionally, these psychotropic medications may cause dizziness, drowsiness, and difficulty concentrating – all of which may enhance feelings of general fatigue; symptoms such as these are also a reason why searching for alternative effective treatment options with fewer side effects, such as exercise prescriptions, are important when considering both the physical and mental well-being of

patients diagnosed with mild to moderate depression (Friedman, 2014). Thus, due to the multifactorial issue of fatigue among depressed patients, it is difficult to determine the exact root cause of this specific symptom; however, clinicians should be mindful of this multifactorial nature and consistently remind their patients that increasing levels of physical activity and exercise can both improve depressive symptoms, while also increasing energy levels and combat fatigue in general (Blumenthal et al., 2007).

Nevertheless, further research is required in order to have a more comprehensive understanding of ways in which healthcare practitioners may work with patients in order to combat fatigue specifically; doing so is fairly important since it may have a positive impact regarding the level of physical activity and exercise that patients are willing and/or able to perform, which could directly impact on symptom alleviation and therapeutic benefit (Busch et al., 2016).

4.7 Barriers Relating to Social Support

It is a fairly common phenomenon that patients with depression often report feelings of isolation (Ranjbar et al., 2015). As a response to this, numerous studies have shown the benefits of social engagement in improving depressive symptoms (Blumenthal et al., 2007; Rogers, Vicari, & Courneya, 2010; Stanton & Reaburn, 2014). One of the largest studies conducted that examined the benefits of exercise as a treatment for depression placed patients in a group exercise program as the primary method of treatment; what it revealed was that those who engaged in group exercise classes, rather than exercising in isolation, for their treatment reported a higher therapeutic benefit associated with exercise (Blumenthal et al., 2007). Taking this increased therapeutic benefit into account, the

findings suggest that social support from other patients may be a key, underlying factor that has the potential to increase symptom alleviation and overall therapeutic benefits (Blumenthal et al., 2007).

In a study conducted by Craft and Perna (2004), it was revealed that women in particular reported lower levels of social support, as participants in the study felt that they possessed little confidence when engaging in regular exercise; they also were able to identify only a few instances of support for regular engagement in exercise from both friends and family (Azar et al., 2011; Craft & Perna, 2004). This finding was supported in a study by Azar et al. (2010), which reported that increased social support of family and friends was a strong predictor for increased engagement with exercise and physical activity among women (Azar et al., 2010). Educating friends and family members, then, becomes an asset when attempting to motivate women to engage in exercise; having friends or family members encourage or even participate in physical activity was a common facilitator for women with mild-to-moderate depression who did engage in physical activity regularly (Azar et al., 2011, 2010). As such, the study supported the idea that interventions, for women in particular, should focus on the development of social networks by encouraging women and their friends or family members to participate or engage in physical activity together as a group. Studies have also shown similar correlations with male participants, however, more research in this area is required before this gap in literature can be adequately addressed and assessed.

Taking the positive impact of including friends and family members in a patient's exercise routine into account, it becomes apparent that physicians should work to find

practical ways of meaningfully implementing social support networks or social support groups when attempting to prescribe exercise as a treatment for mild-to-moderate depression in order to increase patient adherence and overall efficacy of exercise on managing the symptoms of mild-to-moderate depression.

4.8 Understanding and Combating Fear of Injury

Fear of injury was reported several times throughout the studies examined in this scoping review. One such study found that fear of injury was reported by approximately 20% of patients surveyed with higher rates reported by women (Busch et al., 2016). The study revealed that as the perceived risk of injury increased, subjects were less likely to report willingness to engage in various ‘high-risk’ or physically demanding forms of exercise (Busch et al., 2016). As such, physicians should consider both the capabilities and willingness of each patient, regarding the types of exercise that they are willing to – or are able to – engage in; they should not recommend a modality of exercise that exceeds what the patient is comfortable with in order to increase the likelihood of a patient adhering to their prescribed exercise regimen. However, the minimum intensity needed in order for patients to experience any kind of symptom alleviation should also be considered, as some data suggests that at least a moderate level of intensity is required in order for a patient to experience any kind of therapeutic benefit; in other words, a balance needs to be struck between patient comfort and exercise intensity levels (Professional Associations for Physical Activity, 2010).

One observational study theorized that an underlying factor regarding fear of injury among patients diagnosed with mild-to-moderate depression had to do with the fact that

depressive symptoms often preceded deterioration of physical function; in essence, this deterioration of physical health – and thereby an increased proneness to injury – may be a factor worth considering when attempting to overcome this particular barrier (Rosqvist et al., 2009). Furthermore, physicians should also consider older individuals with various mobility limitations as well as patients with other chronic diseases – such as obesity, hypertension, and cardiovascular disease – especially since the fear of injury in these populations may be directly related to their previous conditions and illnesses (Pedersen & Saltin, 2015; Rosqvist et al., 2009). Physicians should further emphasize to these patients that physical activity can actually improve musculoskeletal function and may improve mobility, especially for patients who are also afflicted with obesity (Rosqvist et al., 2009).

4.9 Barriers Associated with Poor Health and Physical Symptoms of Depression

It is not uncommon for patients diagnosed with mild-to-moderate depression to also have other chronic health diseases (Amy Janke & Kozak, 2012). By extension, then, people diagnosed with depression are at a higher risk of having a wide variety of poor health outcomes; these additional health factors and complications can often hinder a patient's ability to engage in exercise on a regular basis – especially if patients are also diagnosed with chronic diseases such as diabetes, cardiovascular disease and obesity, all of which demonstrate strong correlations with higher rates of depression (Amy Janke & Kozak, 2012; Gm et al., 2013; Pedersen & Saltin, 2015).

Furthermore, in a study conducted by Rosqvist et al. (2009), it was found that pre-existing musculoskeletal conditions were also found to increase rates of physical inactivity among depressed patients – which may translate to an increase difficulty in prescribing exercise – especially in older populations. Thus, it becomes apparent that physicians must consider patients' overall health and take any mobility-related complications into account when attempting to prescribe an individualized, specified exercise regimen (Rosqvist et al., 2009).

Additionally, in a study conducted by Sinnot et al., it was revealed that many participants were aware of the benefits of physical activity on their condition(s), but had difficulty converting this knowledge into action due to a misunderstanding that exercise was not an appropriate course of action for their current medical conditions (aside from depression). The researcher suggested that physicians should nevertheless continue to prescribe exercise for these patients, and ensure that the exercise program is tailored to the patient's specific needs (Rosqvist et al., 2009). Furthermore, all advice provided to this population should be delivered in a positive and encouraging tone, and in a consistent manner so as to draw attention to the way in which the patient's own beliefs may impact the efficacy of exercise adherence. In doing so, patients would theoretically begin to understand how preconceived notions regarding their ability to properly engage in exercise actually affected their levels of adherence to their prescribed exercise regimen (Rosqvist et al., 2009).

Physicians should also emphasize the importance of exercise for patients suffering from both depression and obesity, as researchers have previously suggested that the combination of weight gain and obesity may increase the likelihood of the presence of depressive symptoms (Amy Janke & Kozak, 2012). For this particular population, then, exercise prescriptions may actually have additional benefits, considering the fact that exercise has the potential to both alleviate depressive symptoms and reduce obesity-related complications (Gm et al., 2013; Pedersen & Saltin, 2015).

Chapter 5

5 Conclusion

Exercise has the ability to treat mild-to-moderate depression; this is something that has been shown to have a strong therapeutic benefit over and over again in numerous studies, by a myriad of researchers. The benefits that depressed patients report after engaging in exercise regularly are simply too great to ignore – from primary benefits such as mood enhancement and reduction in depressive symptoms to secondary benefits such as cardiovascular disease reduction (Myers & Gerber, 2016; Pedersen & Saltin, 2015; Professional Associations for Physical Activity, 2010). Due to the risk associated with taking antidepressant medications, the research presented here and in other cited studies suggests that physicians should consider using exercise as a *first line* treatment for depression – especially mild-to-moderate depression, as both the safety and efficacy of using antidepressants to treat mild-to-moderate depression is heavily debated in medical communities (Baldwin et al., 2015; Friedman, 2014; Scott, 2012).

Patients afflicted with depression have reported several barriers that prevent them from consistently adhering to their prescribed exercise regimen; physicians have cited several of these barriers as reasons why they are hesitant to prescribe exercise to treat cases of mild-to-moderate depression at all (Craft & Perna, 2004; Cramer et al., 2014; Otto et al., 2007). Thus, understanding patient reported barriers to engaging in exercise may increase the overall success of exercise prescriptions for many patients (Palmer & Jaworski, 2004; Senter et al., 2013). Symptoms of depression, such as fatigue and low levels of motivation, may hinder a patient's willingness to engage in exercise, and it is important

to understand that – given the nature of depression – it may be a complicated barrier for them to overcome (Cooney et al., 2013; Dunlop & Self, 2008; Stanton & Reaburn, 2014). As such, it is imperative that researchers to examine these barriers, and for further studies to consider why these symptoms of depression are so debilitating.

Physicians – given their medical expertise and personal connection to patients afflicted with mild-to-moderate depression – play an essential role in referring and prescribing exercise for this population. Ample evidence exists to suggest that physicians, in many ways, play an essential role in modelling healthy behavior; one such study revealed that 90% of physicians surveyed believed that their credibility and ability to prescribe exercise to their patients would increase substantially if they themselves were physically fit, thus, 80% of physicians surveyed endorsed the notion that physicians should adhere to a healthy personal lifestyle routine in order successfully encourage their patients to do the same (Ng & Irwin, 2013). In reality, however, the same study revealed that only 25% of physicians surveyed discussed physical activity counselling with their patients; from this great disparity in theoretical support and actual implementation, it can be inferred that the physicians' own personal physical activity habits appear to impact their willingness to prescribe exercise to their patients (Ng & Irwin, 2013).

It is also worth noting, however, that it may be more effective to educate current medical students on the benefits of using exercise as a means of treating mild-to-moderate depression rather than waiting for them to complete their medical education and become practicing physicians. In fact, one study revealed that 69% of medical students surveyed

felt that they only received a modest amount of training and education on the myriad of ways in which exercise can be used as an effective treatment for a number of debilitating diseases, including mild-to-moderate depression. Thus, medical schools themselves should also place emphasis on physical activity counselling training during both undergraduate and professional education for future physicians to ensure that they are equipped with the right tools and knowledge-base to prescribe exercise to treat patients afflicted with mild-to-moderate depression. As previously discussed in earlier paragraphs, creating and implementing strategies for physicians to utilize in their practice may be a major key to increasing exercise adherence rates following a prescription (Holtz et al., 2013). Taking this into account, then, it becomes apparent that it is imperative for medical schools to address this gap in education in order to equip future physicians with the necessary resources to adequately and confidently prescribe exercise as a first-line treatment for mild-to-moderate depression.

Patients with depression report many barriers that prevent them from exercising, with motivation and fatigue appearing at the top of the list of patient-reported barriers to engaging in exercise and, by extension, may be the hardest barriers to overcome. Patients taking antidepressants may also experience additional barriers, since two of the main side effects of these medications are fatigue and drowsiness, as well as a decrease in motivation. Beyond motivation and fatigue, self-esteem and lack of availability were also barriers that patients reported quite frequently, however, these barriers are arguably less difficult to overcome than the aforementioned lack of motivation and fatigue. Barriers related to lack of time or availability may be overcome, should physicians place greater

emphasis on the importance of exercise in a patient's quality of life, outlining both the physical and mental benefits that they may gain from regularly engaging in a prescribed exercise regimen. Self-esteem, on the other hand, is a barrier that is slightly more challenging to overcome, as it is something that is often intrinsic for most patients afflicted with depression; however, further research should focus on understanding precisely why patients with depression tend to have higher reported rates of low self-esteem, as a few studies have already reported that physical activity may have the ability to increase self-efficacy – and theoretically, self-esteem – amongst patients afflicted with a variety of mental illnesses, including mild-to-moderate depression.

Physicians should also consider both the capability and willingness of each individual patient. In regards to the types of exercise that individual patients are willing to participate in, physicians should not recommend a modality of exercise – or rather, an exercise regimen – which exceeds both the physical capability and comfort of patients; taking individual patient capabilities into account would theoretically increase the likelihood of patient adherence, and should therefore be something that physicians carefully consider, and discuss with each patient.

By creating a personalized exercise regimen for their patients, physicians should also consider the minimum intensity required in order for patients to actually experience any kind of symptom alleviation; some data suggest that at least a moderate level of intensity is required in order for a patient to experience any kind of tangible therapeutic benefit.

What this means, in other words, is that it is essential that physicians and patients work together to find and strike a balance between patient comfortability and intensity levels

(Professional Associations for Physical Activity, 2010). Future studies should examine and address the specific intensity levels required in order for a patient afflicted with mild-to-moderate depression to experience any kind of symptom relief; doing so may ensure higher adherence rates following a professionally prescribed exercise prescription.

What this scoping review ultimately reveals is an urgent emphasis on the importance of this research – research in the area of “exercise is medicine” – to increase exercise adherence following exercise prescriptions intended to treat mild-to-moderate depression.

Due to a myriad of aforementioned factors, such as both the emotional and monetary burden associated with depression, various governing bodies have a vested interest in increasing the rates of exercise prescriptions. However, without a proper knowledge-base and understanding of the varying barriers that patients experience when attempting to engage in exercise – especially for special populations, such as those afflicted with mental health disorders – implementing these personalized exercise prescriptions into medical practice may be difficult due to the complexity of introducing any kind of behavior change on such a vulnerable population. As such, equipping physicians with the knowledge and resources to overcome these barriers may increase the success of these prescribed exercise regimens. Future research, therefore, should focus on addressing individual barriers that patients with depression consistently report, while theorizing protocols or interventions that can attempt to overcome and work through each barrier in a meaningful, lasting way. Exercise has numerous secondary benefits to patients with depression, and as such, it can address more than one chronic condition. Keeping this in mind while considering the costs associated with depression, this research only emphasizes the importance of preventative medicine, as it has the ability to drastically

reduce healthcare costs while lessening the demand on the current healthcare system.

With global rates of depression expected to increase within the next decade, it is imperative that we find safe and effective treatments to manage symptoms of depression.

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Appendices

Appendix A: Summary of Exercise Recommendations for General Health Including Mental Health Recommendations for Adults 18-64 years old

World Health Organization (WHO)	150 minutes of moderate-to-vigorous physical activity per week or a minimum of 75 minutes of vigorous activity per week or an equivalent combination of the two.
American College of Sports Medicine (ACSM)	150 minutes of moderate-to-vigorous physical activity
Canadian Medical Association (CMA)	150 minutes of moderate-to-vigorous physical activity
Canadian Society for Exercise Physiology (CSEP)	150 minutes of moderate-to-vigorous physical activity per week
National Health Service (NHS)	150 minutes of moderate-to-vigorous physical activity/week
Center for Disease Control and Prevention (CDC)	150 minutes of moderate intensity aerobic exercise/week AND muscle-strengthening activities 2 or more days/week or

75 minutes of vigorous exercise/week
AND muscle-strengthening activities 2 or more days/week
or
an equivalent combination of moderate-to-vigorous intensity exercise **AND** muscle strengthening activities 2 or more days/week

Appendix B: Depression Specific Recommendations for Prescribing Exercise in Clinical Care

National Institute for Health and Care Excellence (NICE)	3 exercise sessions/week, 45 minutes to 1 hour, over 10-14 weeks.
Swedish National Institute of Public Health	Aerobic training: Moderate to High, 2-3x/week, 30-40 minutes Strength training: 8-10 exercise, 1-3 sets, 8-12 reps, 2-3x/week, 30-60 minutes
Sports Medicine Australia	Supervised aerobic exercise, 3x/week, moderate intensity, minimum of 9 weeks
Royal Australian College of General Practitioners	Mixture of resistance and aerobic training, 55-70% of heart rate max, 30-40 minutes, 3/week, minimum of 9 weeks

Appendix C: Summary and Analysis of Articles including Primary Data Results

Author	Title	Year	Country	Study Design		
				Study Type	Methods for Data Collection	Outcome Measures
Knapen, J and Vermeersch, J and H, Van Coppenolle and Cuykx, V and Pieters, G and Peuskens, J	<i>The physical self-concept in patients with depressive and anxiety disorders.</i>	2007	Belgium	Quantitative Study	Questionnaire and Visual Analogue Scale	1) The physical self-perception profile 2) Motivation towards psychomotor therapy 3) The Baecke Questionnaire 4) Experienced benefits and barriers for habitual physical activity 5) Trait Anxiety Inventory
Busch, Andrew M and Ciccolo, Joseph T and Puspitasari, Ajeng J and Nosrat, Sanaz and Whitworth, James W and Stults	<i>Preferences for Exercise as a Treatment for Depression.</i>	2016	US	Quantitative Study	Questionnaire and Visual Analogue Scale	N/A

Kolehmainen, Matthew						
Searle, Aidan and Calnan, Michael and Lewis, Glyn and Campbell, John and Taylor, Adrian and Turner, Katrina	<i>Patients' views of physical activity as treatment for depression: a qualitative study.</i>	2011	England	Qualitative Study	Questionnaire and Visual Analogue Scale	Activity Log & Depression Measure
Craft, Lynette L and Perna, Frank M and Freund, Karen M and Culpepper, Larry	<i>Psychosocial correlates of exercise in women with self-reported depressive symptoms</i>	2008	US	Quantitative Study	Questionnaire	1) Demographic Questionnaire 2) Primary Health Questionnaire (PHQ-9) 3) Godwin Leisure Time Exercise Questionnaire (LTEQ) 4) Perceived Barriers to Physical Activity Scale (PBPA) 5) Social Support Scale for Exercise Behavior 6) Self-Efficacy Behavior

Azar, Denise and Ball, Kylie and Salmon, Jo and Cleland, Verity	<i>Psychosocial correlates of exercise in women with self-reported depressive symptoms</i>	2011	Australia	Quantitative Study	Cross-Sectional Survey	1) General Health Questionnaire (GHQ-30) 2) International Physical Activity Questionnaire (IPAQ-L) 3) Self-report measures of sociodemographic characteristics
Searle, Aidan and Calnan, Michael and Turner, Katrina M and Lawlor, Debbie A and Campbell, John and Chalder, Melanie and Lewis, Glyn	<i>General practitioners' beliefs about physical activity for managing depression in primary care</i>	2012	England	Qualitative Study	Questionnaire and Visual Analogue Scale	N/A
Sinnott, Carol and Quigley, Fionnuala and Morris, Michael	<i>Promoting exercise in patients with depression: lessons learned from a brief educational intervention.</i>	2014	Ireland	Quantitative Study	Open-Ended Questionnaire	1)WHO 5 Wellbeing 2) Internal Physical Activity Questionnaire

Rosqvist, E and Heikkinen, E and Lyyra, T-M and Hirvensalo, M and Kallinen, M and Leinonen, R and Rasinaho, M and Pakkala, I and Rantanen, T	<i>Promoting exercise in patients with depression: lessons learned from a brief educational intervention.</i>	2009	Finland	Quantitative Study	Cross-Sectional Survey	1) Centre for the Epidemiological Studies Depression Scale (CES-D) 2) Self-Report Physical Activity Validated Scale 3) Motives and Barriers to Physical Activity 4) Mobility Test
Joyce, Ciaran L and O'Tuathaigh, Colm M	<i>Increased training of general practitioners in Ireland may increase the frequency of exercise counselling in patients with chronic illness: a cross-sectional study.</i>	2014	Ireland	Quantitative Study	Cross-Sectional Questionnaire	N/A
Krämer, Lena V and	<i>Correlates of reduced</i>	2014	Germany	Quantitative Study	Self-Report Questionnaire	1) Self-report intention 2) exercise 3)

Helmes, Almut W and Seelig, Harald and Fuchs, Reinhard and Bengel, Jurgen	<i>exercise behaviour in depression: The role of motivational and volitional deficits</i>					Motivational and Volitional Health Action Process Approach (HAPA)
Azar, Denise and Ball, Kylie and Salmon, Jo and Cleland, Verity J	<i>Physical activity correlates in young women with depressive symptoms: a qualitative study.</i>	2010	Australia	Qualitative Study	Semi-structured Interviews and Survey	1) Centre for the Epidemiological Studies Depression Scale (CES-D) 2) Social Ecological Model
Stanton, Robert and Franck, Chris and Reaburn, Peter and Happell, Brenda	<i>A Pilot Study of the Views of General Practitioners Regarding Exercise for the Treatment of Depression</i>	2015	Australia	Quantitative Study	Survey	N/A
Patel, A. and Schofield, G.M. and	<i>General practitioners' views and</i>	2011	New Zealand	Qualitative Study	Structured Interviews	N/A

Kolt, G.S. and Keogh, J.W.L.	<i>experiences of counselling for physical activity through the New Zealand green prescription program</i>					
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Author	Study Design	Participants			Review
	Objectives	Age (mean +- SD, range)	Sex (M/F)	Sample Size	Results/Findings: Barriers for Exercise
Knapen, J and Vermeersch, J and H, Van Coppenolle and Cuykx, V and Pieters, G and Peuskens, J	1) Examine which psychological and physical variables explain the level of physical self-concept.	Male: Mean = 35.8 years (SD =9.5). Female: Mean = 32.4 (SD =10.3)	67 males and 124 females	n=191	1) Deficit Self-motivation and self-enhancement strategies 2) psychosomatic complaints 3) Lack of internal locus of controlling concerning health 4) Deficit of energy 5) General fatigue
Busch, Andrew M and Ciccolo, Joseph T and Puspitasari,	1) Rates of willingness to participate in an exercise	Mean age = 39 (SD=13.1; range: 18–62)	Male: 51, Female: 51	n= 102	1) Do not have enough time 2) Find it inconvenient 3) Lack of motivation 4) Mood (sad, angry etc) 5) Too tired 6) Do not find exercise enjoyable 7)

<p>Ajeng J and Nosrat, Sanaz and Whitworth, James W and Stults-Kolehmainen, Matthew</p>	<p>program targeting mood</p> <p>2) preferences for the content and structure of an exercise for depression treatment</p> <p>3) perceived barriers to increasing exercise</p> <p>4) any gender differences in the above aims</p>				<p>Find exercise boring 8) Lack confidence in ability to exercise 9) Fear of being injured 10) Recently injured 11) Lack of encouragement and support from family and friends 12) Lack of environmental access</p>
<p>Searle, Aidan and Calnan, Michael and Lewis, Glyn and Campbell, John and Taylor, Adrian and Turner, Katrina</p>	<p>1) Explore patients' view of physical activity for the treatment of depression in the context of primary care</p>	<p>N/A</p>	<p>Male: 14, Female: 19</p>	<p>n= 33</p>	<p>1) Physical symptoms of depression (lethargy and fatigue) 2) Mental symptoms of depression 3) Emotional symptoms (low confidence) 4) Ability</p>
<p>Searle, Aidan and Calnan, Michael and</p>	<p>1) Explore General Practitioners</p>	<p>N/A</p>	<p>Male: 10, Female: 5</p>	<p>n= 15</p>	<p>1) Extent of patients' ability to assimilate and act on physical activity advice given by GP 2)</p>

Turner, Katrina M and Lawlor, Debbie A and Campbell, John and Chalder, Melanie and Lewis, Glyn	views of physical activity 2) The extent of promotion of physical activity within the course of consultation 3) Awareness of evidence and clinical guidance for physical activity as a treatment for depression				Lack of time 3) Patients ability 4) Self-esteem
Craft, Lynette L and Perna, Frank M and Freund, Karen M and Culpepper, Larry	1) Assessed psychosocial determinants of exercise in a sample of women with depressive symptoms	Mean = 38.6 years (SD =9.7)	Female: 61	n= 61	Low levels of self-efficacy, social support. Depressive symptoms were positively associated with barriers to exercise. barriers were inversely related to exercise. 1) Feeling too tired 2) not enough time 3) lack of an exercise partner 4) self-conscious about one's look when exercising
Azar, Denise and Ball, Kylie and Salmon, Jo	1) Investigate the individual, social, and physical	Mean = 27.8 years (SD = 4.8)	Female: 451	n= 451	1) Self- efficacy 2) Enjoyment 3) Family and friends' social support 4) Accessibility of

and Cleland, Verity	environmental correlates of physical activity among young women at risk of depression 2) Compare these with these with correlates amount young women not at risk of depression				physical environmental facilities
Sinnott, Carol and Quigley, Fionnuala and Morris, Michael	1) Evaluate a pragmatic educational intervention promoting exercise to a group of patients diagnosed with depression, in a community setting.	Mean = 43 (SD = 13)	Male: 8 Female: 27	n= 35	1) Perceived Medical Physical limitations 2) Practical/Logistical Issues 3) Motivational issues 4) Lack of Interest 5) Lack of Energy 6) Lack of Enthusiasm 7) Cost 8) Lack of Amenities
Rosqvist, E and Heikkinen, E and Lyyra, T-M and Hirvensalo, M and	1) Investigate the association between depressive symptoms and physical inactivity	Mean = 77.7 (SD = 1.96)	Males: 162 Female: 483	n= 645	1) Poor health 2) Fear of negative experiences 3) lack of knowledge 4) Lack of time 5) Lack of interest 6) Lack of company 7) Unsuitable environment

Kallinen, M and Leinonen, R and Rasinaho, M and Pakkala, I and Rantanen, T	2) Whether motives for and barriers to exercise explain the potential association between depressive symptoms and physical inactivity in older people.				
Joyce, Ciaran L and O'Tuathaigh, Colm M	1) Evaluate frequency of exercise counselling in patients with various chronic illnesses including depression, by general practitioner era in the mid-west of Ireland 2) whether training in exercise counting influences the frequency of exercise counselling	Mean = 48.5 (SD = 9.5)	Female: 34 Male: 68	n= 102	1) 83% of GPs never received training specifically on exercise counselling 2) 77% felt that they would benefit from further training with regards to exercise counselling for patients with depression 3) 74% reported that they have never prescribed resistance exercise for patients with depression in the last 6 months 4) 72% reported that they have never given personalized written advice on exercise counselling/prescriptions to patients with depression

Krämer, Lena V and Helmes, Almut W and Seelig, Harald and Fuchs, Reinhard and Bengel, Jurgen	1) Uncovering the correlates of reduced exercise in depressed patients	Mean = 47.7 (SD = 15.4)	Males: 39.3% Females: 60.7%	n= 56	1) Intention to exercise 2) Action self-efficacy 3) Low positive outcome expectations 4) Negative outcome expectations 5) Action Planning 6) Self-efficacy 7) Situational Barriers 8) Coping Planning
Azar, Denise and Ball, Kylie and Salmon, Jo and Cleland, Verity J	1) Present the findings of a series of in-depth one-on-one interviews conducted to explore perceptions of physical activity and its determinants in young women with and without depressive symptoms. 2) Explore the possible direction of the relationship	Mean = 24.4	Females: 40	n= 40	1) Early life physical activity experiences 2) Relationship between physical activity and depression 3) Motivation 4) Barriers to physical activity {i. lack of time ii. low priority for physical activity iii. making excuses/procrastination iv. low self-efficacy 5) Social norms 6) Social context 7) Perception of recreational facilities in the physical environment

	between physical activity and mood/depression among these women				
Stanton, Robert and Franck, Chris and Reaburn, Peter and Happell, Brenda	1) Investigate the views of general practitioners regarding exercise and the treatment of depression	Mean = 46.4 (SD = 8.9)	Males: 11 Female: 9	n= 20	1) Lack of time 2) Injury 3) Comorbidities 4) Lack of confidence 5) Lack of resources 6) Lack of motivation
Patel, A. and Schofield, G.M. and Kolt, G.S. and Keogh, J.W.L.	1) To Identify why general practitioners counsel for physical activity and administer Green Prescriptions 2) Examine GP's views and experiences of Green Prescription counselling for the management of depression	Mean = 50.8 (SD = 7.1)	Males: 5 Females: 10	n= 15	1) Time constraints was the only perceived barrier

Appendix D: Database Specific Search Strategies Summary

	Keywords	PubMed (MeSH)	CINAHL (CINAHL Headings)	Cochrane (MeSH)	PsycINFO (Thesaurus)
the concept of: Depression ((mild OR moderate) AND (depress* OR dysth*)) AND exercis* AND health	depress*	depression	"Depression"	depress	exp major depression/
	dysthymi*	dysthymia	Affective Disorders	MeSH descriptor Depression, this term only	atypical depression/
	mild depression	mild-to-moderate		SR-DEPRESSN	seasonal affective disorder/
	moderate depression			HS-DEPRESSN	(depress AND patient AND symptom AND disorder)
	depressive disorder				
the concept of: EXERCISE	sport* OR exercis* OR aerobic* OR running* OR physical medicine* OR (resistance OR weight*)	exercis*	(MH Exercise)	MeSH descriptor Exercise, explode	exp physical activity/
		aerobic*	(MH Resistance Training)	MeSH descriptor Exercise therapy, explode	exp sports/
		running	(MH Therapeutic Exercise)	MeSH descriptor Physical Education and Training	running OR walking/
		jogging	(MH Recovery, Exercise)	MeSH descriptor Physical Fitness, this term only	(cycling OR bicycling).tw
		walk*	(MH Group Exercise)	MeSH descriptor Physical Exertion, this term only	(exercise OR exercising).tw
		hiking	(MH Aquatic Exercises)	MeSH descriptor Walking, explode	(physical AND education OR training).tw
		swim*	(MH Aerobic Exercises)	MeSH descriptor Running, explode	
		aquatic*	(MH Anaerobic Exercises)	MeSH descriptor Swimming, this term only	
		cycling		(cycling OR bicycling)	
		bicycl*		(exercise OR exercising)	
		strength*		(physical NEAR/5 education OR training)	
		fitness			
		resistance			
	lift*				
the concept of: BARRIERS OR FACILITATORS	(prevent* OR barrier* OR facilitat* OR hinder* OR)	prevent*	(MH prevent*)	MeSH prevent*	exp prevent*
		barrier*	(MH barrier*)	MeSH barrier*	exp barrier*
		facilitat*	(MH facilitat*)	MeSH facilitat*	exp facilitat*
		hinder*	(MH hinder*)	MeSH hinder*	exp hinder*
		block*	(MH block*)	MeSH block*	exp block*
		restrain*	(MH restrain*)	MeSH obstacle*	exp obstacle*
		obstacle*	(MH obstacle*)	MeSH restrain*	exp restrain*
	reduc*	(MH educ*)	MeSH educ*	exp educ*	

Figure 1: PRISMA Article Procurement Summary

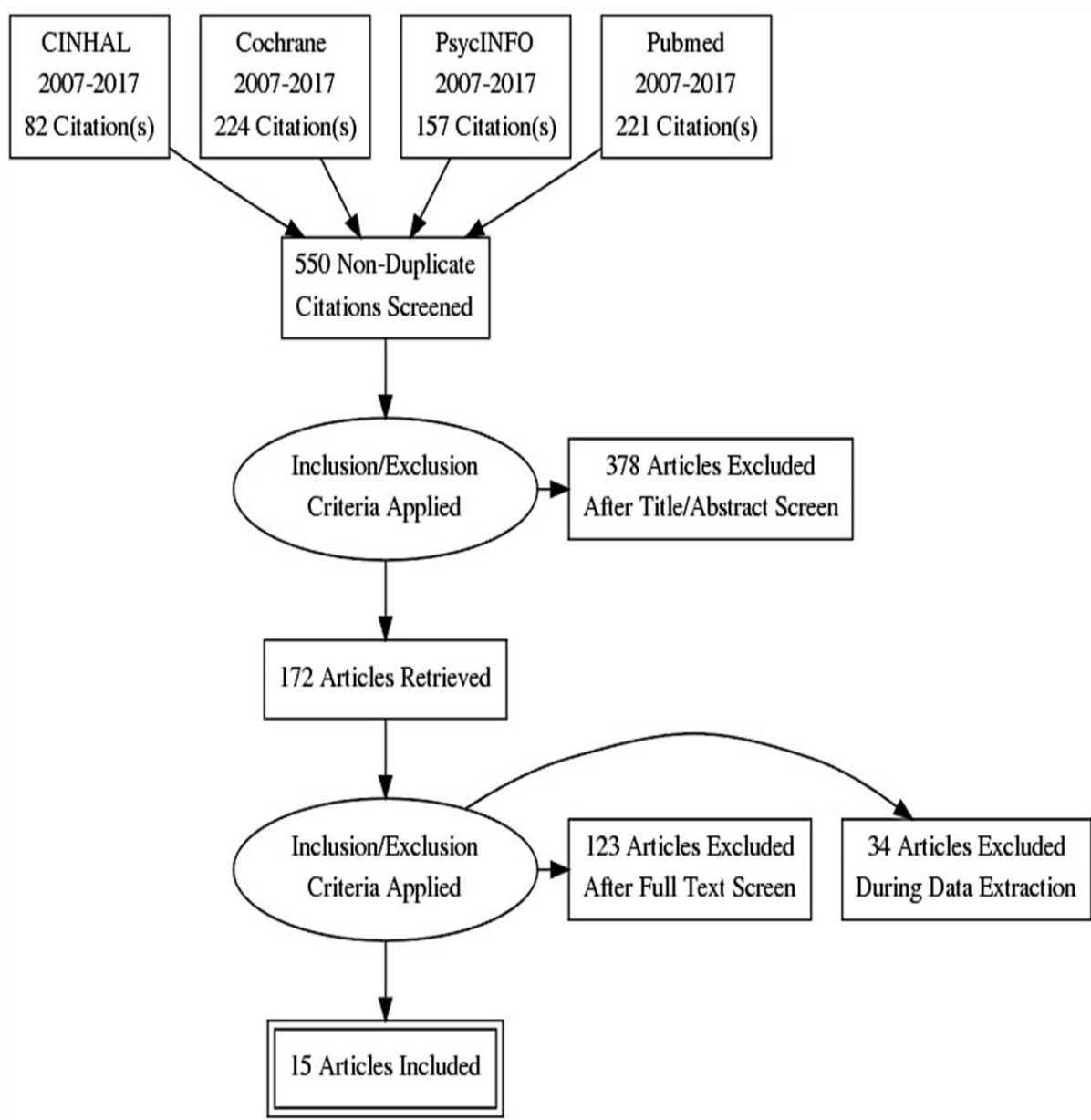
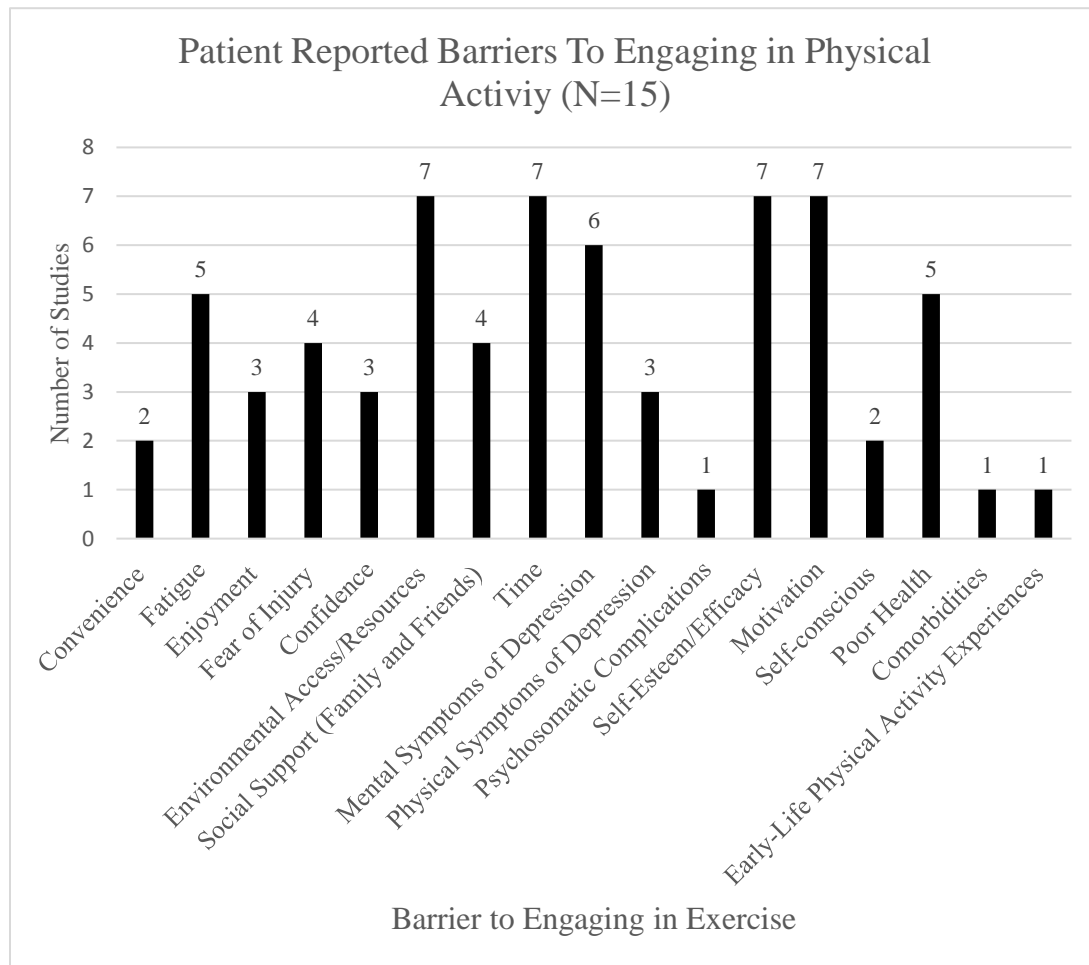


Figure 2: Summary of Data Extraction and Article Analysis



Curriculum Vitae

Name: Andrew Hanna

EDUCATION

- September 2015 Master of Science in Health Promotion
Western University, London ON
- September 2011 Bachelor of Arts - Honours Specialization in Kinesiology
Western University, London ON

SCHOLARSHIPS AND AWARDS

- May 2017 HRS Graduate Conference Travel Award (\$400)
Department of Health and Rehabilitation Sciences
Western University
- April 2017 FHS Graduate Conference Travel Award (\$260)
Faculty of Health Sciences
Western University
- August 2015 Western Graduate Research Scholarship (\$20,000)
Department of Health and Rehabilitation Sciences
Western University

RESEARCH EXPERIENCE

- October 2013 Research Assistant
Western Ontario Therapeutic Community Hostels, London ON
• Supervised by Dr. Stephanie De Jesus
- January 2016 Independent Research Study
Western University, London ON
• Supervised by Dr. Kenneth Kirkwood

LAB EXPERIENCE

- August 2016 Laboratory Technician & Athletic Trainer
Coca-Cola Exercise Science Laboratory
Western University, London, ON.
• Lab Director: Michael Herber

LAB INSTRUCTOR:

- September 2016 Health Sciences 2330 – Systematic Approach to Functional Anatomy. Faculty of Health Sciences, University of Western Ontario, London, ON
- January 2017 Kinesiology 2222 - Functional Human Anatomy for Kinesiology. Faculty of Health Sciences, University of Western Ontario, London, ON

PUBLICATIONS**Manuscripts Accepted and In Press**

Hanna, A.D. & Scime, N.V. Physical activity versus metformin for reducing the severity and onset of type 2 diabetes in pediatric populations. *University of Western Ontario Medical Journal*; 85(2), 2016.

Ableman, D.D & **Hanna A.D.** Applying health promotion theories to improve depressive symptoms through exercise. *University of Western Ontario Medical Journal*; 86(2), in press.

Non-Refereed Publications

Hanna, A.D. (2016). Taking the long way home for good health. <http://www.obesityblog.ca/?p=161><http://www.obesityblog.ca/?p=161> [Canadian Obesity Network – Student and New Professional Blog]

Hanna, A.D. (2017). Staying active for good mental health: why you should exercise during exam season. <http://www.obesityblog.ca/?p=238> [Canadian Obesity Network – Student and New Professional Blog]

PUBLISHED ABSTRACTS:

Hanna, A.D. Prescribing exercise as medicine in Ontario medical schools. Exercise is Medicine Ontario Research Conference 2016

Hanna, A.D., Kirkwood, K. Facilitators and barriers to prescribing exercise in clinical practice to treat depression. Health and Rehabilitation Sciences Graduate Research Conference 2017

Hanna, A.D., Kirkwood, K., Thornton, J. Applying shared-decision making models in clinical practice to treat mild-to-moderate depression by increasing exercise adherence. Canadian Obesity Summit 2017.

Hanna, A.D., Kirkwood, K., Thornton, J. The benefits of prescribing exercise to children and adolescents in order to reduce symptoms of depression while improving overall mental health. Child Health Symposium 2017.

Hanna A.D., Scime, N.V., Kirkwood, K. Understanding Barriers for Engaging in Physical Activity for Patients Afflicted with Mild-to- Moderate Depression. Exercise is Medicine National Student Research Conference 2017.

CONFERENCE PRESENTATIONS & POSTERS

Hanna, A.D. Prescribing exercise as medicine in Ontario medical schools. Exercise is Medicine Ontario Research Conference 2016. London, Canada. June 23-24, 2016. Oral Presentation.

Hanna, A.D. Facilitators and barriers to prescribing exercise in clinical practice to treat depression. Health and Rehabilitation Sciences Graduate Research Conference. London, Canada February 1, 2017. Oral Presentation

Hanna, A.D. Benefits of prescribing exercise to patients afflicted with mild-to-moderate depression. Canadian Obesity Network Research Blitz. London, Canada. March 14th, 2017. Oral Presentation

Hanna, A.D. Treating mild-to-moderate depression with exercise across the Canadian Healthcare System. Three-Minute Thesis (3MT) Research Communication Competition - Faculty of Health Sciences Heat. London, Canada March 29th. 2017. Oral Presentation
*Faculty of Health Sciences Finalist

Hanna, A.D. Treating mild-to-moderate depression with exercise across the Canadian Healthcare System. 3MT Research Communication Competition - Campus Wide Top 20 Finals. London, Canada April 5th. 2017. Oral Presentation

Hanna, A.D. Applying shared-decision making models in clinical practice to treat mild-to-moderate depression by increasing exercise adherence. The Annual Canadian Obesity Summit. Banff, Canada. April 25-28, 2017. Poster Presentation

Hanna, A.D. The benefits of prescribing exercise to children and adolescents in order to reduce symptoms of depression while improving overall mental health. 2017 Child Health Symposium. London, Canada. May 26th, 2017. Oral Presentation

Hanna A.D., Scime, N.V., Kirkwood, K. Understanding Barriers for Engaging in Physical Activity for Patients Afflicted with Mild-to- Moderate Depression. Exercise is Medicine National Student Research Conference. London, Canada. June 22nd, 2017. Oral Presentation

RADIO BROADCAST INTERVIEWS

June 2016 CHRW 94.9 “GradCast”. *Exercise and Health: Simple lifestyle modifications for improved health* (Broadcast Interview). Segment aired June 22, 2016

- September 2016 CHRW 94.9 “GradCast”. *Challenges in Healthcare and Clinical Practice with Regards to Prescribing Exercise* (Broadcast Interview). Segment aired September 13, 2016
- March 2017 CHRW 94.9 “Western Research Form”. *Leadership and Research in Turbulent Times: Why They Matter for Democracy. A conversation with Dr. Pam Bishop* (Broadcast Interview) Segment aired March 10th, 201

GUEST LECTURES

- February 2016 School of Kinesiology, Western University, London, ON. *Weight Bias, Discrimination and Obesity in Canada: Canadian Obesity Network SNP-Chapter*. An invited lecture for the Kinesiology 2907 Class.
- November 2016 School of Kinesiology, Western University, London, ON. *Understanding Obesity Discrimination in the Workforce*. An invited lecture for the Kinesiology 3100 Class.

SERVICE

- May 2017 Competition Judge - Medical Sciences Pane
The Undergraduate Awards
- March 2017 Radio Host (CHRW 94.5) Western Research Forum -
Multidisciplinary Graduate Research Conference
- April 2016 Judge - Medical Sciences Panel
The Undergraduate Awards
- March 2016 Judge - Student and New Professional Research Blitz
Canadian Obesity Network, Hamilton ON
- March 2016 Event Coordinator
London Health Sciences Research Day, London ON

PROFESSIONAL DEVELOPMENT AND CERTIFICATIONS

- May 2017 College of Family Physicians Canada – *The Growing Weight of Obesity: an update on psychological and pharmacological management* (certification 186254-001)
- April 2017 Specialist Certification of Obesity Professional Education (SCOPE) World Obesity Federation - *in progress*
- March 2017 World Health Organization (WHO) Growth Chart Training Program (Module 1-5)

- August 2016 National Institute of Health's (NIH) Office of Extramural Research course on Protecting Human Research Participants
- January 2016 Certificate in University Teaching and Learning
Western University Teaching Support Centre
- November 2016 Interagency Advisory Panel on Research Ethics' Introductory Tutorial for the Tri-Council Policy Statement: Ethics, Conduct for Research Involving Humans (TCPS)
- September 2016 Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS: CORE 2) Panel on Research Ethics, Government of Canada