DOES MINDFULNESS INTERVENTION IMPROVE QUALITY OF LIFE IN ADULTS WITH NON-MALIGNANT CHRONIC PAIN

by

Nikolay Kondratyev

B.S.N., Douglas College, 2013

PROJECT SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE IN NURSING:
FAMILY NURSE PRACTITIONER

UNIVERSITY OF NORTHERN BRITISH COLUMBIA

August 2021

ABSTRACT

Chronic pain is a significant problem that negatively affects quality of life resulting in distress, disability, and inappropriate prescription of analgesics. Primary care providers need evidence for non-pharmaceutical tools, such as mindfulness-based intervention, to manage the complexities of chronic pain. The purpose of this integrative literature review is to investigate the impact mindfulness may have on the quality of life of subjects with chronic pain. A background of relevant information is presented regarding chronic pain, quality of life, and mindfulness. Thereafter, a comprehensive search revealed 14 studies in this integrative literature review. Key findings include that there is low to moderate quality evidence that mindfulness improves QOL, especially in the domains of mental well-being. Overall, mindfulness can be an effective tool for individuals that are currently on pharmacological monotherapy. The study concludes with recommendations for future research and practice.

Keywords: nurse practitioner, chronic pain, quality of life, mindfulness-based intervention, mindfulness-based stress reduction.

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Acknowledgments

I want to extend my heartfelt gratitude to Linda Van Pelt and Lisa Creelman for their guidance, patience, and support during the development of this project. Without their wisdom, this project would not be possible.

Thank you to my colleagues that supported me during the UNBC Family Nurse Practitioner program and thank you to the faculty that pushed me to excel. Thank you to the Musqueam, Tsleil-Waututh and Squamish peoples on whose lands I work and study.

Finally, thank you to my partner, family, and friends, for your love and encouragement.

CHAPTER ONE

Introduction

My interest in the interaction between chronic pain and mindfulness starts with misfortune. Working in a busy emergency department (ER), I had the privilege of hearing a story from a patient that we will call James. James was a middle-aged man found unresponsive by his roommate and after intervention with cardiopulmonary resuscitation (CPR) and naloxone regained consciousness. Brought in by paramedics, James improved enough to share a portion of his story with me.

In our discussion, James relayed that he was a construction worker that injured his back. This pain did not resolve quickly, and strenuous physical labour, necessary to prevent homelessness, exacerbated the injury. As time passed, James took ibuprofen and acetaminophen to help with the pain to get through the workday. Eventually, his primary healthcare provider initiated opioid therapy for the pain. Like magic, the opioids eliminated the pain, and James returned to work eager and ready to continue the life that had been put on hold. Soon enough, the opioid medications that gave such hope turned sinister. First, the medicines did not work as well, and higher doses were needed. Next came physiologic and psychologic compulsion when James found himself unable to stop taking opioids. Finally, came the addiction, where the stop of opioid medications resulted in withdrawal symptoms. James was effectively trapped by the prescribed opioids for his chronic pain.

Unfortunately, this story is hardly unique. Opioids are frequently used as a treatment modality for chronic pain, and their proliferative use is strongly correlated with a new wave of drug overdoses (Heimer et al., 2019). Opioid mortality and morbidity correspond with prescription practices where an increase in prescriptions is associated with an increase in adverse

events (Fischer et al., 2014). Historically, there have been three waves of opioid overdoses, relating to prescription practices, heroin, and synthetic opioids, respectively (Ciccarone, 2019). The first wave of opioid deaths resulted from a significant increase in opioid prescribing during the 1990's and has consistently grown through to 2016 (Ciccarone, 2019). In 2016, the Government of British Columbia (2016) declared a state of emergency regarding the opioid epidemic resulting in systematic changes to prescription patterns of prescribers (Heimer et al., 2019). Even as more judicious opioid use has decreased the availability of narcotics, the cumulative damage caused by years of inappropriate prescribing cannot be easily undone (Vojtila et al., 2020).

This damage is particularly evident as opioid-related deaths continue to climb despite the COVID-19 pandemic. Pre-pandemic, the overdose events prompting a state of emergency fluctuated around 16 per 100,000 population (B.C. Center of Disease Control [BCCDC], 2020a). These already catastrophic numbers have been surpassed during the pandemic. In fact, overdose rates doubled in September 2020, to 31.37 per 100,000 population (BCCDC, 2020a). The cost of life is staggering; in British Columbia 3,890 overdose deaths occurred since 2016 (BC Coroners Service, 2020). In contrast, British Columbia has sustained 598 deaths from COVID-19 from onset until December 2020 (BCCDC, 2020b). This juxtaposition is not meant to minimize the devastating impact of COVID-19 but highlight the ongoing death toll from a different lethal epidemic.

Even as fewer prescriptions are made this paradoxically compounds the problem; Vojtila et al. (2020) argues that fewer opioid prescriptions result in a shift from prescribed opioids to illicit opioids in patients. When individuals are no longer prescribed opioids they may seek them from alternative sources (Sullivan, 2018). The problems presented are two-fold: 1) high opioid

dispensing levels increase adverse events and 2) if prescription practices decrease dispensing levels, individuals already prescribed opioids may shift to a dangerous illicit drug supply (Sullivan, 2018; Vojtila et al., 2020).

Certainly, the argument can be made that the overdose numbers are from illegal opioids and are not directly prescribed by providers, however, this oversimplifies the complexity of the problem. The burden of opioid use in western society was initially fueled by inappropriate prescription practices of the highly successful drug OxyContin, after an "unprecedented promotion and marketing campaign" (Van Zee, 2009, p. 225). Geographic regions that demonstrated an increased rate of prescribing also had the highest rates of diversion and abuse (Van Zee, 2009). Therefore, the presence of high-potency opioids such as fentanyl did not themselves cause an epidemic so much as highlighted a problem that was intensified in the early 2000's and overlooked until deaths became catastrophic. For example, if a sudden snowstorm with sub-zero temperatures killed a portion of the homeless population, the core root of those deaths is homelessness, not weather. In the same way, we must understand the origins of opioid deaths.

Simultaneously, chronic pain is a condition that must be addressed by the primary healthcare practitioner. In Canada, patients with chronic pain have a significant increase of visits to primary care (OR 4.7; 95% CI = 2.8 to 7.9; Mann et al., 2016). Chronic pain is one of the most common reasons patients seek medical care and is associated with "significant medical, social, and economic consequences, relationship issues, lost productivity, and larger health care costs" (Hilton et al., 2017, p. 199). As a result, addressing chronic pain is a common and challenging aspect of primary healthcare. Despite considerable resources on pharmacological management of chronic pain, no definitive solution exists, thereby influencing clinicians to use subpar strategies,

such as over-prescription of narcotics (Heimer et al., 2019), as discussed above. The prevalence and refractory nature of chronic pain has exhausted the pharmacological models available with outcomes ranging from insignificant to deadly (Day et al., 2014; Heimer et al., 2019). This reality led to considerable research into non-pharmacological methods of chronic pain management, such as mindfulness (Day et al., 2014). The addition of non-pharmacological methods in managing chronic pain will give the primary healthcare provider additional tools to manage a complex and recurring condition.

Some promise for treatment for chronic pain involves the application of mindfulness intervention. Mindfulness is a dispassionate state of self-observation that allows reflection of, rather than a reaction to, stressful situations (Bishop et al., 2004). This state is not equivalent to relaxing or mood modification but is a type of purposeful and rigorous "mental training to reduce cognitive vulnerability" (Bishop et al., 2004, p. 231). Mindfulness is a specific non-pharmacological intervention that could mitigate the impact of chronic pain on quality of life (QOL). Based on the premise that mindfulness is a type of mental training, it is unlikely to eliminate chronic pain. Rather, mindfulness may give individuals additional tools to deal with chronic pain, thereby improving their QOL. This is consistent with mindfulness principles because while immediate pain is inevitable, suffering is relative (Husgafvel, 2018, p. 281). As such, the purpose of this capstone is to conduct an integrative literature review (ILR) to answer if mindfulness improves QOL in adults with chronic pain. The question to be answered is: "what is the effect of mindfulness intervention on quality of life amongst adults with chronic pain?" By doing so, the contemporary primary healthcare provider will have an additional tool in managing chronic pain and be able to provide holistic and effective care.

CHAPTER TWO

Background

To investigate how mindfulness intervention impacts QOL in individuals with chronic non-cancer pain (CNCP) it is important to provide background information on these topics. The following section will aim to define and operationalize these core concepts and to provide the necessary context for the remainder of the capstone. The concepts of mindfulness, chronic pain, and QOL are defined and introduced in this section.

Chronic Pain

Pain is an unpleasant sensation unique to each individual (Culgin et al., 2021). Classically pain is described as "whatever the experiencing person says it is, existing whenever the experiencing person says it does" (Culgin et al., 2021, p. 116). Typically, pain functions as an alarm system that is protective and warns of potential or actual tissue damage (Culgin et al., 2021). On the other hand, chronic pain is a consistent noxious stimulus that persists past three months and serves no purpose (Ritter et al., 2020). This pain may occur due to an initial insult or without any known cause and persist for reasons unrelated to the onset of pain (Culgin et al., 2021). Severe chronic pain can arise without cause, such as the case of trigeminal neuralgia, or persist long after the offending injury has healed, such as phantom limb pain (Ritter et al., 2020). Although chronic pain can be related to malignancy, this concept is beyond the scope of this review. Therefore, only research related to CNCP will be considered for the purposes of this ILR.

Chronic pain is widespread. Reitsma et al. (2011) reported that 15.1-18.9% of Canadians live with chronic pain. This number disproportionally affects women and has increased incrementally over time (Reitsma et al., 2011). Older adults have the highest prevalence of

chronic pain estimated at 23.9-31.3% (Reitsma et al., 2011). The impact of this pain is significant as it prevents as many as 13.3% of Canadians from performing some activities (Reitsma et al., 2011). The prevalence of moderately-severely disabling chronic pain ranges 10.4-14.3% in the United Kingdom (Fayaz et al., 2016). The annual economic cost of chronic pain is estimated $560-635 billion in the United States alone (Gaskin & Richards, 2012). The direct cost of treating chronic pain in Canada is $7.2 billion (Hogan et al., 2016). Clearly, chronic pain is a common condition that warrants treatment.

Chronic pain has implications for QOL. Burke et al. (2018) noted that individuals with chronic pain had significantly lower QOL than those without pain. Furthermore, higher intensity of pain was positively correlated with lower QOL (Burke et al., 2018). This is consistent with Hadi et al. (2019) that documents progressive interference with physical functioning, professional life, relationships and family life, social life, sleep, and mood. A review by Fine (2011) demonstrated an impact on mood where chronic pain predicts development of anxiety, depression, and suicidality. In chronic pain QOL is affected by the "aforementioned sequelae, including mental health and sleep, but is also affected by social interactions and daily activities such as personal relationships and employment status" (Fine, 2011, p. 998). Therefore, chronic pain has a tangible impact on QOL and treating chronic pain with mindfulness.

Population

The particular group of interest for this ILR is adults with chronic non-malignant pain of any sub-type. The distribution of chronic pain is widely variable in the general population (Mills et al., 2019). Nonetheless, chronic pain tends to be more prevalent in later decades of life (Fayaz et al., 2016). A prevalence of 14.7% in the 18–25-year-old age group increases drastically to 62% in the >75 year age group (Fayaz et al., 2016). There is a paucity of data in the rates of

chronic pain amongst children (Mills et al., 2019). Evaluating children also provides additional bias to any study, such as maturation bias (Hoffman et al., 2017). Therefore, the highest yield and quality of data is likely to come from adult studies. This paper will investigate adults with chronic pain as the primary population with ages 18-99+.

Mindfulness

Growing academic interest in mindfulness resulted in a dense theoretical discussion as the subject is operationalized for western understanding and inquiry (Chisea, 2013). Mindfulness is a specific way of paying attention in the present moment without preconceived notions or judgments (Conn, 2011). This means that any thoughts, feelings, or sensations that are consequence of stimuli are "observed, acknowledged, and accepted without evaluation or judgment—the experienced phenomena are deemed neither right or wrong, good or bad, important or unimportant; they simply are" (Conn, 2011, p. 993). Nonetheless, the idea that mindfulness is a singular action or tool is misguided; mindfulness is a practice that is a continual, life-long journey (Kabat-Zinn, 2005). Therefore, the meaning of mindfulness is difficult to comprehend as simply a series of definitions or operational questionnaires. For example, most authors agree that mindfulness can be defined as present-moment attention and awareness, however, these are pre-requisites of any discriminative mental state (Conn, 2011). As such, the states of attention and awareness can be considered as prerequisites rather than equivalents to mindfulness (Conn, 2011). This implies that to truly understand mindfulness one must practice it (Kabat-Zinn, 2005; Husgafvel, 2018). For example, describing colours to a blind patient is a different experience than being able to see those colors for oneself. The discrepancy between understanding and investigating a subject has implications on research.

This contradiction presents an interesting conundrum in the quest for operationalizing and researching mindfulness. If the premise that mindfulness cannot be appropriately understood by someone who does not practice mindfulness is true, the researchers that evaluate mindfulness should also be practitioners or undergo extensive, in-depth training. This training is necessary because "merely linear, additive models that sum putative markers of mindfulness could not suffice…[and] any attempt to delineate discrete components of mindfulness is not likely to capture the inherent interrelationships among mindfulness and related concepts" (Chiesa, 2013, p. 262). Conn (2011) illustrates this complication by suggesting that researchers risk evaluating mental processes that are similar to mindfulness but are not mindfulness. For example, researchers may assess concepts of wisdom and ethics that, although may be related to mindfulness, are not equivocal.

There is also a certain paradox in evaluating the impact of mindfulness on QOL in chronic pain. First, mindfulness is not actually intended to fix anything, including pain or stress (Kabat-Zinn, 2005). There is not a specific destination or outcome. For contrast, the medical model is much more specific, where a medication or surgery has identifiable goals and predictable outcomes. We expect, with a reasonable degree of certainty, that approximately 30 minutes after taking an acetaminophen tablet our knee pain will improve. Mindfulness provides no such guarantees. Instead, mindfulness is an invitation to live life in the moment by dispassionately examining where one already is only to realize that what we experience is "severely edited and often distorted through the routinized, habitual, and unexamined activity of our thoughts and emotions" (Kabat-Zinn, 2005, p. 148). This means that mindfulness is never intended to be used as a solution or fix for any ailment. Paradoxically, the purpose of this project is to investigate if mindfulness can, in effect, be used as a means for specific medical outcomes.

This is viable because the intended purpose of mindfulness is irrelevant if the intervention has specific measurable outcomes on QOL in patients with chronic pain.

There is ongoing discussion about defining mindfulness and the implications on practice, although a comprehensive review and discussion are beyond the scope of this project. Most contemporary research on the subject build upon the operational definition outlined by Kabat-Zinn (2005) "the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment" (p. 145). This is the core definition that is used to evaluate mindfulness in contemporary research.

Mindfulness Operationalized

Mindfulness has been practiced since antiquity in various cultures, often in conjunction with religious or spiritual overtones (Kabat-Zinn, 2003). The essential practice of mindfulness has been extracted from religious and cultural connotations and adapted to western medicine by Jon Kabat-Zinn (Kabat-Zinn, 2003; Jensen, 2014). This adaptation consists of an eight-week mindfulness-based stress reduction (MBSR) program taught in a group setting with a specific curriculum (Jensen et al., 2014). Mindfulness programs typically use the MBSR curriculum with minor adjustments or use it as a benchmark in developing unique mindfulness programs such as mindfulness-based cognitive therapy (Marchand, 2012). Therefore, for the purpose of this capstone, any mindfulness intervention with a basis in MBSR is included. This includes mindfulness based cognitive therapy, mindfulness meditation, adapted MBSR, online MBSR, or other modified versions. There are no program length restrictions, although a standard MBSR length is eight weeks (Jensen et al., 2014). Practices that may contain mindfulness but are not mindfulness-based, such as acceptance and commitment therapy (ACT), are excluded.

The most frequently utilized MBSR curriculum involves meditation that starts with paying particular attention to specific sensations, movements, or breathing (Jensen et al., 2014). Sensations could include that of taste or sound. Yoga is an example of an exercise that is attention to movement. Breathing focuses on breath leaving and entering the body. As the participants meditate on their task, eventually distractions will arise in thought, sensation, or other phenomena (Jensen et al., 2014). Participants are taught to recognize the phenomenon and label it in a neutral manner (e.g. "thinking") without reacting with attachment or dislike (Jensen et al., 2014). They acknowledge the presence of a distraction, label it, and then allow their mind to return to the task. In this way, distractions are not inconveniences in the process, but rather an integral part of mindfulness training. This way "it provides an opportunity to notice that the mind has wandered, and then, calmly and non-judgementally, to return attention to the focal object" (Jensen, 2014, p. 7). Mindfulness is typically taught once a week for the duration of eight weeks with one weekend retreat in the original MBSR curriculum (Kabat-Zinn, 2005; Jensen et al., 2014). Participants are instructed to practice mindfulness for at least 45 minutes every day. In this manner, mindfulness becomes a habitual practice and skill rather than a passive treatment (Jensen et al., 2014). Due to a relatively standardized and well laid out process of the MBSR program, it is the most frequently employed and investigated method of instilling mindfulness in western medicine. Although many variations exist, they are typically heavily based on the MBSR curriculum. Therefore, the MBSR will be considered as the primary operationalized form of mindfulness considered in studies.

Utility of Mindfulness

Phenomenological Perspective. Mindfulness can be theorized to work in a series of models, both biomedical and phenomenological. From a phenomenological perspective, if we

conceive that mindfulness is paying attention to the present moment and evaluating each moment in a dispassionate analytical way that is separate from our own biases and emotions, it is essential to consider if that is useful. For example, if I do not have any biases, then there is a questionable utility in practicing mindfulness. On the other hand, if the mind can be manipulated, mindfulness becomes more useful because it provides a tool to discover and evaluate the presence and degree of manipulation (Williams & Kabat-Zinn, 2011).

The idea of mental manipulation is particularly noteworthy in the context of chronic pain because the biases an individual holds may significantly alter their experience of pain; Husgafvel (2018) delineates the difference between somatic sensation, such as pain, and personal experience, such as suffering. An individual may be in significant pain and live their life happily or be in a small amount of pain and be suffering greatly. This disconnect of the somatic and personal experience is consistent with the phenomenological ideas of Martin Heidegger, who claimed that consciousness is a product of the historical context from which it arises and cannot be neatly separated from this context (Stanford Encyclopedia of Philosophy, 2011). It is possible that an individual may have the same amount of pain but based on their context and state of mind they can have significantly less suffering and improved QOL. Therefore, the first question is to evaluate if the human mind is prone to manipulation to determine if mindfulness can be useful.

It is no surprise to discover that the mind can be manipulated, but it can be somewhat shocking to realize how easily this can be accomplished. Seminal research by Mazzoni and Loftus (1998) demonstrated how "participants became more confident that they had had certain childhood experiences after a 30- minute dream interpretation that suggested those experiences" (p. 184). The participants had their own memories manipulated within a 30-minute window. In a now-famous experiment Loftus and Palmer (1974) convincingly demonstrated that the form of a

question can “markedly and systematically affect” (p. 586) the subject's answers to that question. In this experiment, subjects viewed a video of a car crash and then were asked to estimate what speed the cars were going at the point of impact. If the researcher asked how fast the cars were moving when they ‘smashed’ into each other, versus, ‘hit’ each other, the answers differed. These experiments show that memory can be easily manipulated through suggestion and language.

The argument can be made that memory is unreliable, and it is much harder to manipulate the senses in the present. Unfortunately, this argument is dismissed with closer scrutiny; a myriad of studies document how easily subjects are manipulated through their senses. Hirsch (1995) demonstrates how smells increase gambling in a casino. Briñol & Petty (2003) induced head nodding or shaking in their subjects while listening to an argument to discover that this influenced the subject’s perception of that argument. In these experiments, subjects were not aware of how they were manipulated by researchers and how deeply their (apparently sound) conclusions were to bias. These studies can highlight the mind’s propensity to delude itself, and all the while, think itself unbiased.

An argument can be made that none of what is presented relates to somatic symptoms. Given that a major focus of this project is the evaluation of mindfulness in the setting of chronic pain, evidence would need to be presented that the mind can be manipulated in the setting of somatic symptoms. In this setting, the mind can also delude itself based on a series of rules outlined by pioneers in psychology. The now well-established principles of conditioning can be utilized to manipulate core somatic reactions. In classical conditioning, neutral stimulus is paired with an unconditioned stimulus that causes an automatic, unconditioned response (Rehman et al., 2020). After a period, the neutral stimulus becomes conditioned to exert the same response in the

absence of the unconditioned stimulus. In this same way, Pavlov famously made dogs salivate by ringing a bell (Rehman et al., 2020). Classical conditioning can be found in healthcare settings and can cause significant somatic symptoms (Rehman et al., 2020). For example, consider the chemotherapy patient that becomes nauseous during treatment and begins to associate nausea or pain with a neutral stimulus, such as a white coat (Wade et al., 2016). In the future, this patient will experience nausea and discomfort if they meet someone wearing a white coat, despite the absence of any noxious chemicals (Wade et al., 2016). Classical conditioning is just one theory that can explain a degree of mental manipulation that includes somatic symptoms.

Another mental manipulation as it relates to somatic symptoms is the idea of a placebo. The placebo effect is a mental manipulation where an individual feels an improvement of physical symptoms after an intervention with no corresponding medicinal properties (Montgomery & Kirsch, 1997). Unsurprisingly, placebo has been investigated in analgesia, although it does have other applicable effects (Haug, 2011). While the placebo effect's exact mechanism is contested, evidence suggests that expectation impacts human experience (Haug, 2011; Montgomery & Kirsch, 1997). The existence of the placebo effect suggests that our mind is prone to both manipulations from external sources but also based on our expectations. That means that somatic symptoms, such as pain, can be manipulated based on our expectations and other internal mechanisms, as suggested by the existence of a placebo effect. In summary, the human mind can be deluded and manipulated in many ways, including memory, opinion, habits, and somatic symptoms, such as pain.

Based on the idea that the human mind is frequently and easily deceived, there is more merit for mindfulness. If mindfulness is a tool that allows living in the moment and discovers biases that may impact our memory, thoughts, and sensations, there is more opportunity for

control (Williams & Kabat-Zinn, 2011). This discussion underscores the importance of staying in the present and paying attention "to the mind's capacity to fool us moment by moment" (p. 16). Therefore, mindfulness is a theoretically sound practice from a phenomenological perspective and is worth examining in the setting of QOL and pain.

Biomedical Perspective. In the evidence-based practice (EBP) system of contemporary medicine, a biomedical perspective is often a critical step in considering a treatment modality as legitimate or worth investigating (Hollenberg & Muzzin, 2010). The utility of mindfulness can therefore be considered from a biomedical perspective. Brown and Jones (2010) used electroencephalography (EEG) and noxious laser stimulations to demonstrate differences in pain perception. Compared with control, the meditation group evoked lower activation of the right inferior parietal cortex and midcingulate cortex (MCC). The MCC is a component of the limbic cingulate gyrus situated immediately superior to the corpus collosum, theorized to be an important structure in nociception, itch, fear, and pain (Vogt, 2016). When assessed with EEG the researchers noted lower electrophysiological markers of anticipation in the meditation arm that resulted in lower evoked potentials to painful stimuli (Brown & Jones, 2010). This is significant because meditators demonstrated lower pain unpleasantness with the lower activation of the MCC when compared with control. In addition, meditators were never instructed to meditate during the experiment (Brown & Jones, 2010); the implication here is that meditation has enduring tangible changes that make a difference in how the subjects interpret pain signals independent of active meditation.

A different approach was employed by Grant et al. (2011) while investigating pain responses in meditators with a functional magnetic resonance imagining (fMRI). Interestingly, during calibration, the meditator branch required higher stimulus intensities to produce moderate

pain (49.9 vs 47.9 C, p = 0.01 d = 1.05). Meditators had increased activation of the nociceptive tract insula, thalamus, and MCC than control, albeit meditators also received a higher painful stimulus. Despite this physiological response to pain, meditators demonstrated suppressed activity in centers associated with emotion and appraisal, such as the amygdala, caudate, and hippocampus (Grant et al., 2011). During painful stimuli the meditator group demonstrated a weak coupling of the dorsal anterior cingulate cortex (dACC), which is believed an important structure in reward-based decision making, and right dorsolateral prefrontal cortex (DLPFC), which is associated with working memory and selective attention (Bush et al., 2002; Curtis & Disposito 2003; Grant et al., 2011). This disarticulation was not present in the control arm. Grant et al. (2011) argued that decoupling between dACC and DLPFC structures is associated with lower pain sensitivity observed with meditators. Therefore, there may be a training-related "ability to disengage higher-order brain processes while remaining focused on a painful stimulus" (p. 155), resulting in a lower perception of pain. This is consistent with other neuroimaging studies that demonstrate tangible and visible changes in meditators when exposed to chronic pain.

The results of the examined studies are strikingly consistent with mindfulness theory. As discussed, there appears to be either a direct depression of pain perception centers (e.g., MCC) or decoupling of pain processing and higher-order functioning centers (e.g., dACC and DLPFC). The imaging data suggest that meditators have persistent neural changes present long-term without active meditation in subjects. Although there are many neuroimaging research weaknesses, the overall results show the promise of mindfulness as a treatment modality for pain. Mindfulness induces specific physiological changes that can be evaluated. From a biomedical perspective, this means that mindfulness has a sound theoretical base and proposed

pathophysiological function. In summary, this section established that mindfulness has sound theoretical frameworks from both phenomenological and biomedical perspectives and is worth evaluating in the setting of chronic pain. Phenomenological perspective suggests that mindfulness is helpful due to the mind's propensity to delude itself (Kabat-Zinn, 2003). Biomedical perspective suggests that mindfulness induces observable changes in neurological structures, which modulate pain (Grant et al., 2011). It is unclear what impact mindfulness would have on QOL.

Quality of Life

Definitions of quality of life (QOL) are as plentiful and inconsistent as the methods assessing it (Farquahar, 1995; Hacker, 2010). The World Health Organization (WHO, 1996) defines QOL as "the individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns" (p. 5). QOL is a social construct that has no physiological basis or symptoms and incorporates a web of interrelating intrinsic and extrinsic factors to a single person (Belshaw & Yeates, 2018). Therefore, QOL is not a static notion but rather a highly individual and multidimensional concept, varying from person to person (Estoque et al., 2019). Therefore, the problematic component is that different people will value different things, and their preferences will change throughout their lifetime (Farquahar, 1995). Despite the eloquent WHO definition, this concept is difficult to define and operationalize. There is no consensus in academic literature about what this concept is or how it should be measured. Most researchers agree on the premise that 1) the individual is a judge of their own QOL, and 2) QOL is multidimensional (Hacker, 2010). For this project, the WHO (1996) definition will be used to operationalize this concept, although some context is necessary for the ambiguity of this term in research.

There are significant implications for the ambiguity in defining this concept. In a comprehensive review Harldstad et al. (2019) noted that 87% of research studies investigating QOL do not define the concept. Studies often consider QOL as a secondary measure because the dependent variable is seldom designed to impact QOL specifically (Harldstad et al., 2019). Instruments to quantify QOL vary widely but typically have a generic measurement of QOL along with a conditions-specific measure of QOL. There is a specific measure for each disease and several measurements for the generic component, such as Short Form-36 (SF-36), EuroQol-5 Dimensions (EQ-5D), and World Health Organization Quality of Life-100 (WHOQOL-100) for adults (see Appendix B). Because pediatrics is beyond the scope of this project, there is no need to evaluate pediatric measures of QOL. Although there is significant variety, a common tool for measuring QOL is the SF-36, which warrants further discussion.

The most popular tool for measuring QOL is the SF-36 (Lins & Carvalho, 2016). This instrument measures eight domains including physical functioning (PF), role-physical (RF), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role emotional (RE), and mental health (MH) (Lins & Carvalho, 2016). The results of each of these domains is then entered according to the developer's algorithms to provide a physical and a mental QOL score, described as the physical component summary (PCS) and mental component summary (MCS), respectively. Grossly speaking PF, RF, BP and GH inform the PCS score and VT, SF, RE, and MH inform the MCS score, although there is overlap (Ware & Gandek, 1998). There is no way to combine the PCS and MCS scores into one meta-value that was approved or validated by the developers (Lins & Carvalho, 2016; Ware & Gandek, 1998). Unfortunately, many studies attempt to generate one QOL value from the SF-36, which is expressively discouraged by the developers (Lins & Carvalho, 2016).

This is consistent with researchers that differentiate mental and physical domains of QOL and report them separately (Ball et al., 2017). As noted in the mindfulness section, it is unlikely that mindfulness will significantly change the physical domains of QOL but has a strong theoretical framework for improving mental QOL such as that measured by the MCS. There is a degree of ambiguity and variance in measuring QOL can make this a difficult concept to operationalize in research.

Although QOL is difficult to define as a concept, it does not mean that we as a society do not know what it means when we are discussing QOL. For example, the concept of a game is difficult to define. One might say that a game is a leisure activity with two teams and a goal of acquiring more points than the opposing team. These definitions will immediately fail because games can be solo or team-based, competitive or casual, virtual or real, physical or sedentary, or any shade of a myriad of other factors. Does this mean that we as a society do not know what a game is? Of course not. Definitions are helpful as they help clarify grey areas where we are not sure if something is a game or not - or QOL if we drop the allegory. Defining a concept provides clarity and operational guidance, but the lack of a comprehensive or fully agreed-upon definition does not preclude this topic from being investigated.

QOL in Healthcare

The concept of QOL was first used post World-War II often in the context of security and material wealth rather than as a healthcare concept (Barcaccia et al., 2013). Since its inception, QOL has been adapted into various academic fields such as economics, nursing, medicine, philosophy, recreation, visual arts, geography, and architecture (Barcaccia et al., 2013). Traditionally, biomedical models have focused on longevity as end-points in research and treatment (Barcaccia et al., 2013). Over the last several decades the shift in healthcare models

and philosophy has changed to give more weight to the quality rather than quantity of life (Barcaccia et al., 2013; Haraldstad et al., 2019). This shift in thought from quantity to QOL has benefits for healthcare.

When QOL is considered in healthcare, it has multiple advantages over the traditional biomedical model. Utilizing QOL may reveal issues patients experience post-treatment, leading to modifications and improvement of treatment modalities (Haraldstad et al., 2019). QOL can be used to identify a greater range of potential problems for patients; this, in turn, can be used to help future patients understand the consequences of disease and treatment in a more meaningful and holistic way (Haraldstad et al., 2019). Patients that are cured from a biomedical perspective may have ongoing issues that would be missed without a QOL assessment (Haralstad et al., 2019). Finally, QOL values may have important prognostic factors for mortality in various conditions (Keller et al., 2019). For example, Erceg et al. (2019) found the QOL scores were independent predictors for cardiac mortality (HR: 2.051, 95% CI: 1.260-3.339, $P = 0.004$), all-cause mortality (HR: 1.620, 95% CI: 1.076-2.438, $P = 0.021$), and HF-related rehospitalization (HR: 2.040, 95% CI: 1.290-3.227, $P = 0.002$) in adults hospitalized with heart failure. QOL, therefore, has significant utility in healthcare.

In healthcare, some philosophers and researchers make a distinction between QOL and health-related quality of life (HRQOL) as associated but ultimately distinct subjects (Karimi & Brazier, 2016). This distinction is difficult to make because precise definition of either concept is contested. Ultimately, the idea is that HRQOL is sub-category of QOL that relates to healthcare specifically and is not concerned with QOL related to other fields such as politic or economics (Karimi & Brazier, 2016).

This project will not make a specific distinction between HRQOL and QOL when evaluating studies unless the authors of the study make that distinction. The reasoning for this is threefold. First, the majority of researchers do not make the distinction between these concepts and consider them synonymous (Harlstad et al., 2019). Therefore, focusing on HRQOL would artificially lower the search field. Second, the HRQOL is difficult to define and differentiate from related concepts such as health. Most questionnaires or definitions of HRQOL focus on measuring health outcomes, which ultimately fall in the domain of health as a concept (Karimi & Brazier, 2016). The third reason flows from the first two: the concepts of health and QOL are distinct and relatively easy to differentiate. On the other hand, "a distinction between [HRQOL] and both health and QoL is difficult to make" (Karimi & Brazier, 2016, p. 6). As such, this project will not explicitly focus on HRQOL over QOL.

There is no gold standard for measuring QOL for chronic pain and the tools used will vary by researcher, specific subset of chronic pain, and experiment design (Mason et al., 2009). Appendix B presents a summary of some common tools in measuring QOL.

Many calculations of QOL do contain a component of mental health assessment. For example, the WHOQOL contains a mental health component to its questions. In that context, does improving mental health constitute an improvement in quality of life? For example, if a study determines that WHOQOL is not different in mindfulness versus control but determines that mental health is statistically different (i.e. depression is improved, etc), does this constitute and improvement in the quality of life? The answer to this question is not simple. Indeed, anxiety and depression are well established to decrease the QOL of patients in most domains (Brenes, 2007). To complicate matters, mental health questionnaires are often used in studies as cross-reference benchmarks. For example, Bunevicius (2017) uses BDI-II depression scale in order to

validate SF-36 scale in patients with brain tumors. This means that mental health scales and QOL scales are closely related. Even if they are separate concepts, there is value in noting if mental health scales are used and how they are changed by meditation. As such, this project will not explicitly look for mental health scales, such as the BDI-II, with no consideration to inclusion or exclusion criteria; however, if these scales are used, and they determined a difference in the study, they will be noted in the analysis section.

Summary

In summary, the background chapter of this literature has provided context and operational definitions for the concepts of mindfulness, chronic pain, and quality of life with an emphasis on the adult population. The next chapter discusses the methods used in the literature review.

CHAPTER THREE

Methods

The human experience is often plagued by chronic pain, requiring the apt attention of the primary care provider (Fayaz et al., 2016). Pharmaceutical interventions have significant adverse events and, in the case of opioids adverse outcomes may include overdose and addiction (Hilton et al., 2017). Mindfulness is a specific non-pharmacological intervention that could mitigate the negative impact of chronic pain on quality of life (QOL) without the adverse effects of pharmaceuticals (Hilton et al., 2017). This section outlines the methods behind developing the population/intervention/outcome (PIO) question, search strategy, inclusion and exclusion criteria, and data analysis for this integrative literature review.

Research Question

The concepts of mindfulness, QOL, and chronic pain are refined into a searchable PIO question, which specifies the population, intervention, and outcomes necessary for an effective literature search (Hoffman et al., 2017). Literature was reviewed to answer the following question: "what is the effect of mindfulness on quality of life amongst adults with chronic pain?"

Search Strategy

Key terms for the literature review used "mindfulness," "quality of life" and "chronic pain" and all were searched as major headings. In addition, each subject heading was entered as a term that included key variations of that heading. Terms associated with mindfulness such as "yoga" or "Buddhism" were considered, but not applied due to their non-specific nature. Key terms were searched through the abstract rather than all fields in order to narrow the search to relevant literature. An example of CINAHL search is as follows:

S1: (MH “Chronic Pain”) OR AB (chronic pain OR persistent pain OR long term pain) – 44,045 results.

S2: (MH “Quality of Life”) OR AB (quality of life OR well being OR well-being OR health-related quality of life) – 213,068 results.

S3: (MH “Mindfulness”) OR AB (mindfulness OR MBSR OR mindfulness based stress reduction OR mindful therapy) – 5,106 results.

S4: S1 AND S2 AND S3 – 49 results.

The same search terms were applied and searched in PsychInfo and PubMed with mild alterations to accommodate database specific Boolean rules. There were no variations in major headings from the three databases. The results from all databases were exported to database management software. Also, systematic reviews were identified and searched for references, resulting in two additional references that were exported to management software. Duplicates were identified and removed for a total of 164 before review or application of the inclusion and exclusion criteria.

The inclusion and exclusion criteria are summarized in Table 1. No exclusion criteria were proposed based on gender, race, geographical location, pain intensity, or pain origin. Initial exclusion criteria eliminated articles that were published before 2010, those that included pediatric populations, non-English studies, or those that were not primary research. In addition, pilot studies older than 2018 were excluded, as they predate better designed randomized control trials (RCTs) and provide very weak evidence to the topic. After this initial application of inclusion and exclusion criteria, 53 articles were excluded, and 101 articles were submitted for abstract and title review. Following abstract review and including 24 articles underwent full text

review. Full text review removed additional articles to a total of 14 items that met the inclusion criteria.

In addition to this search, any systematic reviews that met the inclusion criteria were mined for references. An additional two references were found and included for full text review. Those references did not meet inclusion criteria and were not included in the synthesis. See PRISMA chart in Appendix A for details.

Finally, grey literature was screened for any additional relevant studies. Google Scholar, World Wide Web, and various meditation-based websites were screened for any additional studies and to ensure saturation. No new studies were included from this review method.

Table 1

Inclusion and Exclusion Criteria

Inclusion	Exclusion	Rationale
Date range 2010-2020	Date prior to 2010	Review the most current literature on the subject. If the results generated are insufficient (<10 articles) due to this limiter it may be extended to 12 years.
English language	Not available in English	Unable to read and interpret studies in other languages without a translator.
Adults ages >18	Pediatric populations ages <19	Project focus is adult patients. Pediatrics are more likely to involve sources of error such as maturation.
Chronic pain >12 weeks	Pain <13 weeks	Pain less than 13 weeks is more likely to be acute or sub-acute rather than chronic. Acute pain falls beyond the purpose of the research question.
Any comorbidities outside the exclusion criteria	Organic brain disease that includes dementia or decreased level of consciousness	Comorbidities are excluded if they interfered with the capacity to be mindful.
Published in academic journals	News or opinions	Highest quality of literature.
Pilot Studies 2018-2020 that contribute new knowledge not explored by other RCTs.	Pilot studies older than 2018	There is an overabundance of pilot studies in a field where more rigorous literature already exists. Pilot studies will only be considered if they consider mindfulness in a way not explored by existing RCTs.
RCT follow up ≥8 weeks	RCT <8 weeks	This criteria allows for better evaluation of outcomes of the intervention.

Data Analysis

Data analysis was informed by the framework by Whittmore and Knafl (2005). Although no gold standard for data analysis exists, Whittmore and Knafl (2005) suggest the steps of data reduction, data display, data comparison, and conclusion drawing. Data reduction and display involves sorting the data through a logical system and use that system to simplify, abstract, and focus the data in a manageable way. The n = 14 articles were submitted to data reduction via the

literature review matrix (LRM). Systematic analysis and primary study RCTs had an individualized LRMs, respectively. This data is displayed in Appendix A.

Data comparison involves analysis of the data display to determine patterns or relationships (Whittmore & Knafl, 2005). The data was organized along thematic clusters, grouping types of pain, types of control, type of delivery, patient population, and evidence towards relationship of QOL and mindfulness in patients with chronic pain. The developed LRMs were used to inform the categories for the thematic clusters.

Conclusion drawing relates to the final phase of data analysis (Whittmore & Knafl, 2005). A particular challenge is drawing conclusions from conflicting evidence. In order to interpret conflicting evidence in studies the technique used was vote counting, where the study compared the frequency of significant positive results with the frequency of significant negative outcomes. The data is summarized and thematically presented in the following chapter.

Summary

The PIO question "what is the effect of mindfulness on quality of life amongst adults with chronic pain?" was systematically reduced to inform a comprehensive literature search that involved formal database searching, reference mining, hand searching, and reviewing grey literature. After applying inclusion and exclusion criteria, 14 studies were identified for data analysis. Data analysis, informed by Whittmore and Knafl (2005), consisted of data reduction and display, data comparison, and conclusion drawing. The results of data analysis are discussed in Chapter 4.

CHAPTER FOUR

Findings

This integrative literature review aims to answer the question "what is the effect of mindfulness on quality of life amongst adults with chronic pain?" After a comprehensive search, eight RCTs (Cherkin et al., 2017; Dowd et al., 2015; Hearn & Finlay, 2017; la Cour & Peterson, 2015; Morone et al., 2016; Nathan et al., 2017; Schmidt et al., 2011; Wong 2013) and six systematic meta-analyses (Ball et al., 2017; Bawa et al., 2015; Chiesa, A., & Serretti, 2011; Hilton et al., 2017; Lauche et al., 2013; Veehof et al., 2016) were appraised. This chapter will assess systematic reviews to establish if mindfulness influences the QOL of adults with chronic pain, and then consider individual RCTs for thematic analysis. Specifically, RCTs are grouped by type of chronic pain, including non-specific non-malignant chronic pain, back pain, fibromyalgia, and neuropathic pain. In addition, results will be analyzed in the context of gender, geography, and potential harms.

For clarity, it is important to understand the difference between active and passive controls in mindfulness studies. In RCTs and the meta-analyses, the test of reliability of an observed mean difference between several groups depends on the magnitude of this difference and the variability within each group (Datta, 2007). Essentially, the greater the observed mean difference, and the lower the variability, the greater the probability that any difference is statistically significant (Datta, 2007). Passive control groups are controls that are typically described as 'waitlist' or 'usual care' where the intervention arm and control arm are quite different (Cherkin et al., 2016). This control type is unable to control for non-specific effects of mindfulness intervention such as increased support, social connection, and attention from researchers (Ball et al., 2017). Therefore, studies with passive controls tend to have more

variability that may not be rigorously evaluated and are likely less reliable (Datta, 2007). Active control groups are groups that mimic the mindfulness intervention as closely as possible tend to decrease the variability and therefore the statistical analysis is more rigorous (Datta, 2007).

Systematic Reviews

There are six systematic reviews that investigate the impact of mindfulness on quality of life (Ball et al., 2017; Bawa et al., 2015; Chiesa, A., & Serretti, 2011; Hilton et al., 2017; Lauche et al., 2013; Veehof et al., 2016). Systematic reviews with meta-analysis were chosen because they contain the most rigorous summary of knowledge on a given subject and use statistics to combine knowledge from multiple studies. Due to the high heterogeneity of studies in this field, meta-analysis provides an opportunity to draw the most robust conclusions from variable data (Bawa et al., 2015). Statistical significance will be used to accept or reject the null hypothesis. The null hypothesis in this review is that mindfulness has no impact on QOL in patients with chronic pain.

QOL Systematic Reviews Rejecting the Null Hypothesis

The systematic review by Ball et al. (2017) investigated the impact of mindfulness intervention on psychological morbidity and QOL, in patients with chronic pain; for this capstone, the QOL results are appraised. Ball et al. (2017) evaluated 13 RCTs consisting of MBSR-based mindfulness programs and extrapolated means, standard deviations, and sample sizes. The statistical evaluation of QOL domains revealed mixed results. Overall, the total quality of life was borderline significant (SMD 0.57; 95% CI 0.25, 0.89; I^2 52.9%). The mindfulness results were subdivided into physical and mental QOL domains. The physical components were not statistically significant (SMD 0.04; 95% CI 0.22, 0.30; I^2 0%), but the mental QOL were

statistically significant (SMD 0.57; 95% CI 0.25, 0.89; I 2¼ 52.9%). Thereby, the improvement in the mental, but not physical, domain of QOL rejects the null hypothesis.

This study has some notable strengths, such as no language restrictions. The study included only RCTs, which makes the conclusions stronger than reviews with other study designs of comparable quality. The quality of studies was systematically evaluated and guided the review through a PRISMA tool. The inclusion criteria was rigorous and the authors excluded action commitment therapy (ACT) studies that usually contain elements of mindfulness but are not mindfulness based. It also assessed the weaknesses of previous systematic reviews and attempted to improve on them.

There were also some weaknesses. This study does not report the magnitude of effect such as the Cohen's d, or decide if the mental QOL improvement was clinically significant as well as statistically significant. The discussion section of this study does not address the impact of the QOL findings in their review, nor did it define or differentiate between physical QOL or mental QOL. A weakness is that all included RCTs had a passive rather than active control group, which likely increases the variability in the study thereby weakening the statistical conclusions. Unfortunately, this study excluded any studies with three arms (e.g. intervention, passive control, active control) in favour of passive control trials and the authors do not explain this decision.

Hilton et al. (2017) performed a meta-analysis investigating the safety and efficacy of mindfulness. The outcomes measured were related to a decrease in intensity of pain, and improvement of quality of life. Hilton et al. (2017) identified and analyzed 38 RCTs, although only 16 of them investigated QOL outcomes in mindfulness. All control groups were considered, including passive control, support group, education, and stress management. Pooled analysis

revealed a positive effect of mindfulness on QOL scores, and these were reported as physical domains of QOL and mental domains of QOL. Physical health-related QOL was significant (SMD, 0.34; 95 % CI, 0.03, 0.65; I^2, 79.2 %) with a low quality evidence. Mental health-related QOL was significant (SMD, 0.49; 95 % CI, 0.22, 0.76; I^2, 74.9 %) with a moderate-quality evidence. In this setting, quality of evidence referred to factors such as confidence intervals and consistency of results. In addition, QOL outcomes did not seem to differ significantly based on underlying medical conditions. This study provides compelling, if low-moderate level, evidence that mindfulness intervention improved QOL in patients with chronic pain.

This study had multiple strengths, including a detailed review of studies that directly relate to mindfulness and not other modalities like ACT. This article provided a detailed analysis with clearly defined methods. Detailed chart and statistical analyses were provided. Only RCT studies were considered in this review. The risk of bias and quality of evidence is considered and discussed for each study.

Hilton et al. (2017) also noted some weaknesses. First, the type of pain reviewed related to all types of chronic pain, including malignancy and conditions often associated with chronic pain but that may not consistently feature chronic pain (e.g. irritable bowel syndrome). The second weakness relates to the quality of the RCTs investigated as the authors noted that the RCTs were, at best, moderate quality and, therefore, it is difficult to draw strong conclusions. Finally, the authors did not comment on if the statistical significance corresponds with any clinical significance.

Veehof et al. (2016) conducted a meta-analysis to investigate if mindfulness or acceptance-based programs are effective for different dimensions of chronic pain, including quality of life. They included 25 RCT trials that included both passive and active controls. In

their review, the immediate post-treatment quality of life dimension was a small effect size that was not statistically significant (SMD 0.44, 95% CI =−0.05, 0.93, p 0.08). On analysis of follow-up data, the QOL reached statistical significance (SMD 0.66, 95% CI = 0.06, 1.26, p 0.03). The study did not comment on how this QOL change from non-significance to significance at follow-up should be interpreted. Other systematic reviews did not differentiate immediate and follow up scores (Ball et al., 2017; Hilton et al., 2017). Veehof et al. (2016) study concluded that mindfulness and acceptance-based interventions were moderately effective in multiple outcomes, especially in the long term.

This study has multiple strengths, such as rigorous evaluation of data and detailed explanation of statistics. The authors included only RCT studies, which allow for more rigorous analysis. RCTs were given a value for low, medium, and high quality and weighted accordingly, where high-quality studies contributed more to the analysis (Veehof et al., 2016). The meta-analytic approach allows for an estimation of effect strength and can be used as a benchmark for treatment and follow-up.

Nonetheless, Veehof et al. (2016) made several design decisions that may have affected their outcomes. First, the authors opted to include ACT in their review of studies, which may increase heterogeneity as ACT is not standardized and may not include mindfulness. The authors did perform a subgroup analysis that determined there was no statistical difference between the ACT and mindfulness intervention ($\chi 2 = 1.74$, $p = 0.19$, $I^2 = 42.4\%$) therefore, it is unlikely that this decision significantly change the result of the study. The decision to include ACT was defended by the authors because it was easier to compare with previous meta-analysis, although they acknowledge it as a weakness.

Second, the authors combined several diverse scales for analysis, such as pain intensity, pain interference, and pain-related effect. Although these may not have affected the QOL component of mindfulness interventions, such decisions have been deemed controversial by other mindfulness experts due to a possible incompatibility of the scales (Ball et al., 2017). Finally, Veehof et al. (2016) did not consider if the QOL changes noted are clinically significant.

Chisea and Serretti (2011) performed a systematic review to investigate mindfulness-based intervention on chronic pain. Their primary outcomes were pain level and depression, with secondary outcomes as QOL. The authors did not exclusively include RCTs but did require a control group making non-randomized control trials (nRCTs) eligible. The review found and analyzed 10 articles. The study noted that patients assigned to mindfulness intervention showed significant improvement in QOL. As this was not a meta-analysis, no statistical evidence was provided to support this result. The authors suggested to be cautious in the interpretation of this result and generally considered the QOL improvement to be due to non-specific effects of mindfulness training (e.g. attention from researchers, greater group support) rather than intrinsic qualities of mindfulness.

One of the primary weaknesses of this review is that it is on the cusp of relevance for this literature review due to age. The 2011 systematic review excludes newer and more rigorous RCTs that contain active controls. Prior to 2011, the majority of RCTs did not have active control groups (Chisea & Serretti, 2011). In addition, newer systematic reviews consider only the most rigorous study designs, such as RCTs, where Chisea and Serretti (2011) considered any study design with a control group. Therefore, due to the decreased body of evidence, lack of statistical analysis, and old age, this systematic review provides very weak evidence that QOL is significantly improved through non-specific means.

QOL Systematic Reviews Supporting the Null Hypothesis

Bawa et al. (2015) performed a systematic review and meta-analysis to investigate if mindfulness could improve economic, humanistic, and clinical outcomes in individuals with chronic pain. Both active and passive control groups were considered. The review includes 11 RCT studies. The study noted physical health component of QOL (combined effect size: SMD 0.16, 95% CI =–0.15 to 0.47; I^2 = 8%) and a mental health component of QOL (combined effect size SMD 0.37, 95% CI =–0.07 to 0.82; I^2 = 46%). Neither component of QOL was considered statistically significant. The study concluded that it found limited evidence for mindfulness-based interventions in chronic pain.

This study narrowly addresses the PIO question because it excludes non-mindfulness interventions such as ACT, and excludes malignant pain or syndromes that may be associated with chronic pain but may not feature chronic pain, such as irritable bowel syndrome (IBS), chronic fatigue, or multiple sclerosis. There were some weaknesses of this analysis. Single reviewer search for articles suggests a greater risk that relevant studies are missed. More rigorous exclusion criteria improved specificity but limited the number and quality of studies. Interpretation of only 11 studies becomes more complicated when seven of them were likely underpowered to detect smaller differences in effect. Given that the majority of systematic reviews that rejected the null hypothesis demonstrated a small effect size, the issue of power is significant (Ball et al., 2017; Hilton et al., 2017; Veehof et al., 2016).

Lauche et al. (2013) performed a systematic review and meta-analysis investigating the short and long-term benefits of MBSR in patients with fibromyalgia. QOL and pain intensity were primary outcomes. This study considered both RCTs and nRCTs, and included a total of six studies. The study found low-quality evidence for small effect size for MBSR on the QOL of

patients with fibromyalgia. There was a significant short-term effect (SMD =−0.35; 95% CI −0.57 to −0.12; P = 0.002). Lauche et al. (2013) found no long-term impact of mindfulness on QOL (SMD =−0.10; 95% CI −0.40 to 0.20; P = 0.50). This finding is somewhat contrary to Ball et al. (2017) who found QOL significance long term, but not short term. Lauche et al. (2013) is considered to support the null hypothesis because long-term effects are likely more relevant for individuals than immediate outcomes.

Weaknesses of this study included all patients with fibromyalgia regardless of age. Furthermore, the inclusion of nRCT studies makes the data analyzed less rigorous than the preceding systematic reviews. The authors acknowledge that the key weakness in their review relates to a lack of eligible studies as only six were analyzed. Although this study provides evidence for determining the impact of mindfulness of QOL the specificity of the type of chronic pain (fibromyalgia) makes it difficult to generalize results to other forms of chronic pain. It is certainly possible that different types of pain lend themselves differently to mindfulness treatment. Therefore, although this study provides evidence that QOL is not improved in patients with fibromyalgia, this data cannot be extrapolated for other types of chronic pain.

Summary of Systematic Reviews

The systematic reviews analysed provide conflicting evidence on the impact of mindfulness on QOL in adult patients with chronic non-malignant pain. Analyzing these results with a framework informed by Whittmore and Knafl (2005), conflicting evidence can be sorted by the vote counting of significant findings to the positive and significant findings to the negative. Overall, the highest quality systematic reviews considering the latest and most rigorous RCT studies provide low to moderate evidence that QOL is improved in patients that undergo mindfulness training (Ball et al., 2017; Hilton et al., 2017; Veehof et al., 2016). The reviews

supporting the null hypothesis were older and likely underpowered (Bawa et al., 2013; Lauche et al., 2015) or highly specific to a particular type of pain, gaining specificity but losing rigor (Lauche et al., 2015). Therefore, the most evidence, both by volume and academic rigour suggests that mindfulness interventions improve QOL in patients with chronic non-malignant pain. Unfortunately, the exact impact and context remains contested and RCTs will be reviewed and grouped by type of pain to extract additional insight into the specific type of pain that may be most amendable to mindfulness treatment.

Effect of Mindfulness on QOL by Randomized Controlled Trial

The systematic literature review in this project identified and analyzed eight RCT studies that addressed the impact of mindfulness on QOL in patients with chronic non-malignant pain. Unlike the systematic reviews which were grouped according to acceptance or rejection of the null hypothesis, the RCTs are grouped according to the type of chronic pain.

Non-Specific Chronic Pain

Four RCTs investigated the impact of mindfulness on the QOL of patients with non-specific chronic pain, excluding malignant pain (Dowd et al., 2015; Hearn & Finlay, 2017; la Cour & Peterson, 2015; Wong 2013). The study by Dowd et al. (2015) investigated the effectiveness of computerized mindfulness-based interventions compared with computerized pain management in patients with chronic pain. This study completed a power analysis and recruited 124 subjects. The CNCP was not restricted to any particular subtype, but 36% of participants experienced chronic back pain. The intervention arm used a modified mindfulness curriculum called mindfulness in action (MIA). The control was active computer psychoeducation. Data was recorded at baseline (T1), on completion at six weeks (T2), and at 26 weeks (T3) with interventions biweekly for six weeks. The study utilized a satisfaction with life

scale and reported improvement over time in both groups (time $F = 71.13$, $P < 0.0001$). However, the MIA group improved to a greater extent than did the PE group from T1 to T2 (time $F = 4.37$, $p = 0.04$). Findings were consistent comparing T2 to T3. The effect size for both groups was large in magnitude ($d = 0.90$). This finding demonstrates the specific effects of mindfulness on QOL regarding the enjoyment of life. Interestingly, this was the only significant difference in control versus intervention group and therefore supports the null for QOL improvement.

This study is included because it evaluates outcomes for chronic pain patients with an online forum and is included to provide context for mindfulness intervention versus an active control group. Online interventions have the advantage of convenience, ease of access, and being more cost-effective (Buhrman et al., 2013). This study informs the PIO question because the outcomes evaluate dimensions of QOL as related to the enjoyment of life, although they do not differentiate physical QOL and mental QOL. This study is overall a relatively well-considered study with an active control group. Despite the study design, the attrition rate was exceptionally high, with 42% attrition at T2 and 55% at T3, limiting the confidence in the result. This study raises the possibility that online models of mindfulness intervention may be prone to exceptionally high rates of attrition.

The study by Hearn and Finlay (2017) investigated the impact of mindfulness intervention on depression symptoms and QOL of patients with chronic pain and comorbid spinal lesions. The mode of delivery was online with a MBSR based intervention arm and an active control arm (psychoeducation), recruiting a total of 67 subjects. Interventions lasted eight weeks, with a total of 16 hours of instruction time. Data was recorded at T1, completion, eight

weeks, and 13 weeks post-intervention. The WHOQoL-brief was used to evaluate QOL outcomes in patients. There were no significant differences between arms for any aspect of QOL.

This study attempted to statistically analyze the characteristics of individuals dropping out due to the attrition rate approaching 35%. On t-test evaluation, those dropping out were of significantly greater age (M = 43.0 years vs M = 49.3 years, 95% CI = 5.22, 7.38, p = 0.04). There were no other statistically significant findings, although greater depressive symptoms in the drop-out group approached significance (p = 0.051). Like the study by Dowd et al. (2015), which also investigated online delivery of mindfulness interventions, the QOL differences were not significant, and the attrition rate was high.

The fourth study by la Cour and Peterson (2015) evaluated MBSR intervention for patients in a hospital setting with long-lasting and severe pain. The MBSR program was eight weeks with a total time of 25 hours of formal mindfulness education. Data was collected at baseline, post-intervention (T2), and at 26 weeks (T3), although the later data was restricted to the intervention arm only. The control group was passive (waitlist). QOL was measured with the SF-36 questionnaire and was separated into physical health composite (PHC) and mental health composite (MHC), which were not significant (d = 0.10, p = 0.61) and significant (d = 0.48, p = 0.01), respectively. This is consistent with the Hilton et al. (2017) meta-analysis, where mental, but not physical, components of QOL were significant. There was no significant change in QOL measures from T2 to T3 in the intervention arm (la Cour & Peterson, 2015). The study concluded that it showed that MBSR had a significant effect on patient's lives when compared with control in multiple domains, including QOL.

This study is beneficial because it evaluates mindfulness use in patients with severe pain, although they do not explicitly quantify this based on their exclusion criteria; they described all

included types of chronic pain as “serious” and “long-lasting” (p. 642). Nonetheless, other included studies did not consider pain severity as an inclusion criteria and this study is the only study that provides any insight on whether mindfulness is helpful in patients with severe pain. In contrast to the above internet-based studies, this in-person study had an attrition rate of 18% post-completion and 23% at 26 weeks, suggesting that an in-person format is more advantageous for retention. Additionally, less attrition suggests there is less potential bias in the results. Another relatively unique study design is the MBSR program has been slightly altered to include breaks and light refreshments for subjects, with the rationale that individuals with chronic pain may need additional rest during sessions. Nonetheless, the control is passive with the inherent weakness that any difference between control and intervention arms are likely non-specific in nature. Overall, this study provides evidence that mental dimensions of QOL are improved with mindfulness in patients with chronic non-malignant pain.

The final study in this category by Wong et al. (2011) investigated if MBSR would reduce pain intensity, pain-related distress and improve QOL in patients with chronic pain when compared with multidisciplinary pain intervention (MPI). This high-quality study employed a rigorous active control to remove non-specific effects of the MBSR program. Subjects required a moderate-to-severe pain rating. In addition, this study controlled for the changing treatment modalities, including changing medications. Interventions for both arms lasted 8 weeks with 2.5 hours of intervention per week. This study did not find any statistically significant differences in the QOL of either study arm at baseline, post-intervention, 3 months, and 6 months. This study did not provide evidence that QOL is optimized with mindfulness therapy in patients with chronic pain.

This was an excellent, well-designed study with clear methods and rigorous control, blinding, and randomization. This study is unique in that it is the only study that investigates mindfulness intervention and chronic pain in primarily non-Caucasian population, based in Hong Kong. They utilized validated tools for the local population and adapted them based on language. All used tools were validated in that language. The attrition rate was only 17% and built on the idea that MBSR has better retention in person rather than digital administration.

Nonetheless, the results of a non-statistically significant QOL between groups should be interpreted cautiously. The study is performed in Hong-Kong and results may not be directly applicable in Canada. This study does not so much establish that MBSR is not effective for QOL in chronic non-malignant pain, but that MBSR is comparable to MPI. In addition, the attrition rate of 17% and was more significant in the MBSR group. The authors report that individuals dropping out of the MBSR group did so because they did not understand the material or it did not make sense to them. The implication is that MBSR may be useful in improving QOL in a particular subset of patients that have characteristics compatible with mindfulness. Unfortunately, what this characteristic subset is, remains unclear.

Chronic Back Pain

Two studies evaluated mindfulness intervention on the QOL of patients with chronic back pain, a subtype of chronic non-malignant pain (Cherkin et al., 2017; Morone et al., 2016). Morone et al. (2016) investigated if a mind-body program improved function and reduced pain in older adults with chronic back pain. Patients were >65 years old with intact cognition. The intervention arm was a standard MBSR program, and the study used an active control with a successful ageing curriculum of "10 Keys to Healthy Aging". QOL was evaluated with RAND 36 Health Status Inventory and PHC at baseline, completion (T2) and at 26 weeks (T3).

Statistical analysis revealed an adjusted between group difference of 1.7 (CI -0.4 to 3.8) at T2 and 0.2 (CI -1.9 to 2.4) at T3 for the RAND 36 Health Status Inventory. The PHC adjusted between group difference was 1.5 (−0.3 to 3.3) at T2 and −0.1 (−1.9 to 1.8) at T3. Neither measure was statistically significant. This study does not provide compelling evidence for QOL improvement with MBSR. This study is high quality with robust methods and uses an active control for comparison. Consistent with previous findings, mindfulness intervention has a lower impact on QOL when compared with active control versus passive control (Buhrman et al., 2013; Cherkin et al., 2017; Wong et al., 2011).

This study considers QOL and mindfulness for an older population, a focus absent from other studies. Hearn and Finlay (2017) demonstrated that those dropping out of mindfulness programs tend to be older, so it is particularly relevant to consider older populations as a sub-population for utilizing mindfulness. In contrast to the findings in Hearn and Finlay (2017), Morone et al. (2016) had an exceptionally low attrition rate of 4.3%. Therefore, the evidence regarding age and attrition rate is conflicting.

The second study by Cherkin et al. (2016) performs a comprehensive 3-arm trial comparing cognitive behaviour therapy (CBT), MBSR, and passive control. The authors hypothesized that MBSR would be superior to passive control for short and long-term outcomes but would be similar to the CBT arm. The trial recruited 282 participants, divided into three arms. Data was collected at baseline (T1), completion (T2), follow up 26 weeks (T3) and 52 weeks (T4). The QOL was measured by SF-12 for the physical component score and for the mental component score, which were analyzed and presented separately. The physical components of SF-12 were not significant in the difference between CBT and MBSR, MBSR and passive, or CBT and passive at T2, T3 or T4. For the mental component score only findings

at T2 were considered significant (MBSR v. usual care, 1.19 CI = 0.98-1.45; MBSR v. CBT, 0.97 CI = 0.82-1.15). Evaluations at T3 and T4 did not maintain significance. For most other outcomes, the CBT and MBSR groups were not statistically different from each other, and each was statistically different from passive control. Overall, this study provides limited evidence that QOL can be improved with MBSR in the short-term, although a similar improvement is noted with CBT.

This high-quality study conducted three arms and included both an active and passive control in the same study. This allows a more detailed evaluation of the specific versus non-specific effects of mindfulness. In addition, this study had the longest follow-up of any RCT investigating mindfulness, QOL, and chronic pain. This study sustained approximately a 20% attrition rate.

Neuropathic Pain

One study evaluated chronic neuropathic pain in people with diabetes (Nathan et al., 2017). This study evaluated if MBSR would improve physical or mental functioning in those with painful peripheral diabetic neuropathy, with QOL as a secondary outcome. The intervention arm consisted of a standard in person 8-week MBSR course, and a passive control. Sixty-six subjects were recruited and randomized. Evaluations were taken at baseline (T1), two weeks post-intervention, and 12 weeks post-intervention. The SF-12 mental health component of QOL 16.30 (CI 7.08 to 25.52, $p < 0.001$) was both an unexpectedly large effect size and reached statistical significance. The study concluded that MBSR is an effective intervention for improving QOL for patients with chronic pain due to diabetic neuropathy.

This study provides evidence for the improvement of QOL in patients with chronic pain from diabetic neuropathy. The QOL improvement was unexpectedly large. The attrition rate of

only 4.5%, which is exceptionally low for these RCTs. It is possible that diabetic neuropathy is a condition where mindfulness intervention can make the most impact. Nonetheless, this study has relatively few subjects and a passive control group, and some more robust studies are necessary before reaching firm conclusions.

Fibromyalgia

One study evaluated the impact of MBSR on QOL of patients with fibromyalgia (Schmidt et al., 2011). Their goal was to evaluate the effect of MBSR on the health-related quality of life of individuals with fibromyalgia. Overall, 177 subjects were recruited and randomized. This 3-armed trial compared a standard 8-week in-person MBSR course, active control designed to mimic the MBSR curriculum without applying any of the mindfulness components, and passive control. The MBSR, active control, and passive control were compared. In each set, no statistically significant group effect on QOL was found. There was a modest 18% attrition rate at the end of study.

This robust study evaluated only fibromyalgia. It applied a 3-arm study design, which is relatively unique amongst RCTs and only one other study employed this design (Cherkin et al., 2016). What is particularly striking about this study is that the active control was designed to be as close to the MBSR program as possible, without being either an established treatment modality (e.g. CBT) or completely tangential (e.g. psychoeducation; Schmidt et al., 2011). This type of control will be most reliable when considering specific effects of MBSR on QOL (Schmidt et al., 2011). Interestingly, the authors were mystified with the results of this study as a previous smaller quasi-experimental pilot using the exact same methodology, down to the instructors, revealed significant improvement in the MBSR arm (Grossman et al., 2007). Schmidt et al. (2013) results are consistent with a systematic review investigating mindfulness and

fibromyalgia (Lauche et al., 2013). It is possible that fibromyalgia is a type of chronic pain that does not lend itself to mindfulness intervention.

Subsequent Mindfulness Interventions

It is unclear if mindfulness intervention such as MBSR improves QOL in patients with chronic non-malignant pain on repeat interventions. RCT exclusion criteria involved patients with previous experience with MBSR or mindfulness intervention for all RCTs reviewed (Buhrman et al., 2013; Cherkin et al., 2016; Dowd et al., 2015; Hearn & Finlay, 2017; la Cour & Peterson, 2015; Morone et al., 2016; Nathan et al., 2017; Schmidt et al., 2011; Wong 2013). Therefore, it is unknown if subsequent mindfulness interventions are helpful in optimizing QOL in patient with chronic pain. It is possible that optimal outcomes occur after a second or third course of mindfulness intervention or that these courses need to be repeated in a particular time frame to be effective.

Mindfulness and Gender

Most studies have a ratio of females to males of 3:1 or more. However, "men and women may experience and cope with pain differently" (Ball et al., 2017, p. 365). Hearn and Finlay (2018) consisted of 54% females, Nathan et al. (2017) 56% females, Buhrman et al. (2013) 59% females, Brown et al. (2013) 73% females, la Cour and Peterson (2015) 85% females, Dowd et al. (2015) 90% females, Shmidt (2011) recruited 100% females. Systematic review by Lauche et al. (2013) pooled 1058 female subjects and 33 male subjects. A meta-analysis by Ball et al. (2017) attempted to extrapolate data by gender but found that the numbers for men were not adequate to draw independent conclusions. Therefore, the results of these studies are applicable to females, but any generalizability to males should be cautious.

Geography

The majority of studies were performed in Western countries and only one study was performed in a primarily non-Caucasian population, based in Hong Kong (Wong et al., 2011). Other studies were placed in the U.S. (Cherkin et al., 2016; Morone et al., 2016), Denmark (la Cour & Peterson, 2015), Ireland (Dowd et al., 2015), United Kingdom (Hearn & Finlay, 2018), Germany (Schmidt et al., 2011), Canada (Nathan et al., 2017), and Finland (Buhrman et al., 2013). Therefore, these results are difficult to generalize to different groups of people, especially on other continents. It is unclear if mindfulness will be more or less effective in populations with diverse cultural, genetic, and historical backgrounds.

Harm

Few studies reported specific harm of mindfulness intervention. In their RCT, la Cour and Peterson (2015) reported that at least two patients experience feelings of anger towards their pain, and two patients experienced more significant anxiety. These would both constitute a number needed to harm (NNH) at 27.5, albeit both harms were temporary. Cherkin et al. (2016) reported that as many as 30% of MBSR participants reported mild harm, such as temporarily increased pain with yoga positions. Other studies did not record or explicitly screen for harms of mindfulness intervention. From a QOL perspective, no studies in this review found that mindfulness reduced the QOL of patients. As such, there is no evidence to conclude that mindfulness-based programs cause any long-term harm.

Incidental Findings

Depression

In the reviewed studies, a recurring theme was utilizing mindfulness for improving depression in patients with chronic non-malignant pain. This facet was beyond the scope of the

current literature review, but we established in Chapter Two that QOL and depression are related. Therefore, it is worth commenting on the utility of mindfulness in this capacity. Most reviewed studies considered depression as a primary or secondary outcome and demonstrated significant improvement in depressive symptoms, independent of the evaluation of QOL (Chissen et al., 2011; Heart & Finlay, 2018; Hilton et al., 2017: Nathan et al., 2017; Morone et al., 2018;). Notably, online mindfulness intervention grossly failed to improve QOL in patient studies but appeared to improve depressive symptoms (Hearn & Finlay, 2018). This is consistent with Buhrman et al. (2013), who demonstrated that although online mindfulness intervention did not improve QOL it did improve depressive symptoms ($F(1,73) = 6.87$, $p = 0.01$). This consideration is essential because online mindfulness delivery is not favourable in the context of QOL but may be favourable in treatment of depression. Therefore, future literature reviews can investigate the role of mindfulness intervention in chronic pain patients with depression.

Somatic Pain

Incidentally, mindfulness does seem to slightly decrease pain in subjects at six months (Brotto et al., 2019; Hilton et al., 2017; Morone et al., 2016), although this was not consistent among all studies (Bawa et al., 2015). It is possible that the variance between nature and severity of chronic pain in subjects account for this discrepancy. It was beyond the scope of this review to evaluate if mindfulness decreases the somatic experience of pain, but if there is a reduction in some individuals, it would be consistent with the phenomenological underpinnings of mindfulness discussed in the background section.

Summary

To summarize, mindfulness-based therapy has low to moderate evidence that it is an effective intervention for improving QOL, especially within the mental QOL dimension. There is

a paucity of data to support physical QOL improvement. Mindfulness appears more likely to be effective in studies that evaluated passive control groups and significantly decreased with active control groups, which suggests that the functional impact of mindfulness is non-specific, and the specific effects of mindfulness are unclear. Attrition rates were high in many studies but were particularly high in online delivery models. All studies contained more females than males, often by a ratio greater than 3:1, thereby reducing the generalizability of the findings to males. In addition, most studies were performed in western Caucasian populations, thereby limiting generalizability of results. There does appear to be some harms associated with mindfulness, but they are not well recorded in the studies and those that are acknowledged as typically rare and mild. The next chapter will discuss the findings and suggest recommendations.

CHAPTER FIVE

Discussion

This integrative literature review answered the PIO question of "what is the effect of mindfulness intervention on quality of life amongst adults with chronic non-malignant pain?" and found low to moderate-quality evidence that mindfulness improves QOL in patients with this type of chronic pain. The reviewed literature generally reached consensus in that mindfulness has some net positive effect on the quality of life, but the scope and specific improvements were contested. A few generalizations can be considered. This improvement tended to be in the mental dimensions of QOL rather than physical, which is consistent with mindfulness theory. This section will aim to elicit further the common themes and disagreements in mindfulness research, circumstances where mindfulness may be particularly useful or ineffective, the potential harms, reasons for attrition, methodological challenges, and recommendations for primary care.

Timing

A common theme in mindfulness research is the idea that the effects of mindfulness are enduring and are notable on follow-up. These effects persist after the conclusion of the intervention period and last for at least 26 weeks (Veehof et al., 2016). Enduring impact is consistent with literature that evaluates mindfulness in conditions that do not necessarily include chronic pain; specifically, a meta-analysis by Aucoin et al. (2014) for symptoms of gastrointestinal disorders noted that the impact of mindfulness persisted for 26 weeks. Brotto et al. (2019) controlled for bias from additional post-intervention modalities with the intervention arm abstaining from any new treatment until follow-up, demonstrating a persistent effect at 26 weeks. No studies evaluated mindfulness beyond 26 weeks. Cherkin et al. (2016) demonstrated that mindfulness does not appear to have a significant effect at less than eight weeks, but this

finding is not corroborated, as other studies did not test midway through the intervention period. The implication is that it takes time for mindfulness to have a measurable effect on subjects, but that this effect appears to persist to at least 26 weeks.

Effects of mindfulness will likely decay with time if the practice is not sustained (Kabat-Zinn, 2003). The rate of this decay is unclear based on the studies evaluated. In addition, there is no apparent critical timeline to see minimal effects. In the study by Howarth et al. (2019), a brief mindfulness intervention of pre-recorded 15-minute sessions was not found to be effective, possibly because it did not reach a certain minimum needed to develop mindfulness. Cherkin et al. (2016) was the only study that evaluated outcomes mid-intervention, and at four weeks, it appears there was no significant change. Nonetheless, the minimum amount of practice may vary from person to person. Given the 8-week standard intervention period in mindfulness research, there is no evaluation for individuals that need more time to learn and absorb mindfulness. More frequent interventions for an extended period may have much more robust outcomes. No reviewed studies considered dose-response investigation in mindfulness and chronic non-malignant pain. There is some evidence that a dose relationship exists, but RCTs have not corroborated this (Creswell, 2017; Carmody & Baer, 2009). Future studies can consider a longer follow-up to evaluate when mindfulness outcomes begin to improve, how they are best maintained, and how long before there is an atrophy of effect.

Mindfulness and Usual Treatment

Another important theme is the idea that mindfulness appears to be extremely useful when compared to usual treatment or doing nothing (Bawa et al., 2015; Cherkin et al., 2016; la Cour et al., 2015; Lauche et al., 2013; Nathan et al., 2017). In contrast, studies where the control undergoes educational sessions or other formal programs, such as CBT, the differences are either

non-significant or minimal in scale (Burhman et al., 2013; Cherkin et al., 2016; Hearn et al., 2016; Morone et al., 2016). The implication is that perhaps elements of mindfulness are helpful but most of the observed change may occur from other components, such as improved social networking, improved support network by connecting with other people with shared experiences, and ready access to a qualified therapist. Overall, mindfulness is a functional tool for chronic non-malignant pain and could be used over usual treatment (e.g. pharmacological management, etc), but there is no evidence that it is preferable to other standardized therapies, such as CBT.

Many mindfulness programs can be expensive, difficult to access, or impossible to run in-person given specific contexts such as pandemics (Government of British Columbia, 2021; Hearn and Finlay, 2018). Therefore, an evaluation of whether mindfulness can be administered through digital methods is particularly relevant. One RCT explored the efficacy of using the internet as a delivery method for MBSR therapy (Hearn & Finlay, 2018). Unfortunately, this study found a statistical improvement in QOL after the mindfulness intervention. A similarly designed study evaluating QOL and online ACT intervention was also negative (Buhrman et al., 2013). In addition, both studies had some of the highest attrition rates of evaluated RCTs, ranging from 35% to 61%. Therefore, there is no evidence that internet-based mindfulness intervention improves QOL in patients with chronic pain.

Still, there was some benefit observed in these online studies. Hearn et al. (2018) noted lower depression scores, lower pain unpleasantness scores, and lower pain catastrophizing scores. Catastrophizing was not reported to be lower in other studies (Morone et al., 2016). However, it is possible catastrophizing improves with online MBSR delivery and no studies have compared online MBSR treatment with traditional MBSR regimens, which may be an important

question to consider in the future. Given that there was no QOL change and high attrition, online mindfulness intervention may not be useful from a practical or cost-benefit perspective.

Methodological Challenges

There is significant bias in this field of study. Several studies have considered a potential risk of publication bias in outcomes, such as depression (Veehof et al., 2016). This is concerning, as many small studies demonstrate a significant improvement in mental health outcomes in the context of depression, but they tend to be small, lower quality, and with high attrition rates (Veehof et al., 2016). Publication bias can occur as only small studies that show the most substantial difference are published, and small studies that show no statistical difference remain unpublished (Veehof et al., 2016). In contrast to other meta-reviews, Hilton et al. (2017) noted significantly lower depression scores in those undertaking mindfulness-based interventions (MBIs), however, they acknowledged risk of this publication bias. In addition, a well cited meta-analysis on the subject was recently retracted for conflict of interest and multiple statistical errors (The PLOS ONE Editors, 2019). Therefore, studies need to be scrutinized and conclusions applied cautiously.

Another common theme in all studies is the lack of a well-designed control. In the best-designed studies, an active control group may involve psychoeducation or CBT (Cherkin et al., 2016). Unfortunately, these are not ideal to evaluate the effects of mindfulness alone, but rather how these other modalities compare to mindfulness. A perfect control would involve mindfulness in the investigation group and pseudo-mindfulness in the control group; this would allow for proper blinding and evaluation of subjects (Ball et al., 2017). This is done for other fields of study; for example, Perry et al. (2017) noted that true acupuncture is no better for managing chronic pain than sham acupuncture. Admittedly, such a control would be difficult to

design for mindfulness. Still, such a control group would rule out any non-specific effects from factors such as increased attention and connection without confusing specific effects of other modalities like CBT.

There is a lack of rigour in many studies. Although mindfulness has been evaluated for decades, recent studies have often been small pilot studies, non-experimental design, or RCTs plagued by subject attrition (Bawa et al., 2015). Meta-analyses mainly consider RCTs, and the relatively low-quality average of literature in this field makes it difficult to draw conclusions (Bawa et al., 2015). To compound this issue, heterogeneity between studies is extremely high, which makes studies difficult to compare directly. Unfortunately, this lack of rigor, even at the RCT level, provides only low to moderate level quality evidence.

Due to the combination of high heterogeneity and poor quality RCTs, the outcomes of the systematic reviews highly depend on the studies chosen. For example, several systematic reviews are outlined in the matrix, and each comes to a different conclusion with almost no overlap. In contrast, a meta-analysis by Veehof et al. (2016) was strikingly consistent with findings of an older meta-analysis by Veehof et al. (2011) several years earlier. As such, the authors and methods of a meta-analysis will have a significant impact on results due to the level of heterogeneity and lack of consistency in primary research. Unfortunately, this adds a layer of complexity when interpreting results and answering my PIO question.

Adverse Effects

A notable omission in studies is the assumption that mindfulness comes with no adverse effects. Not all formal cognitive therapies are helpful; specifically, a meta-analysis by Garland et al. (2019) suggested that techniques, such as relaxation, may cause harm by means of increased opioid use. The idea that MBIs are harmless is largely untested in literature, and few studies

disclose any adverse events that occur during mindfulness-based interventions (Veehof et al., 2016). Although no significant adverse events are anticipated with mindfulness, it is essential to note that this is not a data-driven conclusion. This section will evaluate the evidence for harm in MBIs.

As previously noted, la Cour and Peterson (2015) reported that during the study, some patients developed feelings of anger towards their pain and more anxiety. Although this was classified as a harm in the study with the calculated NNH of 27.5, this outcome is more complex and warrants further discussion. Creswell (2017) notes that this response is well known and documented in mindfulness research and does not actually constitute harm. Instead, these common feelings of agitation, anxiety, discomfort, or confusion are an important component of the therapeutic change process of mindfulness interventions because sustained mindful attention to these experiences allows the patient to explore and "understand the full embodied experience of these reactions, to learn that the experience of these reactions is temporary, and to foster insight into how one reacts to these uncomfortable experiences." (p. 507). Kerr et al. (2011) investigated the development of these negative emotions through a qualitative process and noted that there is a perspective shift in subjects that occurs after approximately five weeks, characterized by an emergence of the "observing self" (p.84). This emergence was associated with a spike in reactivity and an observable shift in perspective and meta-awareness. The authors theorized that "negative reactivity mid-way through the course may catalyze later improvements in reperception" (p. 86). This idea concurs that emotions of anger and anxiety, as described by la Cour and Peterson (2015), are a growing pain of sorts during mindfulness training, perhaps similar to muscle soreness after physical exertion. That is, the negative components, albeit

unpleasant, are not necessarily pathologic or adverse outcomes so much as an integral part of the process.

If the emergence of the observing self is taken to be as a common event, then the outcomes presented by la Cour and Peterson (2015) are likely vastly underrepresented and underreported. The remainder of the RCTs reviewed are not designed in way that allows monitoring, recognition, and report of this transient development. Therefore, it is possible that individuals experiencing this development of the 'observing self' do not inform researchers and this change is undocumented. Given the transient nature of symptoms this emergence may not be recorded and therefore a clear etiology has not been established in the studies.

Some individuals developing temporary negative emotions during the mindfulness intervention associated with a shifting perspective at about five weeks has noteworthy consequences for mindfulness application. First, this is consistent with Cherkin et al. (2016) evaluation that there was no statistically significant change in outcomes at four weeks – midway through the course. According to Kerr et al. (2011), reperception and increase in meta-awareness take time to develop, and the emergence of the observing self was not evident until the second half of the program. As such, this confirms that an eight-week course is reasonable, and individuals that are unable to attend at least five weeks are less likely to undergo the meta-cognitive changes. Second, there may be a clue here about why some individuals are dropping out. For example, Hearn and Finlay (2018) demonstrated that individuals with higher baseline depression scores were more likely to withdraw from the course. It is possible that the observing self temporarily interacted with underlying depression and made the emergence more intense. Other conditions, including trauma or post-traumatic stress disorder (PTSD) that involve a shift from thought suppression to intentional control, may be particularly vulnerable to an intense

emergence (Lang, 2017; Lomas et al., 2015). Given that adverse childhood experiences (ACE) are a strongly associated with mental disorders such as depression, anxiety, or PTSD (Bomysoad & Francis, 2020), patients with this history may also be at risk of adverse outcomes. As such, it would be prudent to identify these individuals to pre-treat and stabilize the underlying condition or monitor them closely during the commencement of mindfulness.

If individuals are not prepared for the development of the observing self and the potential emotional lability associated with this process, they may quit the program right as they develop these changes. Although benign, if a patient is not advised about these changes, they might assume they are getting worse and quit the program because they conclude that mindfulness is not working. Therefore, considerations for mindfulness applications including 1) emphasizing the need to design programs that have at least seven weeks of duration and 2) notifying the participants that an emergence of the observing self is expected, which may include some transient negative feelings that are common and benign.

Unfortunately, not all harms are benign, and mindfulness should be evaluated for the potential to cause more significant harm. Previously, it was theorized that individuals with schizophrenia or seizure disorders may suffer exacerbation of their conditions, but no empirical evidence has been developed to substantiate these fears (Creswell, 2017). Although the RCTs reviewed in this capstone grossly did not evaluate harms it is clear from outcomes that there was overall improvement in one domain or another. No studies demonstrated that mindfulness reduced QOL, aggravated pain, or otherwise had a negative impact on evaluated outcomes. In this regard, even if the scale of improvement to QOL is in question, there is no evidence that QOL deteriorates with mindfulness intervention. Given the wide range of QOL components and the fact that many harms such as depression or chronic pain negatively impact QOL (Brenes,

2007; Burke et al., 2018), the fact that mindfulness does not decrease QOL in RCTs implies that there are no persistent, significant harms. Therefore, it is reasonable that mindfulness could be safely applied in a clinical context.

Clinical Considerations for Mindfulness

Based on the best available evidence there is sufficient data to conclude that mindfulness interventions may have a positive impact on the QOL of individuals with chronic pain. As noted, this is low-moderate level evidence and is not highly definitive. As such, how should a primary care provider integrate this information into their practice? This section will address the issue of applying lower quality data in clinical contexts using the shared decision-making (SDM) process, discussing tolerance of uncertainty, and strategies for implementing mindfulness in primary care.

Clinical SDM is the process of disclosure of all relevant information that would inform client participation in decision making (Braddock, 2013). In essence, SDM is the provision of all pertinent information "followed by a process through which the patient and physician reach agreement over how to proceed" (para. 2). This concept evolved from the idea of informed consent and demonstrates sound ethical grounding, improved patient satisfaction, and reduction of decision conflict (Berger, 2015; Braddock, 2013). SDM is a straightforward application in the settings of high-quality evidence (Braddock, 2013). There is a misconception that SDM is only relevant in high-evidence circumstances, which has hampered the application of this critical concept in lower quality situation.

The issue with lower quality SDM is the uncertainty that is rooted in the unknown. This uncertainty is not necessarily specific to a disease process but to the dysfunctional way that primary care providers and patients may grapple with the concept (Braddock, 2013). Primary

care providers are often socialized that they must be certain in their decisions and become anxious when clinical questions arise around the limitation of medical certainty (Braddock, 2013). On the other hand, patients may expect or assume clinical certainty in all medical intervention (Braddock, 2013). Uncertainty has many facets that include the scientific disease driven component, but also contains practical and personal uncertainty, which apply to the system and patient, respectively. Perhaps a relevant example is that individuals are uncertain about getting certain vaccines despite adequate evidence of their utility (Dror et al., 2020). This distinction demonstrates that uncertainly is generated not only by a lack of scientific data and, by extension, can be reduced in other ways. The advantage of using the SDM process is that there is a shared acceptance of uncertainty that follows a shared exploration of the intervention. This, in turn, will close the knowledge gap between the PCP and patient, promote patient empowerment, and promote trust through transparency (Braddock, 2013). In plain terms, a patient and provider can essentially determine what is known about an intervention, what are the risks and potential benefits, and formulate an informed plan that tolerates some uncertainty.

Tolerating Uncertainty

Chronic pain is a complex refractory condition, and therefore a definitive solution is unlikely to exist. Effectively, it may be impossible to definitively know the impact of mindfulness on chronic pain. Nonetheless, lack of evidence is not the evidence of lack. In other words, the uncertainty surrounding quantifying how mindfulness impacts chronic pain is not the same as finding mindfulness unhelpful or inappropriate for chronic pain. Mindfulness may have marginal benefits in a cohort setting but significant benefits in an individual or clinical setting, consistent with pharmacological options—for example, the B.C. Provincial Detailing Service (2018) determined that of the ten most common medications for chronic neuropathic pain only

three had moderate-quality evidence that they are useful. No reviewed medication had high-quality evidence suggesting their use. Even so, the therapeutic response may differ at the individual level, and drugs that have statistically minimal effect may be successful for individuals (Watson & Gilron, 2018). As such, I argue that uncertainty surrounding mindfulness should not preclude its use in a clinical setting.

Prescribing Mindfulness

Currently, mindfulness is not a common treatment modality used by primary care providers (Kelly, 2019). In the United Kingdom (UK), mindfulness intervention has been a recognized evidence-based treatment modality for medical conditions such as depression. In fact, the National Institute for Health and Care Excellence ([NICE], 2009) has recommended mindfulness in individuals who previously experienced three or more bouts of depression. Despite mindfulness incorporated into formal guidelines endorsed by UK's National Health Service (2019) for more than a decade, primary care providers in the UK do not effectively utilize this modality (Rycroft-Malone et al., 2017). PCPs should consider that there is evidence that mindfulness improves QOL in chronic pain. In comparison there is a lack of clear evidence for using oxcarbazepine, carbamazepine, venlafaxine, amitriptyline, desipramine, nortriptyline, valproic acid, opioids, cannabinoids, or combination of these drugs for treating chronic pain (B.C. Provincial Detailing Service, 2018). Therefore, if a practitioner is considering prescribing any of these medications for chronic pain, they should consider prescribing mindfulness treatment with equal, if not greater, urgency.

Mindfulness and the PCP

Can mindfulness be used by the PCP not as a treatment modality for patients but for themselves? This project is primarily presented from the standpoint of a neutral PCP evaluating

the role of mindfulness for patients with CNCP. The inherent assumption here is that mindfulness is a treatment modality exclusively for the patient. With this perspective, it is difficult for providers to recommend a modality that they do not understand. As outlined in the background section, to understand mindfulness, one needs to practice it (Kabat-Zinn, 2003). To bridge the divide between mindfulness's clinical benefits as presented in this project and the lack of actual use in primary care, it would be helpful for the practitioner to try mindfulness for themselves.

What if the PCP does not have chronic pain? Are there benefits for the practitioner beyond relating to their patient? A Dutch study evaluated MBSR in general practitioners (GPs) and noted a lower burnout rate amongst those GPs that participated (Verweij et al., 2016). Qualitatively, this study reported higher rates of compassion towards themselves and others, which included their patients. These findings fit the general trend of application of mindfulness not to the patient but to the practitioner, as can be seen in the Compassion in Therapy Summit (2021). This trend is consistent with formal medical school educations, where medical programs such as Harvard include mindfulness training in the core curriculum (Dobkin & Hutchison, 2013). In Canada, the University of British Columbia's family residency postgraduate program has a mandatory MBSR-based curriculum for providers (Christie, 2015). An overall shift to mindfulness therapy as beneficial for both patient and provider can be useful for both optimizing the health of the provider and improving QOL in patients with chronic pain.

Type of Chronic Pain

There is evidence that some types of chronic pain are more amendable to management through MBIs than others. Specifically, MBSR treatment in diabetic neuropathy had an unexpectedly large effect on QOL (Nathan et al., 2017). The authors theorized that neuropathy

may be a high-yield indication for MBIs. In other studies, MBSR was an "effective treatment option for patients with chronic low back pain" (Cherkin et al., 2016, p. 1248). This is consistent with the conclusion drawn by Morone et al. (2016) evaluating chronic back pain in the elderly population. Fibromyalgia did not show robust response to MBSR treatment and therefore may not be a high-yield intervention in this population subtype (Lauche et al., 2013; Schmidt et al., 2011).

It is essential to acknowledge that MBIs are a complex social intervention requiring human learning and interaction (la Cour & Peterson, 2015). It would be inaccurate to assume that MBSR treatment would be effective for each person at the same dose. MBIs may not be taken seriously by a patient, and even genuinely interested clients may not be adequately motivated to undergo necessary changes in scheduling and lifestyle (la Cour & Peterson, 2015). Mindfulness research has established that MBIs are a viable treatment modality for chronic pain, improving dimensions such as QOL (Ball et al., 2017; Hilton et al., 2017; Veehof et al., 2016), however what remains unknown is who will benefit most (la Cour & Peterson, 2015; Wong et al., 2011). It is unclear what patient subgroups are most likely to respond to specific MBSR interventions. The following points summarize the key points of the discussion section:

1. Mindfulness intervention is a valid treatment modality that can be used with usual care in patients with chronic non-malignant pain.
2. Clinicians should be aware of mindfulness as an option or treatment modality.
3. Clinicians could utilize a shared decision model when prescribing mindfulness as a tool to help manage uncertainty.

4. Individuals undergoing mindfulness may experience the "emerging self" and this may cause some discomfort initially. They should be reassured that these feelings are common and transient.
5. Clinicians are encouraged to undergo mindfulness training themselves.
6. The internet does not seem to improve QOL with mindfulness, and this route cannot be currently recommended.

Recommendations

Based on the discussion evaluation and the conclusion that mindfulness improves QOL in patients with chronic pain with marginal adverse effect profile, several recommendations are made for practice and research as summarized in Table 2 and Table 3, respectively.

Table 2

Recommendations for Practice

Recommendation	Implementation	Sources
Online MBSR education may be effective for depression symptoms, but there is no compelling evidence for using it for QOL in non-malignant chronic pain.	Prescribing online formats of MBSR for chronic pain patients is unlikely to be effective.	(Buhrman et al., 2013; Hearn & Finlay, 2018)
Mindfulness is a viable intervention to complete and incorporate into daily life.	Providers and patients can continue practicing mindfulness after the MBSR curriculum is complete.	(Hearn & Finlay, 2018).
Greater depression scores predicted a higher drop-out rate. Pre-treating depression or supporting patients with co-morbidities may be an option to improve adherence.	Clinicians may consider a trial of SSRIs or other pharmaceuticals prior to mindfulness intervention.	(Christensen et al., 2009; Hearn & Finlay, 2018)
Gather information on what types of features a treatment program would need to minimize attrition and maximize engagement. Focus groups undergoing MBIs can provide feedback on elements that made engagement easier or more difficulty.	A future rendition of the MBSR curriculum could be adapted to include feedback from focus groups.	(Bawa et al. 2015; Dowd et al., 2015; la Cour & Petersen, 2015; Schmidt et al., 2011)
There may be subgroups of pain types that respond well to mindfulness. Specifically, MBSR may be very effective for neuropathy, effective for back pain, and not effective for fibromyalgia.	Clinicians can refer to MBIs for patients with neuropathy type pain but may not have significant change in outcomes for fibromyalgia. If space is limited it might be reasonable to prioritize neuropathic pain.	(Cherkin et al., 2016; Lauche et al., 2013; Morone et al., 2016; Nathan et al., 2017; Schmidt et al., 2011,)
Educate patients that they may experience the emerging self and this may cause some discomfort initially. They should be reassured that these feelings are common and transient.	This can be done during the referral process and submitted along	(la Cour & Petersen, 2015; Kerr et al., 2011)

Table 3

Recommendations for Future Research

Recommendation	Sources
Future studies can categorize the types of pain most likely to benefit from MBIs and types of pain unlikely to benefit. Beyond this data into "what works for whom" would be useful to guide future MBI treatments. A more definitive mechanism of action, once theorized, can be used to guide this research.	(Cherkin et al., 2016; Morone et al., 2016; la Cour & Petersen, 2015; Schmidt et al., 2011; Wong et al., 2011)
Study the mechanisms by which mindfulness exerts change on psychosocial outcomes including moderators and mediators of effect.	(Cherkin et al., 2016; Dowd et al., 2015; Hearn & Finlay, 2018)
Design high quality adequately powered RCTs with a follow up 6-12 months to assess long term effects.	(Bawa et al., 2015; Hilton et al., 2017; Lauche et al., 2013)
Future research can focus on developing mindfulness programs for patients with neurological injuries	(Hearn & Finlay, 2018)
Investigate if there is a feasible balance of online and in person MBI delivery model, and how much in-person contact is necessary to see change.	(Dowd et al., 2015)
Evaluate MBSR in the setting of a pseudo-mindfulness or design a condition control for non-specific effects such as more attention, access to a qualified therapist, and group participation.	(Ball et al., 2017; Cherkin et al., 2016; Chiesa & Serretti, 2011)
Evaluations of MBSR intervention in males and non-Caucasian populations.	(Ball et al., 2017; Chisea & Serretti, 2011; Lauche et al., 2013)
MBSR appeared to be unexpectedly effective in diabetic neuropathy. Larger studies can confirm this impact on neuropathies in general, and diabetic neuropathy in particular.	(Nathan et al., 2017)
Determine the minimum number of sessions/time required for effect. Establish the optimal dose for MBIs. This can be done in head-head trial of adapted MBSR programs of various lengths/dosing.	(Cherkin et al., 2016; Dowd et al., 2015; Hilton et al., 2017)
Future RCTs should be designed to monitor and categorize harms that occur with mindfulness.	(Hilton et al., 2017)
Future study designs can use technology to establish more intensive measurements and gather data at least once a day to catch emerging changes. Scheduled in a way to catch emerging changes.	(Veehof et al., 2016)
Maintain rigour in studies, including intervention check, adherence to Consolidated Standards of Reporting Trials (CONSORT) standard.	(Hilton et al., 2017; Veehof et al., 2016)

Conclusion

The purpose of this integrative literature review is to address the impact mindfulness may have on the quality of life of subjects with chronic pain. This study concluded that there is low to moderate-quality evidence that mindfulness improves QOL, especially in the domains of mental well-being. Common themes are discussed, but it is difficult to come to any concrete conclusions about the efficacy of mindfulness due to study variation, poor quality, and method heterogeneity, as there is little consistency in results between studies or systematic reviews. In addition, mindfulness appears to slightly decrease pain levels and address mental health co-morbidities such as depression. Effects of mindfulness are persistent and can be noted at 26 weeks, although few studies follow up beyond this time frame. Overall, mindfulness can be an effective tool for individuals that are currently on pharmacological monotherapy but does not offer a clear advantage over other interventions such as CBT. Despite the uncertainty surrounding the exact nature of mindfulness, it should be considered clinically useful based on the preliminary evidence and six recommendations for application to primary care are outlined.

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Appendix A - Literature Review Matrix

Single Studies

Author/Title/Journal	Year	Purpose/Question	Sample	Findings	Timing	Strengths/Weaknesses	Relevance to PIO
Hearn, J. H., & Finlay, K. A. Internet-delivered mindfulness for people with depression and chronic pain following spinal cord injury: a randomized, controlled feasibility trial. *Spinal Cord*	2018	Determine if online (internet) mindfulness versus psychoeducation will improve quality of life in patients with chronic pain following spinal cord injury. There will be no differences in pain levels between groups.	No power analysis was done. Recruited 67. Completed study at 13 weeks: 43. Estimated 35% attrition rate.	Depression: −1.50, 95% CI [−2.43, −0.58] Anxiety: −1.50, 95% CI [−2.60, −0.40 Pain unpleasantness: −0.96, 95% CI [−1.67, −0.25] Pain catastrophizing: −2.26, 95% CI [−4.14, −0.38] Pain intensity, mindfulness facets, and QOL (WHOQoL-Brief): was not significant. Findings remained consistent at 8 and 13 weeks. Those that stopped treatment were	Pain > 3 months. Duration of intervention was 8 weeks. Data recorded at baseline, at 8 weeks and at 13 weeks.	Strength: in detail outlined the curriculum for the eight weeks of training. Allocation was concealed by using software, subjects were randomized. Of those remaining in the study, 78% completed the program. Psychoeducation is an effective control. Weakness: Convenience sample of individuals. There are barriers to using the online system and it was unclear if IT systems were set up, or what provisions were made to accommodate quadriplegic subjects. It is not clear if an orientation class was performed about how	Mindfulness in an online format would give optimal flexibility to administration, especially in a rural setting. This type of study may also have lower attrition and therefore be more reliable. This gives evidence that depression is decreased but suggests that compared to psycho education no QOL improvements are made.

				more likely to have higher depression scores.		to use the technology. Attrition was relatively high and might skew results.	
Nathan, H. J., Poulin, P., Wozny, D., Taljaard, M., Smyth, C., Gilron, I., Sorisky, A., Lochnan, H., & Shergill, Y. Randomized trial of the effect of mindfulness-based stress reduction on pain-related disability, pain intensity, health-related quality of life, and A1C in patients with painful diabetic peripheral neuropathy. *Clinical diabetes : a publication of the American Diabetes Association*	2017	Purpose of this study is to investigate if MBSR would improve physical/mental functioning in those with painful peripheral diabetic neuropathy. Secondary outcomes measured are pain severity, mood, and health-related QoL, as well as on diabetes self-care activities and glycemic control.	Power analysis done, allocation concealed. Recruited 66. End of study: 63 (4.5% attrition).	Primary Outcomes BPI (measures pain related disability). Improved (≥1.0 BPI score) by 63.3% (OR 9.9, 95% CI 1.5–63.8, P = 0.02). Absolute difference 40.5% (NNT 2.5). 2nd outcomes: **Depression** (PHQ-9) 42.0% decreased. (–4.64 (–7.89 to –1.38)), no change in control. **QOL** (SF-12) 52.3% increase (improvement). SF-12 mental health component of QOL 16.30	Pain has no minimum, mean is 7.4 years with SD of 6.0 MBSR eight weeks as standard. Assessment at baseline, two weeks post intervention and 12 weeks post intervention.	Strength: well written and statistics relatively easy to understand. Minimal attrition. Demonstrates large increases in QOL and BPI changes. Group is relatively homogenous in age and type of pain. Weaknesses: does not account for control. Poorly accounts for attrition, although there was little of it. CL is wide and mean changes lack precision.	This high quality study exams MBSR in diabetic neuropathy. Participation in an MBSR course improved function and reduced pain intensity, pain catastrophizing, depression, and perceived stress while improving health-related QoL. As with other studies there is no physical change in QOL.

				(7.08 to 25.52) p <0.001 Some of these were unexpectedly large. **Pain scale**: DPN-specific NeuroQoL and the BPI pain intensity scale, which interrogate about patients' experience of pain, showed reductions of 21.8 and 30.1%, respectively, 12 weeks after the MBSR			
Cherkin, D. C., Sherman, K. J., Balderson, B. H., Cook, A. J., Anderson, M. L., Hawkes, R. J., Hansen, K. E., & Turner, J. A. Effect of mindfulness-based stress reduction vs cognitive behavioral	2016	The purpose of this study was to test two hypotheses: 1) That MBSR would be superior to usual therapy amongst patients with chronic back pain in both short- and long-term as	Power analysis required 264. Recruited 342. Completed: 294 at 26 weeks, 290	At 26 weeks the Rolland Disability Questionnaire (RDQ) showed (MBSR 61%, UC 44%, CBT 58%), where difference between MBSR and UC was statistically significant. CBT	Back pain >3 months. Duration of intervention was eight weeks. Data was recorded at baseline,	Strength: study is adequately powered to answer the question. Methods are clear. Varied group of subjects and power analysis has potential for generalizability. Weakness: Control group did not receive	This study provides evidence that MBSR is an effective intervention for chronic back pain. This is difficult to interpret as it was not

therapy or usual care on back pain and functional limitations in adults with chronic low back pain: A randomized clinical trial. *JAMA*		evidence by improved functional limitations and other outcomes and 2)That MBSR would be compared to CBT and would also be superior.	at end of study. Authors estimate a 20% attrition rate.	and MBSR were not statistically different. There was no impact at <8 weeks. Hypothesis 1 accepted, 2 rejected. Used Roland disability questionnaire	four weeks, eight weeks, 26 weeks, and 52 weeks.	training and was allowed to seek any treatment they wanted during the study. Up to 39% of subjects in the experimental group did not attend six out of eight sessions. Their inclusion of participants in analysis appears flexible as they included in their analysis patients that attended zero sessions. Another weakness is the control was not rigorous enough because there were no sessions in control and not actual tasks. It is possible education/social connection from MBSR and CBT accounted for the statistical difference from control.	statistically different from CBT. The study accepted the first hypothesis but rejected the second as no difference between MBSR and CBT was apparent. It is important that any improvements are retained long-term for mindfulness to be a useful tool.
Morone, N. E., Greco, C. M., Moore, C. G., Rollman, B. L., Lane, B., Morrow, L. A., Glynn, N. W., & Weiner, D. K.	2016	Does a mind-body program improve function and reduce pain in older adults with	Power analysis was done. Recruited: 282	The mindfulness group also had a statistically and clinically significant 30% improvement in	Pain >3 months Duration of intervention was eight weeks.	Strengths: this study had a rigorous control that also underwent clinical sessions. The control also improved on the RMDQ	This high quality study provides evidence that MBSR is useful for

A mind-body program for older adults with chronic low back pain: A randomized clinical trial. *JAMA Internal Medicine*		chronic low back pain?	Completed: 253 at 26 weeks Attrition 4% at eight weeks and 10% at 26 weeks.	current and most severe pain (in the past week). Other measures, such as catastrophizing, are not significant. Short term benefit: improved physical functioning Long term benefit: improved pain intensity. QOL measured with RAND-36 health status inventory. QOL improved significantly but not clinically meaningfully.	Data was recorded at baseline, eight weeks and 26 weeks.	(disability scale) so this study accounts for potential improvement from socialization and education. Participation was high with an average of 6.6 sessions. Weakness: the study had a greater proportion of females to males. They did not note how many sessions a subject could miss and still be eligible for analysis. The RMDQ used only measures physical not mental QOL improvement. Excluded people with depression.	perceived pain. The study explored these effects in older adults; mindfulness is effective for older adults. The study removed variables such as socialization and education as potential reasons for improvement.
Dowd, H., Hogan, M. J., McGuire, B. E., Davis, M. C., Sarma, K. M., Fish, R. A., & Zautra, A. J. Comparison of an online mindfulness-based cognitive therapy intervention with online pain management	2015	Test the effectiveness of computerized mindfulness-based cognitive intervention compared with computerized pain management in adults with	Power analysis was done (51 subjects needed to test hypothesis) Recruited: 124	**Pain interference**: improved in both groups at T2 and remained low at T3. There was no significant difference between control/mind.	Pain > 6 months. Interventions were biweekly for six weeks. Data recorded initially, at six weeks	The study does not explicitly measure the quality of life as a concept but does measure pain interference, life enjoyment and other components that relates to quality of life.	This is a high quality RCT that uses an online component and can suggest if mindfulness is effective if learned digitally. Interestingly,

psychoeducation: A randomized controlled study. *Clinical Journal of Pain.*		chronic non-cancer pain.	Completed at six months (T3): 50 Attrition: lost 42% at completion of intervention, (T2) 55% at 26 weeks (T3).	**Psychological distress** (HADS) – no change **Satisfaction with life**: improved with both groups but was more prominent with MIA group (d = 0.59). Large effect (d = 0.9) overall. **Catastrophizing:** improved to T2 and stead to T3, no difference between groups. **Pain intensity:** no change **Pain acceptance:** increased significantly over time for both groups at T3. **Patients impression of change:** (1) ability to manage your emotions: better at T2 and T3 for MIA; (2) dealing with stressful situations; better	(T2) and 26 weeks (T3).	Strengths: Strong control the compares education to mindfulness program. Measures an online component. Weakness: high attrition rate. No control with a do nothing group. Could use a control group that compares online with in-person. Majority of subjects are females.	despite the online component, it still had a high attrition rate.

				at T2 and T3 for MIA; (3) ability to enjoy pleasant events: better at T2 for MIA, similar as control for T3.			
la Cour, P., & Petersen, M. Effects of mindfulness meditation on chronic pain: A randomized controlled trial. *Pain medicine (Malden, Mass).*	2015	The aim of the present study was to conduct a standard RCT investigation of the effects of a mindfulness meditation program (MBSR) for patients with long-lasting, severe pain conditions of multiple origins in an ambulatory hospital setting.	No note on allocation. Power analysis done. 109 recruited and randomized. 90 completed study (18% attrition). Control was usual treatment x 2 months then the same as intervention arm.	At T2: SF36 vitality was significant after the intervention (level $P \leq 0.05$). Lower levels of anxiety (HADS 9.6->8.4), greater ability to control pain, readiness to engage in actives regardless of pain, and better mental quality of life ($P<0.01$) There were no significant changes from T2 to T3 Of the SF36: no significant change in level of pain.	Long standing chronic pain, with a mean of 19.21 months (SD 11.6 months). Interventions three hours per week for seven weeks and four hours on the eighth week. Assessed at baseline (T1) post eight weeks (T2) – different for control where T2 was pre	Strengths: account for attrition and why individuals would quit a program. Screened and assessed for harm. Statistics were easy to follow. Weakness: control was deligated to usual treatment. Duration of pain was four years longer in the control group. The data collection at T2 was not the same timing between control and intervention. There was no blinding or allocation control, there is a high risk of bias.	This study evaluates MBSR intervention in patients with severe pain syndromes. For individuals that dropped out during the study, they were more likely to be younger (mean 42 vs 50 years) and not married (46% vs 72%). No socioeconomic differences. This may give some clues as who most benefits from MBSR.

				Impact of pain on everyday life was significant improved. Medium effect size, significant positive effect Harm: temporary strong feelings of anger towards their pain (n = 2). At least two patients experienced more anxiety.	intervention assessment for them- and 26 weeks post intervention (T3). Based on this design, there is effectively no follow up at 26 weeks due to no control to compare it to.		It is difficult to consider benefit due to the unusual control during the study. The study shows that mindfulness does not change physical aspects of pain, change is slow, and
Buhrman, M., Skoglund, A., Husell, J., Bergström, K., Gordh, T., Hursti, T., Bendelin, N., Furmark, T., & Andersson, G. Guided internet-delivered acceptance and commitment therapy for chronic pain patients: A randomized controlled trial. *Behaviour*	2013	To investigate if internet-based acceptance and commitment therapy (ACT) could help chronic pain patients. The purpose stated is vague.	Recruited: 76 Completed study: 61 Analyzed at 26 weeks: 29. Attrition 19% at completion, 61% at 26 weeks.	Chronic pain acceptance (small-mod effect size). Lower anxiety/depression scores in treatment (small effect size). Lower catastrophizing in treatment group (small effect size). No QOL difference between groups.	Chronic pain length not precicely defined but was generalized as an "average 15 years". Data recorded at "pre and post intervention" (p. 310) but	Strength: methods explained, validated tools. Detailed security. Weakness: the majority of participants were female, limiting the generalizability of the study. Only 39% of the intervention group concluded all sessions, and the mean was 4.2 (of seven). The control group was not rigorous as they had vague	This study is important because an important aspect of managing chronic pain is accessibility. Internet breaks down barriers to attendance to formal MBSR courses. This finding suggests that

Research and Therapy.				MPI was improved in treatment and further improved at six months (small effect size).	not not exactly noted. Data recorded pre, post, and at six months (treatment group only).	internet-based activities. Patients self recruited. This study does not address those individuals without access to internet. Results were difficult to interpret and statistics were presented in a confusing manner. Chronic pain length was not strictly defined.	internet delivery may be a viable avenue of mindfulness training, which improves accessibility to patients.
Schmidt, S., Grossman, P., Schwarzer, B., Jena, S., Naumann, J., & Walach, H.. Treating fibromyalgia with mindfulness-based stress reduction: Results from a 3-armed randomized controlled trial. *Pain*	2011	To evaluate the effect of MBSR on the health related quality of life of individuals with fibromyalgia. This is a follow up study from a previous smaller study.	Blinded, randomized, concealed allocation. Power analysis done. Recruited 177. End of study 152 (14% attrition).	Measures: Quality of Life Profile for the Chronically Ill (PLC). There were no significant differences between any of the arms at either short or long term measures. Secondary measures: reduction in anxiety (MBSR vs. waitlist), and rating higher on	Eight week MBSR course. Short term eight weeks post intervention.	Strength: well written and easy to understand. Uses three arms comparing MBSR, active control, and a wait list group. Active group followed the 8 week course and was mimicked in everything but the content. Restrictive inclusion criteria decrease heterogeneity. Weaknesses: female only. It was difficult to follow when the assessments took place.	This well designed study with relatively limited heterogeneity. This study ultimately showed no change in quality of life for MBSR. There is a systematic analysis that includes this study (Lauche et al., 2013) that does find an effect.

				mindfulness scale (MBSR vs all). Overall negative findings.			
Wong, S. Y., Chan, F. W., Wong, R. L., Chu, M. C., Kitty Lam, Y. Y., Mercer, S. W., & Ma, S. H. Comparing the effectiveness of mindfulness-based stress reduction and multidisciplinary intervention programs for chronic pain: A randomized comparative trial	2011	Tested the hypothesis that the MBSR program would reduce both pain intensity and pain-related distress and improve the quality of life in individuals with chronic pain when compared with MPI.	Power analysis done. Allocation concealed. Randomized. Recruited 100. End of study 83 (17% attrition).	SF-36 QOL measure was not significant between groups.	Eight week MBSR course, measures taken baseline, upon completion, three months, and six months. Chronic pain length >3 months.	Strength: well conceptualized and well written. Compares an active control group. Did somewhat note analgesic use. Weakness: completed study was defined as	This study addresses the PIO question and is done in a primarily non-caucasion population.

Systematic Reviews

Author/Title/Journal	Year	Purpose/Question	Findings	Strength	Weaknesses	Relevance to PIO
Ball, E. F., Sharizan, E. N. S. M., Franklin, G., Rogozińska, E., & Nur Shafina Muhammad Sharizan, E. Does mindfulness meditation improve chronic pain? A systematic review.	2017	The purpose of this study is to summarize evidence from RCTs to evaluate effects of mindfulness-based meditation on chronic pain and psychological	**Physical QOL**: SMD 0.04; 95% CI 0.22, 0.30; I 2¼ 0% - not significant **Mental QOL:** SMD 0.57; 95% CI 0.25, 0.89; I 2¼ 52.9% - significant	This study only considers RCTs. No language restrictions. Identified weaknesses of previous reviews. Methods	Statistical significance not clearly outlined. Results presented in a confusing manner without any explanation.	This study suggests that mindfulness works not by reducing the perception of pain but by improving associated

		conditions such as depression.	**Total QOL** (SMD 0.86; 95% CI 0.06, 1.78; I 2¼ 88%) – not significant but approaching significance (Secondary Findings) **Pain Intensity:** not statistically significant **Pain Acceptance:** 0.34; 95% CI 0.09 to 0.59 **Affective pain:** Not significant. (-0.13; 95% (CI) 0.42, 0.16). **Depression:** 0.31; 95% CI 0.52, 0.10 **Anxiety:** not statistically significant (-0.21; 95% CI -0.45, 0.03)	explained and authors explained. Quality of studies chosen was discussed as a group (but not as individual studies).	Discussion also does not clearly or adequately discuss results. Does not discuss heterogeneity in studies. It does not consider the quality of evidence. <u>This study makes claims that are not well supported by the evidence presented in the study.</u> This study commented that there was no improvement in quality of life as physical health and as quality of life as mental health,	depression and quality of life. Based on the evidence presented in the study, this claim is poorly supported with no magnitude of effect (such as Cohen's d) reported.

					however, this is difficult to navigate because QOL and health are different concepts.	
Hilton, L., Hempel, S., Ewing, B. A., Apaydin, E., Xenakis, L., Newberry, S., Colaiaco, B., Maher, A. R., Shanman, R. M., Sorbero, M. E., & Maglione, M. A. Mindfulness meditation for chronic pain: Systematic review and meta-analysis. *Annals of Behavioral Medicine: a Publication of the Society of Behavioral Medicine*	2017	The purpose of this study is to assess the safety and efficacy of mindfulness therapies on chronic pain with outcomes as 1) decrease in pain and 2) improvement in quality of life. Pain must be >3 months and migraine, headache, back pain, osteoarthritis, or neuralgic pain in origin.	**Pain**: -0.19% (p. 0.003). Quality of evidence (QOE): low due to heterogeneity, inconsistency in follow up **Depression:** Significantly lowered depression scores SMD 0.49 (95% CI 0.22-0.76). QOE: high. **Quality of life:** significant improvement 0.34 (95 % CI, 0.03, 0.65). QOE: moderate for mental health outcomes, low for physical outcomes **Functional Impairment:** not statistically significant (QOE: low and maybe could be	Detailed analysis. Methods clearly outlined. Detailed chart and statistical analysis were provided. Statistics were easy to follow and were sensical. Only RCT included. Results were clearly presented. Risk of bias discussed. Duplicate study selection by two independent researchers, exhaustive RCT search.	They discussed studies that talked about fatigue from cancer or IBS symptoms. Included only English studies. International sources can be considered from more detail. Many of the studies considered were low quality studies. There was significant heterogeneity between studies and no standard	This study directly addresses my PIO. Metanalysis provides the most detailed review for area where mindfulness can be effective (depression, pain, and QOL) and for areas where mindfulness is not likely to be effective. This study outlines that overall evidence for the use of mindfulness is moderate at best and only in specific contexts. It also states that

			significant with more rigorous research). **Analgesic use:** not statistically significant Findings did not differ by subcategories of pain type (i.e. fibromyalgia vs headaches, etc).	Explains what is considered a high-quality vs low quality study and each study is ranked in a clear table. This is a meta-analysis, which is stronger than a basic review.	exists for measuring specific outcomes. Unpublished studies were not included and primary authors were not contacted.	pain improvement is small but there are enhancements in other domains of being, such as mental health.
Veehof, M. M., Trompetter, H. R., Bohlmeijer, E. T., & Schreurs, K. M. Acceptance- and mindfulness-based interventions for the treatment of chronic pain: a meta-analytic review. *Cognitive Behaviour Therapy*	2016	Conduct a meta-analysis to assess if mindfulness or acceptance-based programs are effective for chronic pain. The purpose stated is somewhat vague.	Depression findings have higher probability of publication bias. **Pain** intensity 0.24 (95% CI = 0.06, 0.42) small effect **Depression**: 0.43 (95% CI = 0.18, 0.68), small effect. **Disability:** 0.40 (95% CI = 0.01, 0.79) small effect **Quality of life:** not statistically significant short term but significant at follow up. **Anxiety**: 0.51 (95% CI = 0.10, 0.92), moderate effect	Methods are clearly explained. Search strategy is sensical and easy to follow. Unpublished studies (dissertation) were included. Mostly RCT were included and non-experimental methodology were excluded. Quality of studies were assessed by two reviewers.	Included ACT, which may overalap with mindfulness but is not equivocal. Reports an improvement in pain likely due to a controversial combination of diverse pain scales (Ball et al., 2017). Do not explicitly detail the quality of studies, or what studies	This study directly addresses my PIO question. This study outlines several potential areas where mindfulness is helpful, such as pain intensity, depression, disability. Interestingly QOL here is unchanged; this study challenges previous notions that QOL is actually improved by mindfulness.

			Pain interference: 0.62 (95% CI = .21, 1.03), moderate effect. CBT and mindfulness were compared and noted that CBT may have similar or slightly better impact on pain interference, disability and depression -these differences were not significant.		are considered low, moderate, or high quality. No rationale for these distinctions is given. Reviewed only studies in English. The objective was poorly defined. The study acknowledges difficulty with managing heterogeneity in this field. Included ACT studies but did not analyze these studies separetly.	Variance in studies can be explained because this analysis considered ACT vs MBSR as different mindfulness techniques and noted that there are differences between the two. This study also considered CBT versus mindfulness and noted that CBT may be more effective.
Bawa, F. L., Mercer, S. W., Atherton, R. J., Clague, F., Keen, A., Scott, N. W., & Bond, C. M. Does mindfulness improve outcomes in patients with chronic pain?	2015	To analyze RCT in order to determine if mindfulness-based intervention on patients with chronic pain improve	**Pain intensity:** not statistically significant. **Anxiety/Depression:** not statistically significant. **Health related quality of life**: not	No restrictions on dates, languages, or publication status. Clear methodology, easy to follow. Clear purpose.	Single reviewer search for articles. More rigorous exclusion criteria limited the	Indirectly and directly addresses the PIO question. Due to the limited amount of studies included and the

Systematic review and meta-analysis. *The British Journal of General Practice: the journal of the Royal College of General Practitioners*		economic, clinical, and humanistic outcomes.	statistically significant. **Physical functioning:** Approaching statistical significance 0.22 (95% CI = 0.00 to 0.45 **Pain Control:** 0.58 (95% CI = 0.23 to 0.93 **Pain Acceptance:** Not statistically significant. **Mindfulness:** High heterogeneity, not statistically significant The study reports there were more positive outcomes from non-validated instruments reported but does not elaborate on those results. Most studies are from 2000-2010 Studies comparing mindfulness with inactive control groups were more	Clear definition of terms including chronic pain. Heterogeneity acknowledged and minimized through exclusion criteria. Tables were well designed and easy to read. Detailed review of quality of studies and rationale for their categorization. Publication bias acknowledged.	number and quality of studies. The study acknowledges difficulty with managing heterogeneity in this field. The study does not give p values and it is difficult to verify statistically significant results from their tables. The results of the studies were difficult to interpret as clinically or statistically significant. Only 11 studies were included and author acknowledges that some of them are not powered to	fact that many of these studies are pool quality, this analysis is only somewhat useful for my PIO. This study notes that a statistical significance is approached when the control group is inactive and is often lost when compared to active control groups. This study suggests that the evidence for the use of mindfulness for chronic pain is weak, with few statistically significant reviews. This article is useful because it challenges the notion that mindfulness is inherently useful in chronic pain

			likely to show significant effect		answer the questions asked.	and provides context.
Lauche, R., Cramer, H., Dobos, G., Langhorst, J., & Schmidt, S. A systematic review and meta-analysis of mindfulness-based stress reduction for the fibromyalgia syndrome. *Journal of psychosomatic research*.	2013	To determine the short and long term effect of MBSR for the treatment of fibromyalgia. Studies were eligible if they assessed QOL or pain.	**MBSR vs Waitlist/Usual** **QOL:** significant small short term effect (− 0.35; 95% CI − 0.57 to − 0.12). No longerterm effects were found. **Pain:** a significant short term effect was found on pain intensity (SMD =− 0.23; 95% CI − 0.46 to − 0.01). No long term effects were found. **Depression:** no significant effect short or long term. **MBSR vs Active Treatment** **QOL:** small short term effect (SMD =− 0.32; 95% CI− 0.59 to − 0.04). No long term effect. **Pain:** small short term effect (SMD =− 0.44; 95%	Clearly laid out process that was easy to follow. Focused on a specific patient population. Evaluated risk of bias. They explained the statistics they used. The studies were analyzed for grade of quality.	There was no clear minimum with patient with chronic pain, however there is underlying assumption that patient have ongoing chronic pain based on their diagnosis.	This strong review compares MBSR outcomes in three arms: control (do nothing) control (active) and intervention and clarifies the impact of MBSR in both of those cases. This is particularly relevant to chronic pain related to fibromyalgia. It suggests that MBSR may be effective in the short term, but not necessarily long term. A weak recommendation for MBSR is made.

			CI − 0.73 to − 0.16). No long term effect. **Depression:** No effect found in long or short term.			
Chiesa, A., & Serretti, A. (2011). Mindfulness-based interventions for chronic pain: A systematic review of the evidence. *Journal of alternative and complementary medicine (New York, N.Y.).*	(2011).	The purpose of this review is to evaluate mindfulness-based interventions on chronic pain. Primary outcomes are pain level and depression. Secondary outcomes are QOL, coping, physical functions, stress reduction and other psychological changes.	**Pain reduction:** MBI's could have non-specific effects for pain reduction (i.e. support group component) and limited evidence for specific effects. **Depression**: suggest that there are nonspecific, but not specific for reduction of depressive symptoms. **Physical function:** no change. **QOL**: significant improvements from baseline in functional status and positive affect domains of QOL, however it is unclear how rigorous this finding is.	Well written and thematically analyzed. Evaluated studies for quality. Discusses strengths and weakeness of the current evidence. Provides conclusions that are well supported by their evidence.	There is no statistical analysis of the studies. There is no analysis for risk of bias for chosen studies. Considers quality of life as an afterthought.	This article provides minimal evidence for the improvement of quality of life in chronic pain as this was a secondary outcome. The discussion on quality of life is minimalistic and provides little insight.

Appendix B – Summary of Common QOL Measurements for Chronic Pain

Instrument	Components	Notes
World Health Organization Quality of Life (WHOQOL) (Mason et al., 2009; WHO, 1996)	Has multiple adaptations (i.e. UK WHOQOL-100, WHOQOL-BRIEF). The 100 suffix denotes assessing 100 items that are assessed, and the BRIEF suffix usually assesses 25 items. It measures domains including physical, psychological, independence, relationships, and spirituality.	Validated for use with chronic pain patients. Has a long completion time 20 min for full, five min for brief.
Pain and discomfort module (PDM) (Mason et al., 2009)	Assesses four facets of QOL: pain relief, anger/frustration, vulnerability, fear and worry, and uncertainty.	Developed for chronic pain.
Short-from 12 (SF-12) (Mason et al., 2009)	Abbreviated form of SF-36. Evaluates two subscales: physical and mental health components.	It uses single items for evaluation and instrument precision suffers, compared to SF-36.
Short-form 36 (SF-36) (Bunevicius, 2017)	Evaluates 8 subscales: physical function, social functioning, role limitations due to physical problems, role limitations due to emotional problems, mental health, vitality, pain, and general health perception.	Highly correlated with depression in chronic pain patients. Is an effective tool for QOL in chronic pain. (Elliott et al., 2003)
Short-form McGill Pain Questionnaire (SF-PMQ) There are other adapatations based on the type of pain such as neuropathic pain SF-PMQ-2 (Mason et al., 2009; Melzack, 1987)	Evaluates a sensory subscale and affective subscale. Evaluates severity of sensory pain, affective pain, total pain, and present pain intensity.	Used in assessing pain in more detail and evaluates analgesics/interventions. It is limited to pain domains and does not explore other components.
EuroQol-5D (EQ-5D) (Balestroni & Bertolotti, 2012)	Five dimensions including mobility, self-care, usual activities, pain/discomfort, and anxiety/depression	A QOL measurement often used in Europe.

Appendix C – Adapted Prisma Flowchart