A feasibility implementation trial for the English version of GLA:D® Back

by

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A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Science

in

Rehabilitation Science

Faculty of Rehabilitation Medicine

University of Alberta

ABSTRACT

Background

Low back pain is common, costly, and considered the number one disability in the world. As a result, evidence-based clinical guidelines for the treatment of low back pain (LBP) have been developed to steer clinicians towards educating patients about their back pain, its natural course, and providing advice to keep active and continue working. Guidelines also recommend first-line care of patient education and exercise therapy as an intervention for persistent LBP. Despite this evidence, clinicians routinely do not follow these recommendations resulting in ineffective and fragmented care. To address this problem, GLA:D® Back, a standardized 8-week group exercise and education care package, was originally developed in Denmark to assist clinicians in implementing evidence-based care into clinical practice.

Objective

The overall objective of this thesis was to determine if group exercise programs were equally effective as non-pharmacological interventions for chronic LBP; and to determine if it was feasible to implement an English translated evidenced-based group education and exercise program, GLA:D® Back, into clinical practice.

Specifically, this thesis had four objectives:1) to assess whether group exercise programs are as effective as individual non-pharmacological interventions for chronic LBP; 2) to evaluate the ability of clinicians to implement a translated English version of GLA:D® Back into clinical practice; 3) to assess clinician's confidence, attitudes, and beliefs before and after implementation of GLA:D® Back; 4) to assess the success of GLA:D® back on patient pain and disability.

Methods

To address the first objective, a systematic review involving four electronic databases were searched by two independent reviewers. Only randomized controlled trials that compared group-based exercise with other non-pharmacological interventions for chronic LBP were eligible. The study quality was assessed using the Cochrane Handbook for systematic reviews of Interventions by two independent reviewers.

To address objectives 2-4, thirty-five clinicians from nineteen clinics in Alberta, Canada participated in the GLA:D Back feasibility study. Feasibility of program implementation, our primary objective, was evaluated in terms of percent adoption with a 50% adoption rate (clinics/clinicians) set as our success criterion. Our secondary objectives included collecting data pertaining to clinician confidence, attitudes, and behaviour of treating patients involved in the program in addition to collecting patient- data regarding pain and disability.

Results

The results of the systematic review found no significant differences between group exercise and other non-pharmacologic interventions in disability levels or pain scores at 3-months post-intervention in patients with chronic LBP. Furthermore, we were unable to find any evidence for or against the use of group-based exercise in the rehabilitation of people with chronic back pain at other time points and for other health measurement outcomes. Additionally, we found no clinically significant differences in disability scores, quality of life, or pain scores between the individual or group non-pharmacological interventions that included exercise.

The results of our feasibility study at 4-months post course found that 79% of the clinics offered GLA:D® Back to their patients within the study period. Of the participating clinicians, GLA:D® Back was delivered by 71% of clinicians. In total, 78 patients were recruited to participate in the

program and 88% of the participants attended the final assessment. Additionally, clinicians exhibited high levels of confidence on the PCS (MD: -1.5, $p<0.001$), and a combined biomedical PABS subscale (MD: 4, $p=0.005$) and behavioral PABS subscale orientation (MD: 2.5, $p=0.023$). Patients had observed minimal median improvements of -5 ($p<0.001$) on the ODI and moderate median improvement of 2 ($p<0.001$) for back pain and moderate improvement of 1 ($p<0.001$) for leg pain from baseline to 3-months post GLA:D Back.

Conclusion

GLA:D® Back has been thoughtfully designed to assist clinicians in delivering well established evidence-based group exercise programs to people suffering from persistent recurrent LBP. The English translation of the Danish GLA:D® Back program was found feasible to implement into practice in both urban and rural settings throughout Alberta. Subsequently, GLA:D® Back represents a potential opportunity for stakeholders to shift away from “low-value” care to “high-value”, cost-effective, evidence-based care.

PREFACE

This thesis is an original work by James Lemieux. The research project, of which this thesis is a part, received research ethics approvals from the University of Research Ethics Board, for the following project:

1. Project Name “A PILOT IMPLEMENTATION STUDY OF GLA:D® BACK”, No. Pro00085118, 2018-12-20 2020-04-27

The literature review in chapter 2 and the data analysis in chapters 3 and 4, are my original work.

Chapter 3 of this thesis has been published as Lemieux J, Abdollah V, Powelske B, Kawchuk G. Comparing the effectiveness of Group-based Exercise to Other Non-Pharmacological Interventions for Low Back Pain: A Systematic Review. J. Lemieux was responsible for the formation and development of the study. V. Abdollah and J. Lemieux were responsible for the data analysis as well as the manuscript composition. G.N. Kawchuk was the supervisory author and was involved with the concept formation and manuscript composition and edits.

Chapter 4 of this thesis has been published as Lemieux J, Kawchuk G, Kongsted A, Hartvigsen J, Jones A. The feasibility of implementing an English language version of GLA:D® Back. Dr Greg Kawchuk, Dr Alice Kongsted and James Lemieux were responsible for the concept formation. J. Lemieux was responsible for data collection and analysis as well as the manuscript composition. G.W. Kawchuk was the supervisory author and was involved in concept formation and manuscript composition and edits. V. Abdollah assisted in data analysis.

DEDICATION

I would like to dedicate this thesis to my wife Marnie, my sons Kristopher, Patrick, my parents Ann and Andre, and mother-in-law Sylvia.

I could not have finished this without everyone's support and encouragement, I am truly grateful.

For all my instructors at Western States Chiropractic College.

ACKNOWLEDGMENTS

I would like to express my most sincere thanks to:

Marnie, my life partner, without your support, patience, and encouragement throughout this master's journey I would not have been able to persevere and finish this master program.

For the staff at Performance Chiropractic, especially Dr. Ashley Todd and Sharka Valtr and Body Restoration, Nadine Fennig for being accommodating to my work schedule and helping me though this journey.

To my supervisor Doctor Greg Kawchuk and Doctor Allyson Jones, who provided extensive feedback and support during this master's program. Thank you, Greg, for your true commitment to the chiropractic profession and your guidance throughout this program in introducing me to researchers from around the world. I am deeply grateful. Thank you, Doctor Vahid Abdollah, for being a great colleague and friend. You were always there for me when I needed help. Thank you, Kate Pratt from the Academic Success Center, I am truly grateful for your encouragement and interest in my thesis content, I really appreciate your help with my writing.

I would also like to thank Alice Kongsted, Jan Hartvigsen from Southern Denmark University for sharing and teaching the GLA:D® Back program with us in Canada. Without your enthusiasm for GLA:D® Back I would not have been exposed to such thoughtful program. I would like to thank Inge Ris Hansen, Line Thomassen and Jasper Hoeg for their help in translating the Danish GLA:D® Back content and in conducting the clinician training session. I would also like to thank the clinicians and patients for participating in this study.

I am also grateful for the financial support of the University of Alberta travel grant that helped me travel to Berlin, Germany and present my research at the World Federation of Chiropractic Epic Conference 2019.

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List of Abbreviations

Activities of daily living- ADL's

Alberta health services- AHS

American college of physicians- APC

Brief illness perception questionnaire- B-IPQ

Canadian chiropractic guideline initiatives- CCGI

Canadian medical association journal- CMAJ

Chronic low back pain- cLBP

Clinical practice guidelines- CPG's

Cognitive behavioural therapy- CBT

Confidence interval- CI

Determinants of implementation behaviour questionnaire- DIBQ

Disability adjusted life-years – DALY's

Good living with osteoarthritis: **Denmark**- GLA:D®

Good living with osteoarthritis: **Denmark hip and knee**- GLA:D HK

Health care providers- HCP's

Low back pain- LBP

Magnetic resonance imaging- MRI

Mean difference-MD

Motor control exercises- MCE's

National institute for health and care excellence- NICE

Non-specific low back pain- nsLBP

Numerical pain rating scale- NPRS

Osteoarthritis- OA

Oswestry disability scale- ODI

Patient reported outcome measures- PROM's

Physicians' attitudes and beliefs scale-physiotherapist- PABS-PT

Practitioner confidence scale- PCS

Research ethics electronic data capture- REDCap

Southern Denmark University- SDU

Start back screening tool- STarT

Toward optimized practice- TOP

Quality of life- QoL

Quality of life subscale questionnaire -SF-36

Social cognitive theory- SCT

Years lived with disability- YLD

CHAPTER 1: GENERAL OVERVIEW OF THE THESIS

1.1 Introduction

1.1.1 Low Back Pain

Low back pain (LBP) is a prevalent chronic condition which effects up to 80% of the general population at least once in their lifetime (T. Vos et al., 2016), is costly (Bussières et al., 2018; Katz, 2006) and considered the number one disability in the world. According to a 2015 Global burden of disease study, LBP is responsible for 60.1 millions years-lived-with-disability (YLD) (Hartvigsen, Hancock, Kongsted, Louw, Ferreira, Genevay, Hoy, Karppinen, et al., 2018; T. Vos et al., 2016).

When considering the cause of pain in the low back region many musculoskeletal structures and organs can be the source (P. O'Sullivan, 2005). There are many causes of low back pain, and the differential diagnosis can be challenging for clinicians. Thus, low pain back pain can be considered a symptom rather than a disease and can result from many different known or unknown diseases or abnormalities (Hartvigsen, Hancock, Kongsted, Louw, Ferreira, Genevay, Hoy, Karppinen, et al., 2018). When the pain can be identified via diagnostic imaging or testing, low back pain can be defined as being specific. Specific causes for low back pain are uncommon and account for 10-15% of all low back cases (Russo et al., 2018). Specific symptoms caused by disease or pathology are most often caused by malignancy, spinal fracture, infection, or cauda equina syndrome (Abbott, Schröder, Enthoven, Nilsen, & Öberg, 2018). Other specific conditions that may cause low back pain are rheumatoid arthritis or osteoarthritis of the of the lumbar spine (Goode, Carey, & Jordan, 2013).

The lumbar spine is comprised of a "three-joint complex" that is supplied by an adequate nerve supply capable of generating LBP (Goode et al., 2013). Thus, with many conditions and pathologies able to cause the pain it is very difficult to be absolutely confident that the pain is

derived from a specific anatomic area (P. O'Sullivan, 2005). If the prevalence of low back pain caused by serious pathology (e.g. infection or tumor) is estimated to be less than 1% of presentation and specific pathology (e.g. spinal canal stenosis) are less than 10% then the rest of LBP (85-90%) would be considered non-specific (Chou et al., 2007; Verhagen, Downie, Popal, Maher, & Koes, 2016).

Consequently, non-specific low back pain (nsLBP) is the most common cause of low back pain when no definitive diagnosis can be achieved and no pathoanatomical pain driver can be identified (Maher, Underwood, & Buchbinder, 2017). Often many clinicians may be misled that the pain driver can be seen with imaging, but contradictory evidence has proven the likewise. Imaging can show that between 50% and 90% of asymptomatic people can have a large range of degenerative findings and large variations in lumbar spine morphology (Brinjikji et al., 2015). This finding indicates that the majority of non-specific low back pain (nsLBP) may not only be a result of benign dysfunctional biological but may be more dependent on psychological and contextual factors influencing the pain experience (Abbott et al., 2018). Thus, countless people living with LBP have multiple influences driving the pain in which co-morbidities, psychosocial, social and biophysical factors can all be involved to drive the perception of pain and result in disability (Hartvigsen, Hancock, Kongsted, Louw, Ferreira, Genevay, Hoy, Karppinen, et al., 2018). When non-specific LBP becomes chronic and the primary pain source cannot be located, a multi-dimensional biopsychosocial treatment model should be considered (Müller-Schwefe et al., 2017).

The nature of LBP is highly prevalent and recurrent: the lifetime occurrence is estimated to be 80%, and ~approximately 50% of these patients will have at least 10 episodes in their lifetime (Hoy et al., 2014). In a minority of patients, low back pain lasts longer than 12 weeks, at which it is considered a recurrent condition (Chou, 2015). For many patients, nsLBP is self-limiting and

not disabling, but 20% will have reoccurring persistent symptoms (Abbott et al., 2018). This persistent recurrent pain can become physically disabling, psychologically distressing and negatively affect their quality of life (Synnott et al., 2015). People that develop recurrent persistent low back pain account for a huge financial burden to healthcare systems and a markedly disproportionate share of the costs associated with low back pain (Hoy et al., 2014; Mutubuki et al., 2020).

To help alleviate this excessive burden to healthcare systems, researchers in Denmark developed GLA:D® Back to address this concern. GLA:D® Back has been designed to integrate evidence-based guidelines into an effective self-management program for people with persistent low back pain. GLA:D® Back consists of two educational sessions followed by eight weeks twice weekly of supervised exercise and patient outcomes are systematically monitored at 3, 6 and 12 months in a clinical registry.

1.2 Purpose

The purpose of this study was to examine the feasibility of the translated English version of GLA:D® Back if it could be successfully implemented into clinical practice throughout urban and rural chiropractic and physiotherapy clinics in Alberta.

1.3 Hypothesis

It was hypothesized that the majority of urban and rural clinics/clinicians conducting the GLA:D® Back program would implement this program within 4 months of completion of the training course resulting in 66-88 participants registered in the database.

1.4 Aim

The aim of this work is to provide a valid English translated version of GLA:D® Back to be implemented and to be used throughout Canada.

1.5 Objectives

1. To assess whether group exercise programs are as effective as individual non-pharmacologic interventions for chronic LBP.
2. To evaluate the ability of clinicians to implement a translated English version of GLA:D® Back into clinical practice by tracking the number of participants screened during the pilot study period and the absolute number and proportion of those who participated.
3. To assess clinician's confidence, attitudes, and beliefs before and after implementation of GLA:D® Back.
4. To assess the success of GLA:D® Back on patient pain and disability.

1.6 Thesis Format

Chapter 1 is a general overview of the thesis that describes LBP and the aims and objectives of the two studies in this thesis. Chapter 2 is a literature review on LBP, its challenges in clinical practice, and possible solutions to overcome these challenges. Chapter 3 is a published systematic review by *Lemieux J., Abdollah V., Powelske B., Kawchuk G., Comparing the Effectiveness of Group-Based Exercise to Other Non-Pharmacological Interventions for Chronic Low Back Pain: A Systematic Review. PLOS One 2020; 15(12): e0244444588* that identifies, summarizes, and evaluated the current evidence on the effectiveness of group-based exercise programs when compared to individual non-pharmacological interventions for chronic LBP. Chapter 4 is a published feasibility study by *Lemieux J., Kawchuk G., Kongsted A., Hartvigsen J., Abdollah V., Jones A. The feasibility of implementing an English language version of GLA:D® Back BMC Pilots and Feasibility Studies 2021 7:38* that investigated the potential of an English

translated version of GLA:D® Back to be implemented into clinical practice throughout Alberta. Chapter 5 discusses the main findings of the two studies and provides implications and possible directions for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

2.1.1 Overview

This literature review aims to gather literature about methods suggested for the treatment of persistent recurrent LBP, evidence-based guideline usage and programs that include guidelines embedded into their programs. This will guide the reader through the exercise and education strategies physiotherapists and chiropractors administer for persistent recurrent LBP as well as familiarize the reader with evidence-based guidelines for LBP, and how evidence-based guidelines can guide clinicians towards “high-value” care. We will also discuss how difficult guideline usage is in clinical practice and possible reasons the dissemination of this information to clinicians remains elusive.

2.2 Background

2.2.1 A brief overview of Low Back Pain

Low back pain (LBP) is common, as it affects up to 80% of the general population at least once in their lifetime and is now considered the number one disability in the world with a global point prevalence of activity-limiting LBP in 2015 of 7.3% at any one time affecting 540 million people (Theo Vos et al., 2017). LBP is also costly with estimates to be between 6-12 billion dollars annually in Canada (Bussières et al., 2018), 9 billion in Australia (Walker, Muller, & Grant, 2003), 6.6 billion euros in Switzerland (Wieser et al., 2011), 12.3 billion British pounds in the UK (Maniadakis & Gray, 2000) and over 100 billion dollars in the USA for direct (medical) cost and indirect (lost wages, productivity) and societal costs (Katz, 2006).

Low back pain is technically a symptom rather than a disease and can result from many different known or unknown diseases or abnormalities (Hartvigsen, Hancock, Kongsted, Louw, Ferreira, Genevay, Hoy, Woolf, et al., 2018). When considering the cause of pain in the low back, many

musculoskeletal structures and internal organs can be the source (P. O'Sullivan, 2005). As such, the diagnosis of LBP can be challenging for clinicians. When the pain can be identified via diagnostic imaging or testing, low back pain can be defined as being specific. Specific symptoms caused by disease or pathology are most often caused by malignancy, spinal fracture, infection, or cauda equina syndrome (Abbott et al., 2018). Specific causes for LBP are uncommon and account for 10% of all low back cases (Russo et al., 2018). Thus, the prevalence of low back pain caused by serious pathology (e.g. infection or tumor) is estimated to be less than 1% of presentations, and specific pathology (e.g. spinal canal stenosis) presentations are less than 10%, then the rest of LBP (90%) is classified as non-specific (Verhagen et al., 2016). With many conditions and pathologies able to cause the pain, it is very difficult for clinicians to be confident that the pain is derived from a specific anatomic area (Maher et al., 2017). In other words, we know that there are many causes for back pain but determining the cause in a specific patient is challenging.

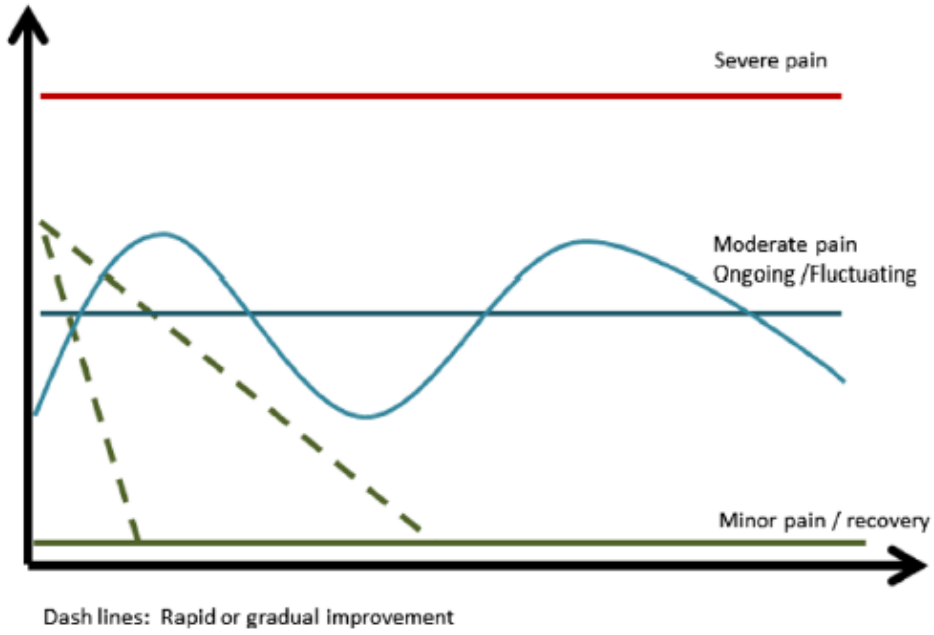
Non-specific LBP is the most common cause of LBP when no definitive diagnosis can be achieved and no pathoanatomical pain driver can be identified (Maher et al., 2017). Often many clinicians may be misled that the cause of pain can be directly correlated to imaging findings, but contradictory evidence has proven the likewise. Imaging can show that between 50% and 90% of people that are symptomatic or non-symptomatic can have a large range of degenerative findings and large variations in lumbar spine morphology (Brinjikji et al., 2015). This indicates that the majority of non-specific low back pain (nsLBP) may not only be a result of benign dysfunctional biology but may be more dependent on psychological and contextual factors influencing the pain experience (Abbott et al., 2018). Thus, countless people living with LBP have multiple influences such as co-morbidities, psychological, social, and biophysical factors that can influence the perception of pain and result in disability (Hartvigsen, Hancock, Kongsted, Louw, Ferreira, Genevay, Hoy, Woolf, et al., 2018). When non-specific LBP becomes chronic and the primary

pain source cannot be located easily, a multi-dimensional biopsychosocial model should be considered.

2.2.2 Trajectories of Low Back Pain

Until recently nsLBP has been classified often as acute, subacute, and chronic LBP according to the duration of the episode (Kongsted, Kent, Axen, Downie, & Dunn, 2016). Now the paradigm is shifting toward a notion that LBP is a recurrent condition with multiple LBP episodes. This traditional classification of acute, subacute, and chronic LBP has led to some difficulties in choosing the appropriate treatment at the appropriate time for many patients. This classification system has resulted in poor long-term outcomes and the possibility of long-term disability in susceptible people. With this shift in thinking we may now be able to categorize patients into meaningful groups and specific strategies. For many years nsLBP was considered to be a self-limiting condition but in the last two decades LBP researchers have shown some nsLBP to be a re-current life long episodic condition and that people who have had experienced previous nsLBP will likely experience future episodes (Axén & Leboeuf-Yde, 2013). Therefore, nsLBP may resemble other chronic conditions such as asthma or diabetes and may need to be managed as a lifelong process with different causes and modifying factors (Axén & Leboeuf-Yde, 2013). This paradigm shift alters the current thinking that nsLBP is a self-limiting single-entity and moves towards a concept that recurrent nsLBP is a condition that may have a series of painful episodes that differ in intensity (Axén & Leboeuf-Yde, 2013). To this point, trajectories of nsLBP are defined as patterns of changes in pain over time that can be identified (**Figure 2.1**). Many studies looking at trajectories of nsLBP have discovered a pattern of fluctuating nsLBP of interchanging intensity of pain intermingled with periods of no pain (Kongsted et al., 2016). Because of the complexity of nsLBP trajectories, categorizing nsLBP into meaningful prognostic ‘phenotypes’ may be an effective means of identifying patterns of pain so that effective treatment strategies can target these observable pain characteristics (Kongsted et al., 2016).

Figure 2. 1 Mean nsLBP intensity of simplified principal trajectory patterns (Kongsted et al., 2016)



For many, nsLBP is self-limiting and not disabling, but 20% will have recurrent persistent symptoms (Abbott et al., 2018) that is described above. In a minority of people, nsLBP will last longer than 12 weeks, at which it is considered a persistent condition (Chou, 2015). In this population, persistent recurrent LBP can become physically disabling, psychologically distressing and negatively affect their quality of life (Synnott et al., 2015) and reoccur and persist for many years. Not only can it be debilitating for the person but can be a huge financial burden to healthcare systems and a markedly disproportionate share of the costs associated with LBP (Mutubuki et al., 2020; Walker et al., 2003).

2.2.3 Burdens of Low Back Pain

Low back pain is an extremely common symptom experienced by people of all ages but more so as people age and is considered a major health burden that is now the number one cause of disability worldwide (Hartvigsen, Hancock, Kongsted, Louw, Ferreira, Genevay, Hoy, Woolf, et al., 2018). Low back pain is responsible for more years lived with a disability at 60.1 million disability-adjusted life-years (DALY's) in 2015 when compared to other conditions (Hartvigsen, Hancock, Kongsted, Louw, Ferreira, Genevay, Hoy, Woolf, et al., 2018) and is one of the most encountered conditions in clinical practice (Hoy et al., 2014). Researchers and clinicians have historically used different ways of addressing the issue of LBP. Even with the overspending on "low-value" care which includes excessive testing, imaging, prescription of opioids, spinal injections, and surgery (Hartvigsen, Hancock, Kongsted, Louw, Ferreira, Genevay, Hoy, Karppinen, et al., 2018) low back pain and back-related disability continues to rise globally (N. N. E. Foster et al., 2018). These "low-value" treatments are potentially harmful, expensive and create a significant evidence-practice gap (N. N. E. Foster et al., 2018).

2.2.4 What happens to people with persistent recurrent low back pain?

People who have persistent recurrent LBP often have difficulties performing usual activities of daily living (ADL'S). These difficulties have led many pain science researchers to believe that persistent pain may be generated at the tissue level, and, conversely, some have suggested pain is driven from the central nervous system (Taylor, Goehler, Galper, & Innes, 2011). Researchers have contemplated what may be the mechanism that is taking place. Many biomedical researchers believe this is a "bottom-up" tissue driven process (Taylor et al., 2011) and on the other hand, psychosocial and pain science researchers believe it is a "top-down "centrally driven process (Brumagne, Diers, Danneels, Moseley, & Hodges, 2019). With these two conflicting (competing) models it is becoming evident that there is a bidirectional interaction between the

peripheral tissues and the brain that contribute to physical and mental health and may influence each other (Taylor et al., 2011).

People often fear certain movements or positions that may aggravate their pain and often result in fear-avoidance behaviour (Leeuw, Goossens, Linton, Crombez, Boersma, Vlaeyen, et al., 2007; Rainville et al., 2011). This fear is often initiated by a belief that pain may indicate tissue damage or harm and as a result, avoiding these movements or positions can set up a vicious cycle of inactivity and physical deconditioning (Kjaer et al., 2018). This deconditioning can eventually, in some, create a dysfunctional movement pattern that is enhanced by worry and anxiety that appears when an offending stimulus that is related to pain is perceived as a threat (Goossens et al., 2007). Along with fear a small proportion of LBP patients may exhibit inappropriate beliefs and catastrophizing thoughts that lead to the belief that tissue has been damaged (Moseley, 2003). These thoughts can impair sensorimotor control and have been suggested as a mechanism that can retain pain because of suboptimal tissue load and damage (Brumagne et al., 2019). This mechanism is considered a “bottom-up” approach to pain. Bottom-up processing can be defined as sensory input that starts at the tissue level and travels up to the brain to create a perceptual experience based entirely on the sensory stimulus at the tissue level (Brumagne et al., 2019; Taylor et al., 2011). This mechanism can lead to abnormal central nervous system processing that may increase sensitivity in the central nervous system (Meeus & Nijs, 2007). This increase sensitivity known as central sensitization has been associated with people with co-morbidities of depression or anxiety (Bair M.J., 2003) and can be associated with poorer outcomes after an acute or recurrent episode of LBP (Currie & Wang, 2005; Melloh et al., 2013). Thus to change patients sensitivity and combat persistent low back pain addressing the abnormal processing system may be addressed by top-down cognitive interventions such as education, cognitive behavioural therapy (CBT), and specific motor training (Brumagne et al., 2019). These changes can also be addressed by targeting bottom-up processing with exercise

and manual therapy (Brumagne et al., 2019). If better outcomes in patients with recurrent and chronic LBP are to be attained a combination of bottom-up and top-down approaches to care programs may be required (Brumagne et al., 2019).

2.2.5 Biomedical versus the Biopsychosocial model of Pain

Currently, there are two major competing models that clinicians may follow in practice, the biomedical and the biopsychosocial. Historically, LBP has been addressed using a biomedical/biomechanical model of care. The biomedical model of care postulates that a predictable relationship exists between identifiable tissue damage and pain (Quintner, Cohen, Buchanan, Katz, & Williamson, 2008). This model reduces pain to a structural pathological experience and acts as an explanatory tool that holds a direct relationship between a change in bodily structure and a person's complaint (Quintner et al., 2008). For the clinician, it is simple, clean, logical and follows a conventional approach to care. Despite being extremely successful in the treatment of many other diseases such as heart disease, diabetes, asthma, chronic nonspecific recurrent LBP has been deemed resistant to the biomedical model of care (Weiner, 2008). Only a few people suffering from chronic persistent LBP respond well to this care method and evidence around the world is seeing costs and the number of people disabled by this condition increasing substantially (Buchbinder, van Tulder, et al., 2018; N. N. E. Foster et al., 2018). With chronic persistent nsLBP, it is difficult to identify that a unique underlying pathoanatomic/pathophysiologic lesion that exists that corresponds to the pain and disability. To this point, degenerative changes in the spine have been noticed both in symptomatic and asymptomatic people and a connection between noticeable degenerative change and pain/disability has been elusive (Goode et al., 2013).

Thus, the lack of abundance of useful interventions or "low-value care" and escalating costs for the health system to address LBP has been a cause for concern (N. N. E. Foster et al., 2018).

Because there is no proven effective biomedical intervention for people suffering from nsLBP, it has triggered many stakeholders to change their focus from the biomedical model of illness to a more holistic biopsychosocial model. This model of care addresses individuals psychological and social contextual factors along with the biological in the rehabilitation process (Weiner, 2008). In contrast to the biomedical model, Engel's biopsychosocial model of illness suggests that no biological system exists in isolation and every system is influenced by its environment (Engel, 1979; Quintner et al., 2008). Engel's model includes all-natural systems pertinent to health and disease and enlarges its scope to consist of psychological and social factors (Engel, 1979). The choice of treatment model can also depend on clinicians preconceived attitudes and beliefs (Côté, Durand, Tousignant, & Poitras, 2009).

Frequently, chiropractors and physiotherapists follow a practice philosophy that aligns with their training and follows a biomedical model which may or may not follow updated evidence-based guidelines (Poitras, Durand, Côté, & Tousignant, 2012). Many studies have observed a poor correlation between spinal structural tissue damage and levels of disability (Hartvigsen, Hancock, Kongsted, Louw, Ferreira, Genevay, Hoy, Karppinen, et al., 2018). They have also observed a relationship that psychosocial factors can have more of an impact on the transition from acute to chronic LBP than just biomechanical factors (Domenech, Sánchez-Zuriaga, Segura-Ortí, Espejo-Tort, & Lisón, 2011). Also, a person's beliefs and attitudes towards pain are predictive factors of further disability (Vlaeyen, Crombez, & Linton, 2016). Founded on these observations, the biopsychosocial model for LBP has been proposed to address the factors that can result in the pain becoming long-standing. Because beliefs and attitudes around nsLBP play a pivotal role, more attention has focused on the attitudes and beliefs of health care providers and the influence it has on patients (Domenech et al., 2011).

Thus the treatment a patient receives for nsLBP has been found to be associated with the clinician's beliefs and attitudes towards persistent nsLBP (Jeffrey & Foster, 2012). As many clinicians have been trained using the biomedical model, there can be resistance to using the biopsychosocial model, even though it has been shown to be more effective for patients with persistent recurrent nsLBP (Gardner et al., 2017). Moreover, current evidence-based guidelines recommend the use of the biopsychosocial model and advocate including all aspects that may influence the patient's pain experience (Hartvigsen, Hancock, Kongsted, Louw, Ferreira, Genevay, Hoy, Karppinen, et al., 2018). Determining clinicians' experiences and feelings of treating patients with chronic persistent nsLBP may help to explain some of the challenge's clinicians face in clinical practice. To address the above problem and find "high-value" treatments, clinical guidelines for LBP have been developed not only in Canada but worldwide to address this gap.

2.3 Management for Back pain

2.3.1 Clinical Guidelines for Back Pain

Clinical guidelines are designed to effectively disseminate recommended information within a knowledge translation process (O'Connell, Cook, Wand, & Ward, 2016). Guidelines recommend effective, evidence-based interventions and discourage interventions lacking scientific support. Clinical practice guidelines (CPG's) serve to optimise quality care while reducing harmful or "low-value" care (O'Connell et al., 2016). When clinical practice guidelines are followed, the intention is that clinicians and patients can be reassured that the best care and best practice is being delivered (O'Connell et al., 2016).

There are two prevailing types of guidelines that are followed in clinical practice: evidence-based or consensus. Evidence-based also known as clinical practice guidelines provide recommendations based on scientific research to assist decision making about health

interventions and aims to provide health care providers (HCP) with the most current, best evidence to support clinicians to choose the most appropriate, cost-effective treatments for their patients (C. B. Oliveira et al., 2018). Evidence-based guidelines or clinical practice guidelines are defined as: “systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances” (Manchikanti et al., 2013).

Consensus guidelines are issued by professional organizations typically represent a consensus or agreement among experts about a certain approach to diagnose or treat a disease or condition when insufficient evidence is available to create an evidence-based guideline (de Boeck, Castellani, & Elborn, 2014). Thus, guidelines aim to provide health care providers (HCP’s) with recommendations based on the strength of available evidence as well as professional consensus for interventions’ risk and benefits for the patient.

Numerous national and international clinical practice guidelines have been produced to address the impact of non-specific LBP and many of these guidelines from around the world have similarities and are consistently recommending clinicians to select non-pharmacological treatment for acute and recurrent LBP as first-line treatment (Bussières et al., 2018). Some of these guidelines include supervised exercise therapy that may or may not be combined with manual therapy (C. B. Oliveira et al., 2018).

Many of the top guidelines such as the American College of Physicians (APC), Danish National guidelines, National Institute for Health and Care Excellence (NICE) and the Canadian Chiropractic guideline initiatives (CCGI) recommend similar interventions, and all do not recommend imaging for recurrent low back pain (**Table 2.1**).

Table 2. 1 Comparison of Recommended Clinical Practice Guidelines (Wong et al., 2017)

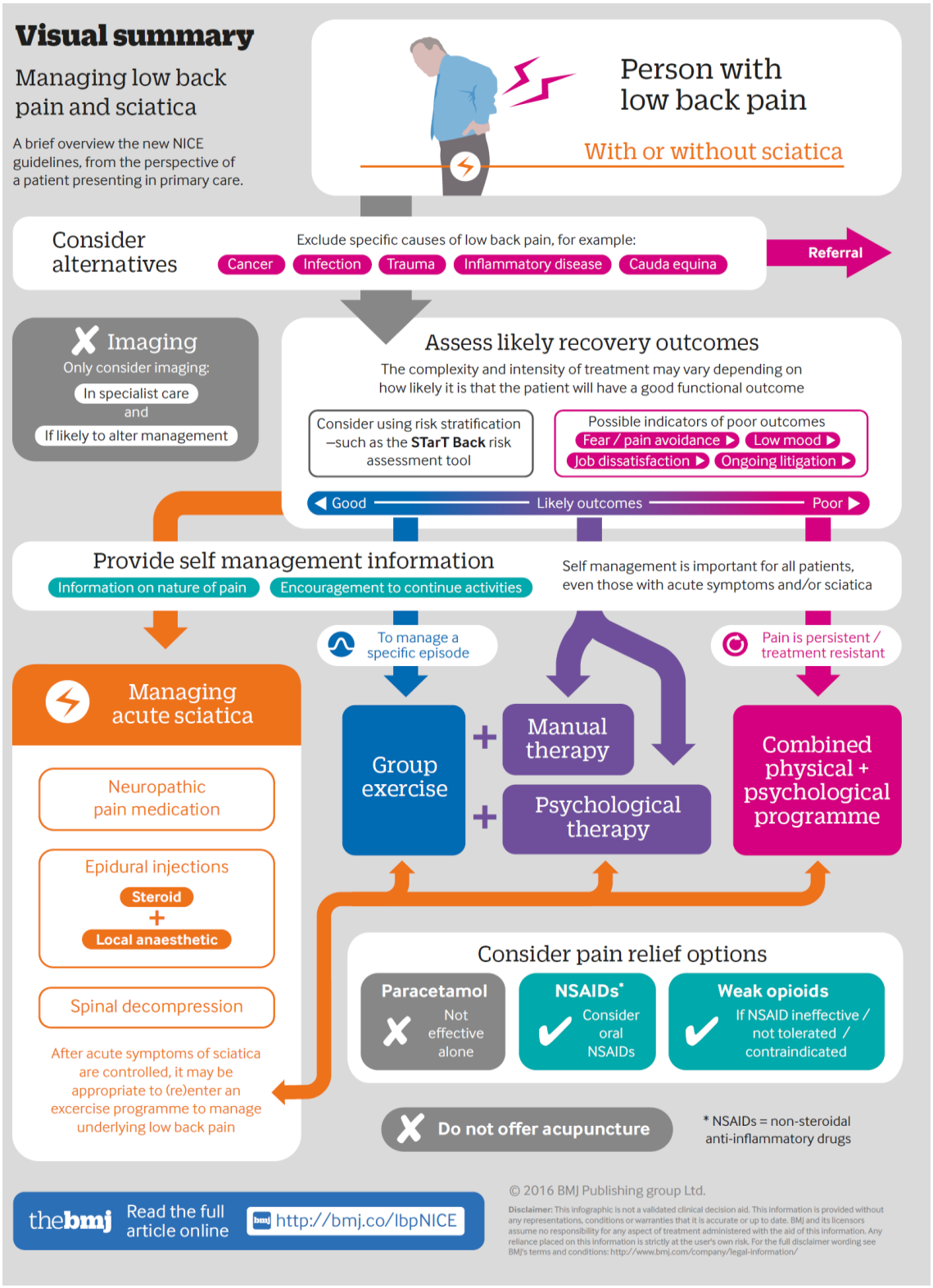
	American College of Physicians (APC)	Danish National guidelines	National Institute for health and Care Excellence (NICE)	Canadian Chiropractic Guideline Initiative (CCGI)
SMT	Yes	Yes	Yes	Yes
Education	Yes	Yes	Yes	Yes
Exercise Therapy	Yes	Yes	Yes	Yes
Acupuncture	Yes	No	Yes	Yes
Diagnostic Imaging	No	No	No	No

Abbreviations: SMT-spinal manipulative therapy

All of the above guidelines consistently recommend that recurrent LBP patients are educated about their condition, are encouraged to remain physically active, and stay working (First-line intervention) (C. B. Oliveira et al., 2018). These guidelines aim to promote self-management (N. N. E. Foster et al., 2018) (N. E. Foster et al., 2018a) and self-efficacy in this recurrent LBP population.

A visual infographic has been developed summarizing the NICE guidelines to overcome poorly implemented recommendations that were constraining clinical practice (**Figure 2.2**).

Figure 2. 2 Low Back Pain and Sciatica: Summary of NICE guidance (Bernstein, Malik, Carville, & Ward, 2017)



Clinical practice guidelines also recommend evaluation of biopsychosocial factors in people with recurrent LBP, but many practitioners do not assess and treat these factors (Gardner et al., 2017). Many studies have confirmed a relationship between treatment orientation and clinical practice. Both beliefs and attitudes regarding treatment style and patient-clinician factors need to be considered when introducing new models of care and maximizing these models into clinical practice.

There are many reasons why clinicians may not use clinical guidelines in practice. Implementation strategies must be based on current knowledge about effective interventions and assess potential barriers to guideline adoption. Once these barriers are identified they may lead to effective implementation strategies.

Barriers exist at the level of the patient, practitioner, organization, and at the level of social and cultural context (Lugtenberg, Zegers-Van Schaick, Westert, & Burgers, 2009). On the patient level, a significant treatment barrier relates to patients noncompliance that can take many forms such as the advice given from the healthcare professional to manage the condition is often misunderstood, is not culturally meaningful, not affordable, often carried out incorrectly, forgotten, or even completely ignored by patients (Walters-Salas, 2012). Nonadherence can be approximately 70% if preventative or treatment regimens are very complex and/or require modification of existing habits or require a lifestyle change (Walters-Salas, 2012). Other barriers are a patients preference for imaging, spinal procedures, and referrals to back specialists (Weber et al., 2017; Wilson et al., 2017).

Barriers at the practitioner level can be related to clinician knowledge - they may lack awareness or familiarity with the guidelines and attitude - they may be resistant to change their practice style and clinicians may have difficulty changing deep-seated routines even while being aware and

familiar with guidelines (Baiardini, Braido, Bonini, Compalati, & Canonica, 2009). Also, clinicians may be unconvinced by the evidence and challenge the guidelines (Dixon-Woods, McNicol, & Martin, 2012; Fischer, Lange, Klose, Greiner, & Kraemer, 2016; Suman, Dikkers, Schaafsma, van Tulder, & Anema, 2016) or have a lack of effective strategies too help clinicians embrace new behaviours (Liang et al., 2017; Mesner, Foster, & French, 2016; Suman et al., 2016). Thus, clinicians may question the recommendations consequently creating low implementation.

At the organizational level, significant barriers to guideline adherence are a result of a lack of time for more comprehensive appointments, clinician and patient turnover or coordinating different professionals to work together as a team (Baiardini et al., 2009).

The reasons for not using clinical practice guidelines (CPG's) in practice are varied and may not always be influenced solely by the practitioner but often clinician's attitudes and beliefs (Schröder, Öberg, Enthoven, Kongsted, & Abbott, 2020) can guide treatment style and ultimately give us insight on why clinical guidelines are not followed.

Healthcare practitioners' attitudes and beliefs about health and illness are likely to play a role in the approach they take in treating patients and their ability to utilize guidelines. According to the theory of planned behaviour, "behaviour is determined by the attitudes and beliefs that a person has about the likely consequences of the behaviour" (Ajzen, 2001). Beliefs are defined as 'a cognitive process resulting in a concrete cognition of how we think things are' (Jeffrey & Foster, 2012). Attitudes are 'a more complex cognitive state involving beliefs and feelings as well as values and predispositions to act in a certain way' (Jeffrey & Foster, 2012). Attitudes and beliefs can influence the interaction between the practitioner and patient which can influence the patients' expectation of the care they will receive (Jeffrey & Foster, 2012). Health care practitioners (HCP) attitudes and beliefs have been shown to impact guideline adherence in low back pain and if the

practitioner follows a bio-medical model and has high fear-avoidance beliefs often guideline adherence is low (Gardner et al., 2017). To understand clinicians' beliefs and attitudes in clinical practice the most used measure is the PABS-PT (Physicians Attitudes and Beliefs Scale-Physiotherapists).

The PABS-PT is a validated measure that provides a score of treatment orientation of the health care provider (Gardner et al., 2017). The orientation of treatment style has been shown to have a high correlation with clinical practice (Gardner et al., 2017). According to Darlow et al in a systematic review from 2012, the attitudes and beliefs of a healthcare professional affect patients' attitudes and beliefs, and health outcomes (Darlow et al., 2012). An understanding of a clinician's attitudes and beliefs and possible barriers will enable more effective implementation of current guidelines and new treatment models when educating practitioners of the effective ways to manage recurrent low back pain (Poitras et al., 2012).

2.3.2 First-Line and Second-Line Interventions for Back Pain

First-line care is defined as "the first treatment given for a disease or condition that is often accepted as the best treatment" (Cancer.gov, n.d.).

First-line care may not cure the disease thus it is often part of a standard set of treatments that may include second line care. The primary goal of treatments for chronic LBP are pain relief, enhanced mobility, improved quality of life and physical function (Koldaş Doğan, Sonel Tur, Kurtaiş, & Atay, 2008) along with reassuring that their back pain has a favourable prognosis and is not dangerous (C. B. Oliveira et al., 2018; V. C. Oliveira et al., 2012). As most guidelines endorse the use of self-management as a useful strategy to address LBP they have been considered as a first-line treatment (Bernstein et al., 2017).

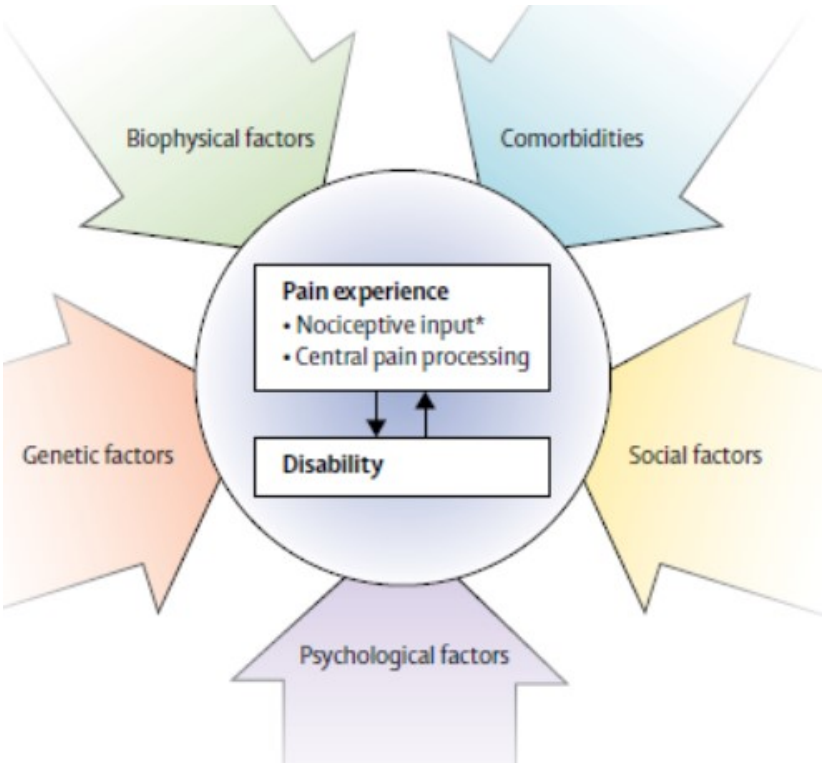
First line care for the management of low back pain recommended by the top three guidelines from the UK, USA and Denmark consist of reassurance and advice (O'Keeffe, 2019). For people with a good prognosis advice about keeping active and support for self-management are recommended (Bernstein et al., 2017). These three guidelines also include second-line treatment that endorse a variety of non-pharmacological options that include exercise either alone or in a combination with therapies such as spinal manipulation, soft tissue care, massage or psychological therapies such as cognitive behavioural therapy (CBT) (O'Keeffe, 2019). The rationale behind using reassurance and advice as first line care are that both chronic and acute low back pain in the majority of cases improve greatly in the first 6 weeks ("NICE Guidelines Low back pain and sciatica in over 16s : assessment and management," 2019; Qaseem, Wilt, McLean, & Forciea, 2017; Stochkendahl et al., 2018). Thus, clinicians should reassure patients that their back pain is not harmful, it may fluctuate over time with substantial improvement and occasional flare ups may occur regardless of the type of treatment received. To this point, clinicians should advise people to enjoy an active lifestyle, avoid bed rest, continue working and continue with usual activities, despite their pain level (N. Foster, Anema, Cherkin, & al., 2018).

Second-line therapy that is endorsed from the guidelines and has shown potential to address persistent low back pain is psychological therapies, cognitive behavioural therapy (CBT), mindfulness and multidisciplinary treatment ("NICE Guidelines Low back pain and sciatica in over 16s : assessment and management," 2019; O'Keeffe, 2019). These therapies have been used in chronic or persistent LBP because persistent long-lasting LBP are associated with greater levels of disability and may be influenced by factors like mood, beliefs, confidence, anxiety, and fear. A 2015 systematic review that measured the effectiveness of cognitive behavioural therapy (CBT) for nsLBP found a moderate effect in favour of CBT interventions for a range of PROM's when compared to no treatment or guideline-based active treatment (Richmond et al., 2015). They found that CBT when compared to wait list/ usual care the pooled standardised mean difference

(SMD) was -0.19 (-38,0.01) for disability, and -0.23 (-0.43, -0.04) for pain and when comparing to guideline-based active treatment the pooled SMD for disability was -0.83 (-1.46,-0.19) and pain was -0.48 (-0.93,-0.04) both favouring CBT (Richmond et al., 2015).

As mentioned above, no one treatment can address persistent LBP successfully, but some interventions can reduce pain and disability better than others (Maher et al., 2017). Low back pain is complex with many contributors to pain and disability consisting of psychological factors, societal factors, biomechanical factors, co-morbidities and abnormal pain-processing mechanisms (Hartvigsen, Hancock, Kongsted, Louw, Ferreira, Genevay, Hoy, Karppinen, et al., 2018) (**Figure 2.3**).

Figure 2. 3 Contributors to low back pain and disability
(Hartvigsen, Hancock, Kongsted, Louw, Ferreira, Genevay, Hoy, Karppinen, et al., 2018)



Evidence-based guidelines have been developed to include first-line and second-line treatments for persistent recurrent LBP that address both biomechanical and psychological factors. For this reason, first-line treatments for recurrent LBP include educating the patient and assuring them that the pain is not dangerous and that a serious cause for the patient's low back pain is unlikely (Kjaer et al., 2018; Kongsted, Hartvigsen, et al., 2019). For people that do not respond to first-line care, second-line care places an emphasis on exercise therapy, psychological therapies, spinal manipulation and massage and considers managing bio-psycho-social issues (Maher et al., 2017) including co-morbidities before managing this condition with a more outdated method of "low-value" care (imaging (X-ray, MRI), pharmaceuticals (Opioids) and surgery) (N. Foster et al., 2018; O'Connell et al., 2016).

The patient also needs to be reassured that there is no need for any further medical tests or imaging (Maher et al., 2017). According to the Toward Optimized Practice (TOP), clinicians should educate the patient with a clear diagnosis, advise to stay active, discuss the idea of hurt versus harm and pace activity (Francisco, 2017). The patient should also be prescribed recommendations of exercise or therapeutic exercise and possibly given options for analgesic medicines as second-line recommendations (Francisco, 2017). Other recommendations suggested in a 2016 systematic review and meta-analysis on the prevention of LBP concluded that exercise alone or in combination with education is an effective treatment for the prevention of low back pain (Steffens et al., 2016). The National Institute for Health and Care Excellence (NICE) LBP guidelines recommend patients to avoid bed rest and continue with activities as usual (Bernstein et al., 2017). Although second-line treatments for LBP are exercise and education, there is not currently a recommended approach that best outlines a specific type of exercise for persistent recurrent LBP (**Table 2.2**).

Table 2. 2 First- and Second-line care for Acute and Persistent LBP (O'Keeffe, 2019)

Intervention Type	Intervention	Acute LBP (>6 weeks)	Persistent LBP (> 12 weeks)
Education/Self-Care	Advice to remain active	First Line	First Line
	Education	First Line	First Line
	Superficial Heat	Second Line	Insufficient Evidence
Nonpharmacological Therapy	Exercise Therapy	Limited Use	Second Line
	Cognitive Behavioral Therapy	Limited Use	Second Line
	Spinal Manipulative Therapy	Second Line	Second Line
	Massage	Second Line	Second Line
	Acupuncture	Second Line	Second Line
	Yoga	Insufficient Evidence	Second Line
	Mindfulness-based stress reduction	Insufficient Evidence	Second Line
	Interdisciplinary rehabilitation	Insufficient Evidence	Second Line

Effective strategies that show clinically significant improvements in pain and function are approaches that seem to be designed for individuals (with follow-ups) and concentrate on stretching and muscle-strengthening exercises (Hayden, Van Tulder, & Tomlinson, 2005) that are the most effective types of exercise to manage LBP. The specific types of exercises were mean ranked from best to worst improvement in pain and disability outcomes. Stretching was ranked first on mean rank for pain outcomes at 95% CI. Muscle strengthening was ranked first on mean rank for function outcome at 95% CI (Hayden, Tulder, Malmivaara, & Koes, 2005; Hayden, Van Tulder, et al., 2005). A systematic review based on 43 studies of individual or group-based exercise therapies which were low dose or intensity interventions reported greater improvement in pain (29%) than function (4%) compared to no treatment (Hayden, Van Tulder, et al., 2005).

Other therapies also included education or advice to stay active, nonsteroidal anti-inflammatory drugs (NSAIDs), manual therapies, and passive modalities. Stretching and muscle-strengthening exercises were the most effective types of exercises for treating chronic LBP.

A systematic review article based on 3907 participants discussed that exercise for non-specific LBP should comprise of 20 hours of supervised sessions over 8-12 weeks and incorporate a home program (Hayden, Van Tulder, et al., 2005; Hoffmann et al., 2016). The type of exercise was found less important than the execution of the program which included supervision, a home program and lasted at least 8 weeks in duration. Also, these exercise programs often included education that addressed psychological manifestations of fear-avoidance, pain catastrophizing and low pain-self efficacy which can be obstacles to engaging in physical activity (Macedo et al., 2012). When people suffering from persistent recurrent LBP overcome these physical and psychological hinderances it led to effective self-management of their condition.

2.4 Exercise intervention for the treatment of persistent recurrent low back pain

Exercise therapy is widely used for LBP (Hayden, Van Tulder, et al., 2005) and exists in many forms ranging from general fitness/conditioning, aerobic, muscle-strengthening, flexibility and stretching exercises (Hayden, Van Tulder, et al., 2005; Stuber, Bruno, Sajko, & Hayden, 2014). A series of randomized controlled trials have provided scientific evidence supporting the benefits of exercise for the management of LBP (Hayden, Van Tulder, et al., 2005). Many studies and systematic reviews have tried to decipher the optimal type, mode, frequency and intensity of exercise (Hayden, Van Tulder, et al., 2005; O'Keeffe, Hayes, McCreesh, Purtill, & O'Sullivan, 2017). In this section of the literature review, we will be discussing the various forms of exercise and their potential benefit or lack of benefit for managing LBP.

2.4.1 Stretching and strengthening exercises for LBP

Stretching and strengthening exercises for LBP have been widely prescribed for the treatment of chronic LBP. These exercises have demonstrated effectiveness for improving function and work activities in a 2004 review on exercise (Rainville et al., 2004). The goal of these exercises is to increase flexibility of the back, increase strength of the back, and improve cardiovascular fitness while increasing capacities. The exercises are basic in that many people recognize them as being helpful for gaining flexibility and strength. Stretches that are recommended to improve back flexibility are ones that address the hip flexors, back extensors, back rotators, hip adductors, hip abductors, hamstrings, quadriceps, and calves. Stretches are typically held (static) for 20-40 seconds and recommended to be performed three times per week. Strengthening exercises are typically targeting the trunk muscles in the front and back of the body. The most researched form of exercise is resistance training and many advocate for using body weight for resistance (Rainville et al., 2004).

2.4.2 Motor Control Exercises

Motor control exercises (MCEs) are a common form of exercise used to manage LBP. These exercises focus on activating deep trunk muscles, with the goal of restoring motor patterns (control and coordination) and ultimately progressing to more complex and functional tasks (B. T. Saragiotto, Maher, Yamato, Costa, Menezes Costa, et al., 2016). Over the last 20 years, many studies have evaluated the potential use of this very popular mode of exercise in clinical practice (Russo et al., 2018; B. T. Saragiotto, Maher, Yamato, Costa, Costa, et al., 2016). The rationale for MCEs is based on the idea that stability and control of the spine are altered in people with LBP (L. O. P. Costa et al., 2009). MCEs are therapeutic exercises that were hypothesized to improve segmental stabilization thereby protecting the joints and decreasing pain (Hodges PW, Richardson, 1996). These exercises focus on activating the transversus abdominus and multifidi muscles of the trunk and spinal segments, respectively (Macedo et al., 2012). Because MCEs are

very popular in rehabilitation medicine and with manual therapists (chiropractic and physiotherapists) they have been researched extensively (B. Saragiotto et al., 2016). Although extremely popular, their effectiveness in controlling or preventing persistent recurrent LBP may be in question. A systematic review from Saragiotto et al concluded that MCEs are more effective than minimal intervention for reducing pain but probably does not influence disability in chronic LBP patients (B. T. Saragiotto, Maher, Yamato, Costa, Menezes Costa, et al., 2016). As for a comparison between MCEs and other forms of exercise or manual therapy, MCEs did not have clinically important differences for chronic and acute LBP patients (B. T. Saragiotto, Maher, Yamato, Costa, Costa, et al., 2016). Motor control exercises are used by physiotherapists and chiropractors to treat LBP, but these exercises focus only on localized muscle groups instead of using other muscle groups located globally that connect indirectly to the lower back (i.e., core, gluteal, quadriceps, hamstrings, latissimus dorsi).

2.4.3 Stability exercises

Core stability or stabilization exercises have become a common practice among clinicians for managing LBP. They have also become a widespread fitness trend and have gained popularity in the fitness world (Akuthota, Ferreiro, Moore, & Fredericson, 2008). Most health professionals who treat people with back pain use this type of training with their patients use this in their training programs. It has been suggested that core stability exercises are an effective technique to decrease pain in LBP patients (Stuber et al., 2014). The core is described as the area that involves the transversus abdominis in the anterior (front of the body), paraspinals and gluteal in the posterior (back of the body), the diaphragm superior (the roof) and the pubo-coccygeal and hip muscles in the inferior (the pelvic floor) of the abdominal area of the body (Akuthota et al., 2008) These muscles when working together form a corset around the centre of the body that will support and stabilize the lumbar spine and pelvis during functional movements (Akuthota et al., 2008). This exercise method is based on the premise that LBP is linked to a dysfunction of the

activation and timing of local spinal stabilization muscles (Falla & Hodges, 2017). The premise of core stability is that these specific exercises were designed to retain the coordination, timing, and activation of the local spinal muscles to decrease back pain (Smith, Littlewood, & May, 2014). Many other researchers have doubted this link between back pain, a weak core and non-appropriate muscle activation. If this rationale where true back pain would be deemed obsolete. A recent systematic review and meta-analysis of 29 studies suggested that core stability exercises alone lack positive evidence to be an effective treatment form for the management of LBP (Smith et al., 2014). Despite this evidence, core exercise teaching and training continues to gain tremendous popularity throughout the last several years.

Van Tudler et al in a 2000 Cochrane review assessed the effectiveness of exercise therapy for LBP on pain, function, overall improvement and return to work (Malmivaara, Esmail, Koes, & others, 2000). The results of that study conclude that therapeutic exercise was helpful for chronic LBP. Studies show that stability exercises are minimally better than no activity and that core stability exercises are more effective than motor control exercises when treating LBP.

2.4.4 Pilates

The Pilates method has gained some attention in the last decade for the treatment of nonspecific LBP (T. P. Yamato et al., 2016). Pilates was developed in the 1920's and consists of isometric contractions of the core muscles responsible for stabilization of the spine both with activity and rest. It consists of complete body conditioning to improve on better posture and body awareness (T. Yamato et al., 2015). Some documented benefits of Pilates include a better range of motion, strength, coordination, balance, muscles symmetry, flexibility, posture positional awareness (proprioception) muscle definition and general health which are all needed to improve LBP (Bryan & Hawson, 2003). Many randomized controlled trials and systematic reviews have assessed the effectiveness of Pilates exercises in physiotherapy for LBP and a Cochrane review of 9 studies

concluded that there is low quality evidence that Pilates is better than more effective than usual care or minimal interventions for pain in the short term (MD -14.05, 95% CI -18.91 to -9.19 p<0.001, n=265) and moderate quality evidence for pain (MD -10.54, 95% CI -18.54 to -2.62, n=146) at intermediate time frames (T. Yamato et al., 2015; T. P. Yamato et al., 2016). There was also low-quality evidence that Pilates improves disability at short-term versus usual care or minimal intervention with a small effect size (MD -7.95, 95% CI -13.23 to -2.67; P=0.003, n=248). It was less clear if Pilates was more effective than other exercises for pain intensity, disability, and function; thus, it was found that Pilates was not superior to other forms of exercise (T. P. Yamato et al., 2016). Consequently, the choice to use Pilates as an intervention for LBP would be based on the preference of patients and providers and the costs involved in the intervention (T. P. Yamato et al., 2016).

2.4.5 Yoga

Yoga as a treatment for LBP is a commonly used complementary treatment to physiotherapy. Yoga is characterized as a mind-body exercise intervention most known to address both physical and mental parts of pain with therapeutic techniques incorporating flexibility, posture, strength, breathing and meditation (Cramer, Lauche, Haller, & Dobos, 2013). Because of the potential benefit that Viniyoga- style Yoga has in studies; it has been recommended by the American Pain Society's guidelines for the treatment of chronic LBP (Chou et al., 2007). A systematic review of eight studies found strong evidence for short term effectiveness and moderate effectiveness of Yoga for chronic LBP for pain and disability (Cramer et al., 2013). Yoga was more effective than education, was not any more superior or inferior to usual care or other exercise and is safe (Cramer et al., 2013). This review was in line with a previous clinical practice guideline that concluded that there is moderate evidence that there may be long-term effectiveness for chronic LBP (Chou et al., 2017). Thus, yoga may be a form of exercise recommended as a second-line therapy to patients who do not improve with education on self-care options (Cramer et al., 2013).

Yoga as an intervention for persistent recurrent LBP has shown strong evidence for short-term and moderate evidence for long-term reduction of LBP and disability (Cramer et al., 2013)

Pilates and yoga have often been seen as similar interventions, although Yoga incorporates more mind-body awareness as an important component of its philosophy. These two very popular forms of exercise for LBP have been incorporated into clinical practice in the last several years. Although similar, Yoga has greater potential than Pilates to be a therapy to address both physical and mental aspects of LBP (Cramer et al., 2013; Sorosky, Stilp, & Akuthota, 2008).

Comprehensive programs that are developed for the management of LBP need to be based on theories that address physical function, neuromuscular changes, decreased physical fitness, altered levels and patterns of activity (Kjaer et al., 2018). Consequently, there are many forms of exercise that have been studied and reviewed systematically. Recent opinions from these reviews have suggested that there is no one mode of exercise that is superior or inferior to any other exercise for the management of persistent recurrent LBP (Hayden, Van Tulder, et al., 2005). Thus, the choice of exercise for the management of chronic LBP should depend on the expertise of the therapist, patient preference, cost, and safety.

In light of this, programs such as GLA:D® Back are acknowledging this idea and considering a variety of exercise techniques encompassed into one pre-packaged program that may be of a greater benefit to this group of patients (Kjaer et al., 2018). Many researchers realize now that LBP is multifaceted, does not fit a simple model and numerous strategies have been used to manage this condition (Sorosky et al., 2008).

In this next section of the literature review, we will be discussing the various forms of education and behavioural programs and their potential benefit or lack of benefit for managing LBP.

2.5 Pain Education and Behavioural Programs

Diagnosing specific causes for LBP deems difficult, most LBP in primary care are labelled as nsLBP (Kent & Kjaer, 2012) and may have more dimensions to back pain than only pathoanatomical causes. Current evidence in back pain research recognizes that there is a psychosocial component to back pain. Thus, much research in the last two decades has focused the attention on psychosocial aspects of non-specific LBP along with pathoanatomic causes. For these reasons back pain education is now becoming a key component to back pain programs.

Behavioural interventions are frequently used in the treatment of persistent LBP and are assumed that the persistent pain and disability are influenced not only by somatic dysfunction but also by psychological and social influence (Van Tulder et al., 2001). Persistent LBP may vary depending on the person's perception of pain and coping skills that influence the attitudes, beliefs, psychological distress and behaviour around illness (Van Tulder et al., 2001; Waddell, 1987). Subsequently, therapies for LBP not only address the physical source of the condition but also concentrate on the cognitive (Van Tulder et al., 2001). These behavioural techniques are often utilized jointly as a comprehensive treatment approach and known as cognitive behavioural therapy. Cognitive behavioural therapy is founded on a multidimensional model of pain that includes cognitive, behavioural, emotional, and physical elements (Van Tulder et al., 2000). Cognitive-behavioural therapy often includes educating the person about identifying provoking and annoying thoughts, feelings, and behaviours around back pain and identifies maladaptive thoughts which are modified through the use of coping strategies and relaxation (Van Tulder et al., 2000). In a systematic review by Van Tulder et al in 2001, it was noted that the treatment was only effective if the person was ready to change and was motivated (Van Tulder et al., 2001). Consequently, the addition of behavioural therapy for people with LBP seems to be effective, and clinicians should be acutely aware that psychosocial risk factors are important to address in order

to avoid progression of persistent LBP, which can lead to disability (Van Tulder et al., 2001). Cognitive behavioural therapy has had the most potential effect on chronic LBP and as a result, is the predominant psychological treatment for people with chronic conditions such as low back pain (Ehde, Dillworth, & Turner, 2014). Along with chronic persistent recurrent LBP, many also have mood, anxiety and sleep disorders and CBT has found to be effective for treating these conditions (Babson, Feldner, & Badour, 2010; Driessen & Hollon, 2010; McEvoy & Nathan, 2007).

Thus, the goal of CBT is to reduce pain and psychological distress by first addressing maladaptive thoughts and behaviours then identifying and correcting these maladaptive thoughts and beliefs (Ehde et al., 2014). By using this technique persistent recurrent LBP sufferers can increase their self-efficacy for managing pain (Ehde et al., 2014).

2.6 Self Efficacy

Self-efficacy is an important skill to help people become self-reliant and manage pain (Bandura, 2004). People that have persistent recurrent LBP often have difficulties performing usual activities of daily living (ADL'S). There is also a huge variation in people's disabilities and how researchers have tried to identify the reasons that these variations exist. There is evidence that psychological factors play a role and may explain the development and maintenance of persistent recurrent chronic LBP. Low back pain in many people can be influenced by poor pain self-efficacy and fear of movement that are proposed to facilitate the relationship between pain intensity and disability (L. D. C. M. Costa, Maher, McAuley, Hancock, & Smeets, 2011). Hence targeting self-efficacy and addressing fear avoidance are two potential targets for psychological interventions.

A theory based on Bandura's theory of social learning describes self-efficacy as the confidence that a person has in his or her ability to achieve the desired outcome(Bandura, 1978, 2004). Thus, people with higher pain self-efficacy believe that certain activities can be carried out despite their pain experience. If people can attain higher pain self-efficacy then this should be associated with

better outcomes such as reduced disability (L. D. C. M. Costa et al., 2011). The Fear-avoidance behaviour model has also been proposed to be a reason why people experiencing LBP reduce their activities (Leeuw, Goossens, Linton, Crombez, Boersma, & Vlaeyen, 2007). This model of low back pain describes behaviours related to avoidance attributable to people's catastrophic thoughts and fear of movement that they believe could increase pain and as a result limit activities (L. D. C. M. Costa et al., 2011).

A study by Costa et al found that pain self-efficacy is an essential variable when comprehending the relationship between pain and disability (L. D. C. M. Costa et al., 2011). Fear has less of an effect on pain and disability when predicting future disability (L. D. C. M. Costa et al., 2011). For this reason, programs such as GLA:D® Back are focusing more on self-efficacy rather than just changing thoughts about fear.

2.7 Combining Education with Exercise Programs

Another therapy strategy that has had success is combining cognitive therapies with motor control training to combat recurrent persistent LBP. A 2003 study by Moseley et al suggests that an intervention grounded in the cognitive theory that combines pain education and motor control training is effective in reducing pain and disability associated with LBP (Moseley, 2003) and it is likely to be more effective than pain biology education alone. This strategy follows evidence-based guideline recommendations and has been used in current studies.

2.8 Implementing Education and Exercise into Clinical Practice

The implementation of evidence-based care into clinical practice is one of the most effective methods for improving patient care. But being the most effective can also be the most challenging. A common finding in health service research is that the latest translated research findings are not finding their way into clinical practice (J. Grimshaw, Eccles, & Tetroe, 2005).

Billions of dollars are spent globally each year to disseminate evidence-based guideline recommendations on healthcare training, professional development, quality improvement, patient safety, and risk management (Grol & Grimshaw, 2003). Despite these numerous actions, many in healthcare still have difficulty applying this information and delivering the most effective care to their patients. Established evidence-based guidelines and many randomized controlled trials with promise of more effective and safer patients' care are developed every year (Grol & Grimshaw, 2003); however, the evidence still does not make it into clinical practice and ultimately is not delivered to patients (Grol & Grimshaw, 2003).

Although randomized controlled trials and guidelines exist to manage LBP, introducing evidence-based guidelines for LBP into clinical practice remains challenging because of a lack of clarity of how to effectively implement guidelines in ways that change practice (Slade et al., 2015; Slade, Kent, Patel, Bucknall, & Buchbinder, 2016). Despite the efforts to improve quality care, many patients are receiving unsuitable or even harmful care for LBP (Grol & Grimshaw, 2003) and 20-25% of medical care for is not needed or potentially harmful (Grol & Grimshaw, 2003). For example, it is estimated that 30-40% of patients in the USA or Netherlands do not receive evidence-based care for LBP (J. M. Grimshaw, Eccles, Lavis, Hill, & Squires, 2012). Because of this evidence-practice gap patients are exposed to unjustified risks of iatrogenic harms (opioids and surgery) and needless expenditure on diagnostic imaging (MRI, X-ray) (N. N. E. Foster et al., 2018). In rehabilitation medicine, guideline usage is also a challenge because in this context, an evidence-based program to be implemented effectively should be well designed, well prepared, pilot tested and structured to improve patient care (Grol & Grimshaw, 2003).

Uptake of research findings traditionally has been through various methods. The availability of this information has been acquired through reviews of clinical journal articles, in clinical guidelines,

continuing medical education, conferences (Grol & Grimshaw, 2003) and knowledge translation (Jones, Roop, Pohar, Albrecht, & Scott, 2015). Most health practitioners find it difficult to keep up with the fast pace of staying current to maintain the synthesis of present knowledge and use this evidence in clinical practice (Grol & Grimshaw, 2003). It is also true that in both physiotherapy and chiropractic practices, it can be equally difficult to get information in the hands of these rehab practitioners, both to deliver this information consistently and make these clinicians responsible for the guidelines. Knowledge translation is also a strategy that may help the uptake of research information into clinical practice. It uses educational meetings most commonly to get research information into the hands of practitioners. Although commonly used, it was found to have limited effectiveness. The authors of this systematic review along with others have suggested multicomponent interventions that target the barriers seen in clinical practice (J. M. Grimshaw et al., 2012; Jones et al., 2015).

Evidence-based guidelines regarding LBP deem evaluation of biopsychosocial factors when making decisions about managing patients with chronic LBP is encouraged (N. N. E. Foster et al., 2018). The top guidelines for LBP recommend educating the patient about their condition, stay active, keep working and use education and exercise as second-line treatments (O'Connell et al., 2016; K. O'Sullivan, O'Keeffe, & O'Sullivan, 2017; Wong et al., 2017). Again, despite evidence-based guidelines existing, musculoskeletal clinicians (physiotherapists and chiropractors) tend to consider the biomedical model of disease and focus on the biomechanical and physical impairments of these patients and not consider the psychosocial dimension of chronic persistent nsLBP (Gardner et al., 2017).

It has been commonly assumed that the individual healthcare practitioner is to be blamed for the lack of uptake of evidence-based guidelines. It is thought that practitioners may lack the knowledge, present with negative attitudes and have underdeveloped skills (J. Grimshaw et al.,

2005). Although this may be a reason, other factors do exist, for instance, barriers in the healthcare system may be represented by structural (financial disincentives), organizational (inappropriate skills, lack equipment/facility), peer group (local standards of care not in align with practice philosophy) and professional-patient interactions (patients belief about what is best) (J. M. Grimshaw, Shirran, Thomas, & Mowatt, 2001). Health care professionals are inundated with information including research findings which they may not read or act upon (Haines & Jones, 1994), thus many clinicians may doubt or overlook the research if it is not congruent with the clinician's own beliefs (Humphris, Littlejohns, Victor, O'Halloran, & Peacock, 2000).

2.9 Possible Solutions

As mentioned before, clinical guidelines recommend the use of patient education, patient's active participation, exercises, physical activity, and sometimes manual therapy with an outlook towards self-management (Kjaer et al., 2018). Unfortunately, the specific content of the information, education, exercises, and physical activity is poorly described in the literature and consequently poorly implemented (Kongsted, Hartvigsen, et al., 2019). Because clinicians have trouble addressing all the relevant components of persistent/ recurrent back pain in the intervention, the challenge of integrating these components is an important factor in the evidence-practice gap. Also, successful implementation of the guideline recommendations requires a "buy-in" from both the patients and clinicians' alike for a treatment to be feasible. To address this problem standardized care programs have been developed. Standardized programs are developed to create consistency in care and use the evidence in an easy-to-follow format. This assures that every participant in a program will be delivered a consistent reproducible product.

> "*There is a need for more specific descriptions of the content of patient education, exercise and self-management strategies, as well as their method of delivery, and treatment regimen to guide the provision of*

evidence-based advice and treatment to patients with back pain" (Kongsted, Hartvigsen, et al., 2019).

Chapter 4 discusses this study and the potential of implementing a program that follows the recommended guidelines for people with persistent recurrent low back pain (J Lemieux et al., 2020).

2.9.1 GLA:D® – A Program that follows Evidence-Based Guidelines

A program that may address recurrent low back pain and uses guideline recommendations is the GLA:D® program from Demark (Kongsted, Ris, et al., 2019). GLA:D®, Good Life with osteoarthritis in Denmark, is a standardized structured prepackage exercise and education program built for clinicians to successfully implement in clinical practice.

Standardized care programs can enable clinicians the translation of recommended guidelines into clinical practice (Kjaer et al., 2018). A standardized care program developed in 2013 by SDU researchers Eva Roos and Soren Skou called GLA:D® Hip and Knee is an example of this type of program (Skou & Roos, 2017). The aim of this program is to implement evidence-based guidelines for the treatment of knee and hip osteoarthritis (OA) in clinics throughout Denmark (Skou & Roos, 2017). GLA:D® Hip and Knee consists of three mandatory elements: a 2-day training course for physiotherapists; 8 weeks of education and supervised neuromuscular exercise for patients with hip and knee OA symptoms delivered by a certified physiotherapist (Skou & Roos, 2017). Five years after inception, GLA:D® Hip and Knee has more than 1000 clinicians worldwide certified via the 2-day course, more than 400 clinics offering the program and have treated nearly 30000 patients from hip and knee osteoarthritis in Denmark (Roos et al., 2018). It has been successful in making a standardized evidence-based package available in many countries including Canada (Roos et al., 2018). The program reported improvement in knee

pain of 27% and hip pain of 22% and that knee QoL measures improved by 13% for knee patients and 10% for hip patients ("Annual Report 2019 GLA : D ® Back," 2019) GLA:D® Hip and Knee has had an overwhelming success rate for patients with OA and has become a high-value option for patients with hip and knee OA (Roos et al., 2018). GLA:D® Hip and Knee was implemented in Canada in January 2016, Australia in December 2016, and China in September 2017 (Roos et al., 2018) with implementation in New Zealand and Switzerland (GIN meeting April 2019). Evidence supports that the GLA:D® program is an effective, feasible with clinical practice guidelines into clinical practice (Kongsted, Hartvigsen, et al., 2019).

2.9.2 Development of GLA:D® Back

Building on the success of GLA:D® Hip and Knee, another program under the GLA:D® trademark has been created: GLA:D® Back. The overall aim in the development of GLA:D® Back was to create a program that compiles elements of effective and recommended interventions into a standardized care package that is feasible and implemented by clinicians in primary care (Kongsted, Hartvigsen, et al., 2019). A recent review from Australia suggested that people with back pain are often receiving the wrong type of care. Medical care still relies on referring patients for imaging (33%) and up to 60% received an opiate after a visit to emergency (Kamper, 2020). Only 20% of patients received recommendations and advice that aligned with clinical practice guidelines (Kamper, 2020). For adjunctive therapies such as physiotherapy and chiropractic, LBP treatment is often directed through a passive model of care that may provide immediate pain relief and long-term dependence upon the treatment (V. C. Oliveira et al., 2012). This type of care model over time is costly and not beneficial to patients. A shift to active from passive care along with learning self-management skills would be more in line with the guidelines and involve patients in their own care. This self-management strategy would promote positive attitudes towards controlling persistent/ recurrent back pain (Kongsted, Hartvigsen, et al., 2019). The GLA:D® Back program takes components of psychological therapies including cognitive behavioural therapy

(CBT), mind-body therapies (relaxation, meditation, guided imagery), lifestyle (stress management) along with physical activity (supervised group exercise), and pain education. The intention of this program is to promote self-management for patients with a goal of improving the participants' health status or quality of life by teaching skill to apply in everyday life (Kongsted, Hartvigsen, et al., 2019).

The rationale to develop GLA:D® Back was based on the back-pain literature, consequences for the individual suffering from back pain, the societal consequences and the challenges faced by the clinician (Kongsted, Hartvigsen, et al., 2019). The content of GLA:D® Back intervention was derived from clinical guidelines, reviews, randomized controlled trials and discussed in a multidisciplinary expert group (Kongsted, Hartvigsen, et al., 2019). The expert group selected components of the intervention that included: patient education, suitable for groups of patients, targeted for patients with recurrent/or persistent non-specific back pain and addressed factors related to poor outcomes (Kongsted, Hartvigsen, et al., 2019).

2.9.3 Aim of GLA:D® Back

Ultimately, GLA:D® Back was developed to address prognostic factors related to back pain that are identified to cover the whole spectrum of Waddell's biopsychosocial model of pain and disability (Bekkering et al., 2005). Some examples in the biopsychosocial spectrum are pain catastrophizing, distress, somatization, and fear-avoidance behaviour (Bekkering et al., 2005). The overarching goal of GLA:D® back is to improve peoples self-management skills to address persistent recurrent LBP and to address prognostic factors for developing back pain related disabilities (Kjaer et al., 2018). This program would then be pre-packaged into a format that would be feasible in clinical practice and acceptable to patients and clinicians (Kongsted, Hartvigsen, et al., 2019). After review of the literature and planning group discussions, the planning group identified several needs for patients with persistent back pain, needs for the

clinicians delivering the program and societal concerns (Kongsted, Hartvigsen, et al., 2019). The primary need or aim was to change a patient's beliefs, feelings and behaviours associated with their condition by explaining pain, replace the patient's belief of structural causes of back pain and help restore a patient's confidence in moving in various ways and being physically active (Kjaer et al., 2018). All these activities within the program are to support patients with self-management strategies. GLA:D® Back aims to improve self-management of people with persistent or recurrent back pain by translating recommendations from clinical guidelines into an intervention that consists of a group-based supervised education and exercise program.

This program is based on two key concepts. First, pain does not necessarily reflect tissue damage. Second, creating human movement with natural variation creates positive expectations and reduces the fear of movement. These two key concepts have been used to develop the GLA:D® Back program which is aimed at improving self-efficacy and increasing pain control leading to positive effects on disability and quality of life. Overall, these changes are expected to reduced health care utilization and disability/sick leave.

2.9.4 The GLA:D® Back Intervention as a method to improve first-line recommendations for Low Back Pain

GLA:D® Back has been designed from a theoretical framework which distils evidence-based guidelines into a high-value care package of patient education and structured exercise aimed at increasing self-management in people with persistent low back pain. The program as a group intervention is unique because of its close integration of patient education and exercise which is driven by the patient's personal goals and capacities (Kjaer et al., 2018). This program was developed around a social cognition theory, the cognitive behavioural theory and behavioural change theory, where patients will face their individual challenges while participating in tasks during the education and exercise sessions (Kongsted, Hartvigsen, et al., 2019). Education and

movement are the tools used to support the development of self-efficacy along with addressing patients' existing beliefs and concerns (Kongsted, Hartvigsen, et al., 2019).

2.9.5 Description of the GLA:D® Back intervention

GLA:D® Back starts with an individual assessment measuring four physical measures of abdominal strength, back extensor strength, forward flexion flexibility and sit to stand test in 30 seconds (Kongsted, Hartvigsen, et al., 2019). Along with physical testing the initial session also will set up S.M.A.R.T. goals and the starting level for the exercises (Kongsted, Hartvigsen, et al., 2019). After the initial assessment session, two 1-hour pain and back education classes are taught followed by twice per week of 1-hour supervised group exercise sessions for 8 weeks. The focus of exercises addresses the abdominal area, back extensors, abdominal obliques, lateral hip muscles, core and leg/thigh muscles incorporating the squat mechanism, mid-back rotation, agility, and flexibility. Throughout the program participants will be encouraged to move freely and try each level of exercise in the eight various blocks of exercises. The participants will do repetitions of each exercise between 5-20 reps and go through the 8 sections of exercises twice within the hour at their own pace. The chiropractic or physiotherapist instructors will show the exercises in the first few classes and are encouraged not to critique participants form of the exercise. This is much different than the GLA:D® Hip and Knee program where proper biomechanics is essential. The reason for the difference between the two programs is to allow the LBP patients to move freely and try the exercises on their own to establish less fear of motion and a better locus of control. If the patients are having some difficulty with the exercises the instructors can give some direction or alternatives to the exercises. The recommended group size for the supervised exercise will be 6-8. The program will end with a final assessment where personal goals are revised, and the clinical tests are repeated (Kongsted, Hartvigsen, et al., 2019).

The next section, chapter 3, compared the effectiveness of group exercise programs to other non-pharmacological interventions for chronic LBP. Chapter 4 investigated if it was feasible to implement an English translated version of GLA:D Back into clinical practice.

CHAPTER 3: COMPARING THE EFFECTIVENESS OF GROUP-BASED EXERCISE TO OTHER NON-PHARMACOLOGICAL INTERVENTIONS FOR CHRONIC LOW BACK PAIN: A SYSTEMATIC REVIEW

A version of this chapter has been published. Lemieux J., Abdollah V., Powelske B., Kawchuk G., Comparing the Effectiveness of Group-Based Exercise to Other Non-Pharmacological Interventions for Chronic Low Back Pain: A Systematic Review. PLOS One 2020; 15(12): e0244444588

Abstract

Background: Low back pain (LBP) is the leading cause of disability worldwide with a substantial financial burden on individuals and health care systems. To address this, clinical practice guidelines often recommend non-pharmacological, non-invasive management approaches. One management approach that has been recommended and widely implemented for chronic LBP is group-based exercise programs, however, their clinical value compared with other non-pharmacological interventions has not been investigated systematically.

Objective: To compare the effectiveness of group-based exercise with other non-pharmacological interventions in people with chronic LBP.

Methods: Four electronic databases were searched by two independent reviewers. Only randomized controlled trials that compared group-based exercise with other non-pharmacological interventions for chronic LBP were eligible. Study quality was assessed using the Cochrane Handbook for systematic reviews of Interventions by two independent reviewers.

Results: Eleven studies were eligible. We identified strong evidence of no difference between group exercise and other non-pharmacologic interventions for disability level and pain scores 3-month post-intervention in people with chronic LBP. We could not find any strong or moderate evidence for or against the use of group-based exercise in the rehabilitation of people with chronic LBP for other time-points and health measurement outcomes. We found no statistically significant differences in disability and quality of life and pain between the group and individual non-pharmacological interventions that included exercise.

Conclusion: With this equivocal finding, group-based exercise may be a preferred choice given advantages in other domains not reviewed here such as motivation and cost. Further research in this area is needed to evaluate this possibility.

3.1 Introduction

Low back pain (LBP) is the leading cause of disability globally with a substantial financial burden on individuals, families, communities and governments worldwide (Hoy et al., 2014). At an individual level, LBP diminishes individuals quality of life by limiting activities of daily living, deteriorating mental health, decreasing life span (Fernandez et al., 2016) and inducing financial hardships (Froud et al., 2016). Therefore, LBP is thought to be the most costly disability of the working-age population (Bussières et al., 2018). The nature of LBP is highly prevalent and recurrent: the lifetime occurrence is estimated to be 85%, and ~50% of people will have at least 10 episodes in their lifetime (Hoy et al., 2014).

In addressing chronic LBP, clinical practice guidelines often recommend non-pharmacological and non-invasive management approaches for chronic LBP (Froud et al., 2016). Specifically, these guidelines recommend education and exercise as first-line interventions (Bernstein et al., 2017; Stochkendahl et al., 2018; Wong et al., 2017). While many randomised controlled trials have provided scientific evidence supporting the benefits of exercise in chronic LBP (O'Keeffe et al., 2017), how to best deliver exercise interventions is less clear. Individual exercise programs are the most widely implemented approach for addressing chronic LBP (Hayden, Van Tulder, et al., 2005). In contrast, group exercise-based classes have been found to be beneficial (Frost, Lamb, Moffett, Fairbank, & Moser, 1998; Frost, Moffett, Moser, & Fairbank, 1995; Underwood, 2004), but are not as widely used. Group exercise may be an equally effective alternative to individual exercise with potentially lower healthcare costs (O'Keeffe et al., 2017). The potential for social support and better social interaction in groups should also be considered a potential advantage (O'Keeffe et al., 2017). With this in mind, group exercise approaches have been recommended by the National Institute of Health and Care Excellence (Underwood, 2004).

Given the above, we could not identify any prior systematic reviews that compared group-based exercise to individual non-pharmacological interventions that may include education and/or exercise in people with chronic LBP. Therefore, we conducted this review to evaluate the comparative effectiveness of group-based exercise to other non-pharmacological interventions that may or may not include education and exercise on pain and disability in patients with chronic LBP.

3.2 Methods

In this systematic literature review, we considered group exercise as the intervention and employed the Cochrane Handbook for Systematic Reviews of Interventions (Higgins, Green, & Collaboration, 2008).Our reporting was planned according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Liberati et al., 2009).

3.2.1 Literature search and study selection

A systematic search was conducted on June 26, 2020, using MEDLINE®, EMBASE, CINAHL, and Scopus. Search terms were selected through consultation between two rehabilitation experts and a university librarian. References cited within included articles were reviewed to identify additional studies. Two authors (JL and VA) had selected studies up until June 26, 2020, that compared group exercise with other forms of intervention programs for people with LBP. Results from each database were uploaded to Covidence (www.covidence.org) and duplicates were excluded after software review.

Group-based exercise programs were defined as a group of three or more participants taking part in an exercise class supervised by a health care provider. A non-pharmacological intervention was defined as one-on-one care between a health care provider and their patient that did not

involve pharmaceuticals. The intervention programs were identified using the search terms “group exercise”,” GLA:D® Back”, “group strengthening”, “group physical activity”, or “group strength training”. Low back pain was identified using the search terms “chronic back pain”, “persistent back pain”, “long-standing back pain”, “long-duration back pain”, “long-standing lumbar pain”, “long-duration lumbar pain”, “chronic low back pain”, “persistent low back pain”, “long-standing low back pain”, or “long-duration low back pain”.

3.2.2 Eligibility criteria

Only peer-reviewed, randomized, controlled trials comparing group-based exercise including strengthening, physical activity, and strength training with other types of non-pharmacologic interventions for chronic LBP were included. We excluded reports related to conference proceedings, specific low back pain diagnoses, case series of fewer than ten subjects, case studies, systematic reviews, and protocol papers.

3.2.3 Selection of studies

Two investigators (JL and VA) with more than 10 years of experience in reviewing literature screened all titles and abstracts independently and retrieved the full text of the potentially eligible studies. Disagreements at the titles and abstracts stage were resolved through consensus.

3.2.4 Data extraction

A standard form (Appendix II) was developed to extract data based on published guidelines (Bialocerkowski, Klupp, & Bragge, 2010; Jerosch-Herold, 2005; Mokkink et al., 2010). Data for each study were extracted and cross-checked by two investigators (JL and VA). Disagreements were resolved by a third investigator (GK). The following information was extracted for each study: 1) characteristics of the participants: sample size, age, gender, height, diagnosis, pain duration,

location, and intensity; 2) inclusion and exclusion criteria; 3) characteristics of the interventions: the type, length of the program, mode of application, frequency and duration of group and individual exercise-based physiotherapy; 4) characteristics of the outcomes: pain and disability outcomes measures, follow-up times.

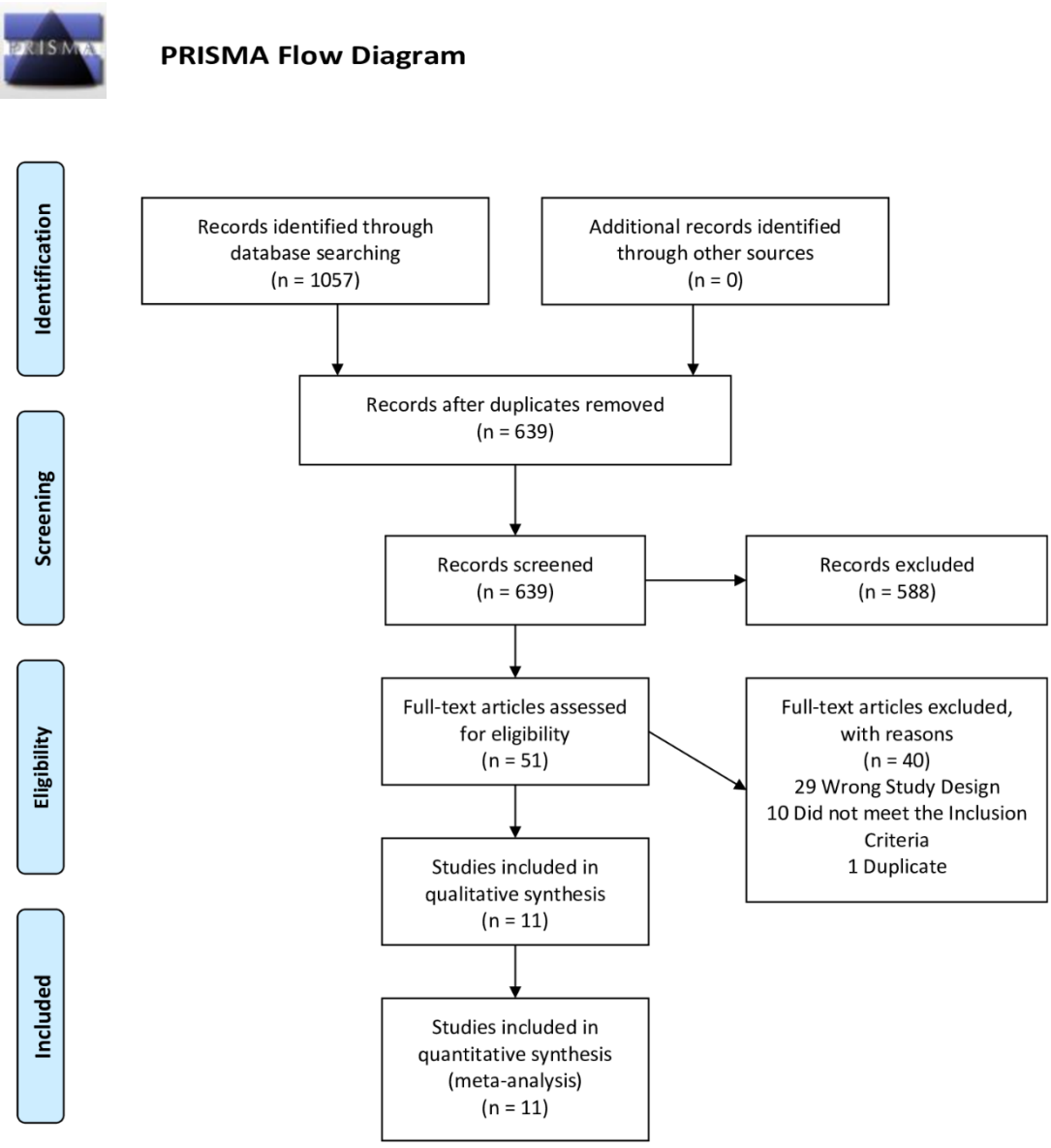
3.2.5 Methodological quality

The quality of included studies was assessed as outlined by PRISMA, and the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (Vandenbroucke et al., 2007). The quality appraisal focused on seven categories: subject recruitment, examiners, methodology, outcomes, handling of missing data, statistical analysis, and results (Appendix III). Two reviewers (JL, VA) conducted critical appraisal separately on each of the papers and decisions were verified through consensus. Practice appraisals and discussion of five full-text papers occurred for calibration before the full review. Studies with a minimum score of 70% were considered to be of high quality and those with a lower score to be of low quality (Cornelius, van der Klink, Groothoff, & Brouwer, 2011).

3.2.6 Data synthesis and analysis

A PRISMA flowchart was constructed to summarise the article selection process (**Figure 3.1**) (Liberati et al., 2009). Agreement between reviewers on article selection at each stage and on the quality appraisal of the included full-text articles was described using percentages. The level of evidence (strong, moderate, limited, no, and conflicting evidence) for the effect of interventions was determined according to the consistency of the research findings and the methodological quality of the included studies (Cornelius et al., 2011). The level of evidence was considered strong if there was more than 75% agreement between at least two high-quality studies and more than two low-quality studies on the outcome of the interest (**Table 3.1**) (Cornelius et al., 2011).

Figure 3. 1 Search strategy guided by the PRISMA Flow Diagram



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.

The evidence was considered moderate if there was more than 75% agreement between a high-quality study and at least three low-quality studies (**Table 3.1)** (Cornelius et al., 2011). The evidence was considered limited if only one high-quality study reported that outcome or at least three out of four low-quality studies (75%) reported the same outcome (Table 3.1) (Cornelius et al., 2011).The evidence was considered conflicting if there was less than 75% agreement among the studies irrespective of study quality (**Table 3.1**) (Cornelius et al., 2011).

Table 3. 1 Levels of evidence for summary statements and description of criteria adopted a priori to determine the level of evidence (Cornelius et al., 2011)

Level	Description
Strong	Consistent results (≥75%) from at least 2 high-quality* studies
Moderate	1 high-quality* study and consistent findings (≥75%) in 1 or more low-quality studies
Limited	Findings in 1 high-quality* study or consistent results (≥75%) among low-quality studies
No	No study identified
Conflicting	Inconsistent results irrespective of study quality

*Studies with quality scores over 70% were deemed high quality.

Summary tables were prepared for participants' descriptions (**Table 3.2**), intervention used (Table 3), quality appraisal scores (Table 4), the level of evidence summary statements and outcomes extracted (**Table 3.5**).

3.3 Results

3.3.1 Studies included

The search identified 639 references following removing duplicates (**Figure 3.1**). After title and abstract screening, 628 papers were excluded. One paper was identified by manual search. This resulted in a total of 11 papers meeting the selection criteria. The most frequent reason for exclusion was inappropriate study design (e.g. did not carry out between-group comparisons).

3.3.2 Pain information

Of the 11 studies meeting the inclusion criteria, all enrolled participants having chronic LBP. All but one of the 11 studies reported on pain chronicity (Johnson et al., 2007) (**Table 3.2**) Seven of the included studies reported pre-intervention and post-intervention pain intensity (Daulat, 2016; Hurley et al., 2015; Johnson et al., 2007; Lewis et al., 2005; Masharawi & Nadaf, 2013; Ryan, Gray, Newton, & Granat, 2010; Sahin, Albayrak, Durmus, & Ugurlu, 2011a).

Table 3. 2 Description of study type and study participants in the included studies

Authors	Study Type	Recruitment Strategy and Selection Criteria	Number of Subjects and Groups	Participant Age (years)	Diagnosis	Pain (Duration)
Daulat (Daulat, 2016)	Permuted Blocks, Single Blinded, Two-arm RCT with 6-month follow-up	Male and female Aged 20- 75 years, Mechanical Chronic LBP >3 months Motivated and willing to attend both the physiotherapy group programs	Spinal Rehabilitation: 15♂, 26♀ Back to Fitness: 16♂, 24♀	Spinal Rehabilitation: 46.4 ±12.1 Back to Fitness: 43.3 ±12.7	Chronic LBP referred from General Physicians	Median (Interquartile Range): Spinal Rehabilitation: 36.0 (61) Months Back to Fitness: 21.5(62) Months
Harris et al. (Harris et al., 2017)	Three-arm RCT with	At least 50% sick leave due to unspecific LBP, Aged: 20- 60 years, being At least 50% employed Having one of the following International Classification of Primary Care diagnoses for the current sick leave episode	Brief Intervention: 43♂,56♀ Cognitive Behavioral Therapy: 31♂,24♀ Physical Exercise 32♂,28♀	Brief Intervention: 44.8±9.7 Cognitive Behavioral Therapy: 45.5±9.1 Physical Exercise: 44.2±10.6	Non-specific LBP	Brief Intervention 12.5±11.3 years Cognitive Behavior Therapy 9.6±10.9 years Physical Exercise 11.5±10.6
Hurley et al. (Hurley et al., 2015)	An assessor-blinded, Three-arm RCT trial with and 12-month follow-up	Male and female Chronic LBP (≥3 Months) or recurrent (≥3 episodes in previous 12 Months) Mechanical LBP with/without radiation to the lower limb Aged 18- 65 years	Exercise: 24♂, 59♀ Walking: 24♂, 58♀ Usual Physiotherapy: 31♂, 50♀	Exercise: 45.8±11.1 Walking: 46.2±11.3 Usual Physiotherapy: 44.2±11.7	Non-specific chronic or recurrent LBP	Exercise: 7±8.0 years Walking: 8.7±9.0 years Usual Physiotherapy: 7.5±7.9 years

Authors	Study Type	Recruitment Strategy and Selection Criteria	Number of Subjects and Groups	Participant Age (years)	Diagnosis	Pain (Duration)
		No spinal surgery within the past 12 Months Deemed suitable by their general practitioner/hospital consultant to carry out an exercise program willing to attend an 8-week treatment program of exercise classes Access to a telephone (for follow-up support) Fluency in English (verbal and written) Low" or "moderate" levels of PA measured by the IPAQ (<600 metabolic equivalents of the task -minutes/ week)				
Johnson et al. (Johnson et al., 2007)	Two-arm RCT with 15-month follow-up	Aged 18- 65 years Consulting General Physicians with LBP between January 2002 and July 2003	Active intervention 45♂, 71♀ Control: 49♂, 69♀	Active intervention 47.3±10.9 Control 48.5±11.4	LBP	?
Lewis et al (Lewis et al., 2005)	Two-arm RCT	Aged between 18 -75 years, fluency in English, LBP >3 months	Group exercise 14♂, 26♀ Individual exercise 26♂, 14♀	Group exercise 46.1±12.7 Individual exercise 45.7±12.7	Non-radicular mechanical LBP	Group exercise 11.1±12.6 years Individual exercise 10.1±9.9 years

Authors	Study Type	Recruitment Strategy and Selection Criteria	Number of Subjects and Groups	Participant Age (years)	Diagnosis	Pain (Duration)
Masharawi & Nadaf (Masharawi & Nadaf, 2013)	Single-blinded, pilot, Two-arm RCT with 12-week follow up	Female, Aged 45–65 years, LBP > 12 weeks, Able to give informed consent, Understood instructions, Willing to cooperate with the treatment.	Group Exercise 20♀ Control 20♀	Group Exercise 52.4±10.6 Control 53.6±9.5	Non-specific LBP	Minimum of 12 weeks,
O'Keeffe et al. (O'Keeffe, O'Sullivan, Purtill, Bargary, & O'Sullivan, 2020)	Pragmatic, Two-arm RCT with 12 months post-randomization	Chronic LBP	Group-based exercise and education intervention 30♂, 70♀ Cognitive functional therapy 24♂, 82♀	Group-based exercise and education intervention 47.0±13.2 Cognitive functional therapy 50.6±14.9	Chronic LBP	Median: 60 months
Ryan et al. (Ryan et al., 2010)	Single-blinded, Two-arm RCT with 3-month follow up	Male and female Aged 18-65 years Pain >3 Months No history of surgery	Education + Exercise: 6♂, 14♀ Education: 7♂, 11♀	Education + Exercise: 45.2±11.9 Education: 45.5±9.5	Non-specific LBP	Education + Exercise: 28.1±20.4 Education: 39.3±26.2
Sahin et al. (Sahin et al., 2011a)	Two-arm, RCT 3-month follow-up	Non-specific LBP>12 weeks without neurological deficits	Back school: 18♂, 55♀ Control: 16♂, 57♀	Back school: 47.2±11.2 Control: 51.4±9.6	Non-specific LBP	Back school: 6.5±7.3 months Control: 7.3±6.5 months
Sherman et al. (Sherman, Cherkin, Erro, Miglioretti, & Deyo, 2005)	Three-arm RCT with 26-week follow-up	Aged 20-64 years Had visited a primary care provider for treatment of	Yoga 11♂, 25♀* Group exercise	Yoga 44±12.0 Group exercise	LBP	Most experienced back pain more than 1

Authors	Study Type	Recruitment Strategy and Selection Criteria	Number of Subjects and Groups	Participant Age (years)	Diagnosis	Pain (Duration)
		LBP 3 to 15 months before the study	13♂, 22♀ Self-Care Book 10♂, 20♀	42±15.0 Self-Care Book 45±11.0		year before the study, Two-thirds of participants reported pain lasted for more than 1 year.
Carr et al. (Carr et al., 2005)	Two-arm RCT with 12-month follow-up	Mechanical LBP lasting at least six weeks	Individual Physiotherapy 45♂, 74♀ Group Exercise 49♂, 69♀	Individual Physiotherapy 42.5±11.2 Group Exercise 42.0±10.6	Mechanical LBP	Individual Physiotherapy 54%>6 months 46%<6 months Group Exercise 65%>6 months 35%<6 months

Abbreviations and symbols: RCT: Randomized Control Trial; LBP: Low Back Pain; ♂: males; ♀: females
*Gender percentages are converted to a number.

3.3.3 Intervention used in the included studies

Table 3.3 summaries the intervention, duration, metric used, and data collection time points used in the included studies. From the resulting 11 studies, 27 different outcome measurements were identified (**Table 3.3**).

Table 3. 3 Description of the intervention used in the included studies

Authors	Groups	Intervention	Duration	Metric Used	Data Collection Timepoints
Daulat (Daulat, 2016)	Experimental	Group multimodal exercise therapy + one-to-one education and/or manual therapy sessions	Six 1-hour treatment sessions over a 3-month period	Functional Rating Index NPRS EQ- 5D-5L Participant Satisfaction Reporting Scale Group interviews	BL POI 6M POI
	Control	General exercise sessions using a circuit-based exercise format + weekly group education sessions at the end of the exercise period.			
Harris et al. (Harris et al., 2017)	Brief cognitive intervention	Brief cognitive, clinical examination program based on a non-injury model addressing pain and fear avoidance, where return to normal activity and work is the main goal.	two sessions over a period of 5 days with the choice of two booster sessions.	Increased work participation ODI Hospitality Anxiety and Depression Scale Subjective Health Complaints Inventory Utrecht Coping List Instrumental Mastery-Orientated Coping Fear-Avoidance Beliefs Questionnaire	BL Monthly POI up to 12 months
	Brief cognitive intervention + Cognitive-behavioural treatments	Cognitive-behavioural treatment manual adopted from the CINS trial (Reme et al., 2011)	7 session at 90min for a total of 10.5 hours over a 3-month period		
	Brief cognitive intervention + physical group exercise	Strength and endurance training + relaxation	90 min, Three times/week over a 3-month period		
Hurley et al. (Hurley et al., 2015)	Walking	Walking	10-min walk at least 4 days per week proceed to 30 min of moderate-intensity PA for 5 days per week at week 5 for a total of 8 weeks	ODI NPRS Fear Avoidance Beliefs Questionnaire-PA subscale Back Beliefs Questionnaire International Physical Activity Questionnaire Exercise Self-efficacy Questionnaire	BL 3M POR 6M POR 12M POR
	Exercise class	A programme of progressive or graded exercises + a back-care education message	1-hour weekly class up to 8 weeks		

Authors	Groups	Intervention	Duration	Metric Used	Data Collection Timepoints
	Usual physiotherapy	Individualized education/advice, exercise therapy + manipulative therapy	?	Readiness to Change Questionnaire Patient Satisfaction Questionnaire	BL 3M POR
Johnson et al. (Johnson et al., 2007)	Active intervention	Booklet and audiocassette + community-based treatment program (problem-solving, pacing and regulation of activity, challenging distorted cognitions about activity and harm, and helping patients to identify helpful and unhelpful thoughts about pain and activity)	Eight 2-hour group sessions over a 6-week period	VAS RMDQ General Health Questionnaire EQ-5D	BL 3M POI 9M POI 15M POI
	Control	Booklet and audiocassette	None		
Lewis et al (Lewis et al., 2005)	Exercise class	10 station exercise class involving aerobic exercises, spinal stabilization exercises, and manual therapy	8 treatments over 8 weeks	Lumbar flexion Lumbar extension Side flexion Straight leg raising test Quebec back pain disability scale	POI 6M POI 12M POI
	Individual treatment	One-to-one intervention, 30 minutes of manual therapy (mobilizations to the spine) and spinal stabilization exercises			
Masharawi & Nadaf (Masharawi & Nadaf, 2013)	Group exercise	10 repetitions of 10 exercises aimed at improving lumbar mobility/flexibility and stability	45 min group exercise session twice a week, over 4 weeks, Thereafter, monthly meetings took place to review and	VAS RMDQ Flexion ROM Extension ROM Left and right rotation ROM	BL 4W POI 8W POI (only intervention group)

Authors	Groups	Intervention	Duration	Metric Used	Data Collection Timepoints
			reinforce program consistency.		
	Control group	Waitlist			
O'Keeffe et al. (O'Keeffe et al., 2020)	Group-based exercise and education	Three components to the intervention: 1) pain education; 2) exercise; and 3) relaxation.	Up to six classes over 6–8 weeks, each lasting ~1 hour and 15 min, with up to 10 participants in each class.	ODI Numerical Rating Scale Fear-avoidance using the physical activity subscale of the Fear Avoidance Beliefs Questionnaire Coping subscale of the Coping Strategies Questionnaire Pain Self-Efficacy Questionnaire Nordic Musculoskeletal Questionnaire Örebro musculoskeletal screening questionnaire Subjective Health Complaints Inventory Depression, Anxiety and Stress Scale Patient Satisfaction Questionnaire	BL 6M POR 12M POR
	Cognitive functional therapy	Comprehensive one-to-one interview and physical examination by physiotherapists. Three components to the intervention: 1) cognitive component: making sense of pain; 2) exposure with 'control'; and 3) lifestyle change, which have been described in detail elsewhere	Length varied in a pragmatic manner based on the clinical progression of participants.		
Ryan et al. (Ryan et al., 2010)	Education and exercise group	Pain biology education + "The Back Book" + group exercise (Back to the Fitness exercise program, circuit-based, graded,	six classes, once a week for six weeks One session lasted 2.5 hrs	RMDQ NPRS Repeated sit-to-stand test	BL POI 3M POI

Authors	Groups	Intervention	Duration	Metric Used	Data Collection Timepoints
		aerobic exercise with some core stability exercises)		Fifty-foot walk test 5-min walk test Tampa Scale of Kinesiophobia-13 Pain self-efficacy questionnaire Step-count for 1W	
	Education only group	Pain biology education cognitive behavioural intervention + "The Back Book"			
Sahin et al. (Sahin et al., 2011a)	Back school + Exercise + Physical therapy	Didactic and practical training	1 hour, 2 times a week for 2 weeks	VAS ODI	BL 3M POI
		Lumbar flexion exercises Lumbar extension Lumbar stretching exercises, and strengthening exercises Transcutaneous electrical nerve stimulation, ultrasound, and hot pack	5 times a week for 2 weeks		
	Control	Lumbar flexion exercises Lumbar extension Lumbar stretching exercises, and strengthening exercises Transcutaneous electrical nerve stimulation, ultrasound, and hot pack			
Sherman et al. (Sherman et al., 2005)	Yoga	Yoga session + auditory compact discs to guide them through the sequence of postures with the appropriate mental focus	75 min weekly for 12 weeks	Telephone interviews RMDQ Short Form-36 Health Survey	BL 6W POR 12W POR 26W POR
	Conventional therapeutic exercise classes	short educational talk + exercise class (7 aerobic exercises and 10 strengthening exercises that emphasized leg, hip, abdominal, and back muscles)			

Authors	Groups	Intervention	Duration	Metric Used	Data Collection Timepoints
	Self-care book.	The Back-Pain Help book	?		
Carr et al. (Carr et al., 2005)	Back to Fitness Program	Low impact aerobics, strengthening and stretching exercises for the main muscle groups, and relaxation + A cognitive-behavioural approach underpinned messages	8 hrs. over a 4-week period	RMDQ SF12 EQ5D Pain Self-Efficacy Scale	3M 12M
	Physiotherapy	One (or a combination) of McKenzie exercises, strengthening exercises, stretching exercises, spinal stabilizations, other exercises, manipulation, mobilizations, traction, Short wave diathermy, ultrasound, interferential, TENS, other treatment (including massage, heat, laser, advice/education).	?		

BL: baseline; min: minutes, hrs.: hours, POI: post-intervention; POR: post-randomization, W: Week; M: Month; VAS: Visual Analogue Scale; ODI: Oswestry Disability Index; NPRS: Numerical Pain Rating Scale; RMDQ: Roland and Morris Disability Questionnaire; ROM: range of motion.

3.3.4 Methodological quality

Five studies met the methodological high-quality threshold of 70% (**Table 3.4**) (Carr et al., 2005; Johnson et al., 2007; Masharawi & Nadaf, 2013; O'Keeffe et al., 2020; Sahin et al., 2011a). Five studies scored between 60% and 69% (Harris et al., 2017; Hurley et al., 2015; Lewis et al., 2005; Ryan et al., 2010), and one scored 50% (Daulat, 2016). The major source of bias in the resulting 11 papers was the failure to formulate correlation and mean difference-testing hypotheses (i.e. a priori), and therefore, these studies did not provide any information whether the expected direction of correlations or mean differences met the original hypotheses. All studies clearly described 1) their sample size estimation for each experimental group and 2) their main findings.

Table 3. 4 Quality appraisal of the studies included

Authors	Recruitment /7	Examiners /4	Methodology /5	Outcomes /2	Missing Data /8	Statistical Analysis /5	Results /2	Overall Score /33	Overall Score (%)
Daulat (Daulat, 2016)	5	1	5	2	2	2	1	18	56%
Harris et al. (Harris et al., 2017)	6	2	2	2	5	3	1	21	66%
Hurley et al. (Hurley et al., 2015)	6	2	4	1	4	3	2	22	69%
Johnson et al. (Johnson et al., 2007)	6	0	4	2	6	4	1	23	72%
Lewis et al (Lewis et al., 2005)	6	2	3	2	2	4	1	20	63%
Masharawi & Nadaf (Masharawi & Nadaf, 2013)	6	1	4	1	6	4	1	23	72%
O'keeffe (O'Keeffe et al., 2020)	5	4	5	2	4	5	2	27	82%
Ryan et al. (Ryan et al., 2010)	7	0	3	1	4	4	2	21	66%
Sahin et al. (Sahin et al., 2011a)	5	2	4	1	5	5	2	24	75%
Sherman et al. (Sherman et al., 2005)	6	3	4	1	4	4	2	24	75%
Carr et al. (Carr et al., 2005)	6	2	4	2	5	4	1	24	75%

Overall score: the sum of all scores

3.3.5 Measurement outcomes

From the resulting 11 studies, 47 different outcome measurements were identified with the resulting level of evidence and summary statements described in **Table 3.5** as applicable.

3.3.6 Primary outcome measures

Self-administered disability measures

Low back pain associated disability was evaluated in 10 studies. Five studies used the Roland-Morris Disability Questionnaire (Carr et al., 2005; Johnson et al., 2007; Masharawi & Nadaf, 2013; Sherman et al., 2005); four used the Oswestry Disability Index Questionnaire (Harris et al., 2017; Hurley et al., 2015; Sahin, Albayrak, Durmus, & Ugurlu, 2011b; Sullivan et al., 2018) and one used Quebec back pain disability scale (Lewis et al., 2005). There was strong evidence of no difference between groups 3-month post-intervention from 3 high-quality studies and a study with moderate quality (Carr et al., 2005; Johnson et al., 2007; Ryan et al., 2010; Sahin et al., 2011b). Likewise, there was limited evidence of no difference between groups from one study for 9-month and 15-month post-intervention (Johnson et al., 2007) and another study for 6-month post-randomization (Hurley et al., 2015). Two studies compared the post-intervention disability level with pre-intervention disability level (Lewis et al., 2005; Ryan et al., 2010). There was limited evidence of lower disability scores in people who received individual intervention compared to group exercise immediately and 6-month post-intervention. Results indicated limited evidence of no difference between exercise and education vs. education group only 3-month and 6-month post-intervention compared to the base-line group (Ryan et al., 2010). The results were inconsistent from two studies 6-month post-intervention (Lewis et al., 2005), and from two studies 3-month post-randomization (Hurley et al., 2015; Sherman et al., 2005), three studies 6-month post-randomization (Hurley et al., 2015; Ryan et al., 2010; Sherman et al., 2005). There was limited evidence from one study for lower disability scores 4-week post-intervention (**Table 3.5**). People in the group exercise (intervention group) had a lower disability score than people in the

waiting list (control) 4-week post-intervention (Masharawi & Nadaf, 2013). Likewise, there was limited evidence from one study for lower disability scores 6-week post-randomization (Sherman et al., 2005). In this study, people in the yoga intervention group had a lower disability score than people in the booklet only group 6-week post-intervention (Sherman et al., 2005). In this study, the difference was not significant between yoga and conventional therapeutic exercise classes vs. self-care book, and between and conventional therapeutic exercise classes vs. self-care book (Sherman et al., 2005). There was limited evidence from one study for lower disability scores 12-month post-randomisation (**Table 3.5**). Cognitive functional therapy led to greater reductions in disability compared with the group exercise intervention (O'Keeffe et al., 2020).

Pain

Pain level was measured in three studies using the Visual Analogue Scale (Lewis et al., 2005; Masharawi & Nadaf, 2013; Sahin et al., 2011b) and using the Numeric Pain Rating Scale in four studies (Daulat, 2016; Hurley et al., 2015; O'Keeffe et al., 2020; Ryan et al., 2010) (**Table 3.5**). There was moderate evidence of no difference between groups for 6-month post-randomization and 12-month post-randomization (Hurley et al., 2015; Sullivan et al., 2018). There was limited evidence of a lower pain score of people in the group exercise and education compared people of the education group 3-month and 6-month post-intervention compared to baseline (Ryan et al., 2010). There was limited evidence of non-difference between groups for immediately and 6-month post-intervention (Daulat, 2016), 9-month and 15-month post-intervention (Johnson et al., 2007), and 3-month post-randomization (Hurley et al., 2015). There was limited evidence of a lower pain score of people in the group exercise compared people of the individual intervention group 4 week post-intervention (Masharawi & Nadaf, 2013).

3.3.7 Secondary outcome measures

Quality of life

Quality of life was evaluated in four studies. Two studies used the EQ-5D quality of life scale (Carr et al., 2005; Johnson et al., 2007), one used the EQ-5D-5L, one used the EQ-VAS (Carr et al., 2005) and one study used the short form SF-36 Health Survey (Sherman et al., 2005). There was strong evidence of no difference between groups in health surveys scores from two high-quality studies (Carr et al., 2005; Johnson et al., 2007). Likewise, there was limited evidence of no difference among groups for all measurement time points (Carr et al., 2005; Daulat, 2016; Johnson et al., 2007; Sherman et al., 2005).

Lumbar spine flexibility (flexion, extension, and lateral flexion)

There was limited evidence for no difference between groups post-intervention and 12-month post-intervention (Lewis et al., 2005) with respect group exercise vs. individual intervention on lumbar spine flexibility, however, there was limited evidence for more flexion, extension, and lateral bending range of motion in people of the group exercise group compared to the controls 4-week and 8-week post-intervention (Masharawi & Nadaf, 2013). Likewise, there was limited evidence of a higher range of motion for lumbar extension and lateral bending 6-month post-intervention (Lewis et al., 2005). Differences in the flexion range of motion between these groups were not significant (Lewis et al., 2005).

Fear beliefs

Low back pain associated fear beliefs were evaluated in three studies (Harris et al., 2017; Hurley et al., 2015; Ryan et al., 2010) with inconsistent results irrespective of the quality of the studies included. One study evaluated pain-related fear with the Tampa Scale of Kinesiophobia-13 (TSK-13, a modified version of the original Tampa scale of Kinesiophobia) (Ryan et al., 2010), one used the Fear-avoidance Beliefs Questionnaire (FABQ) (Harris et al., 2017) and one used the Fear

Avoidance Beliefs Questionnaire-PA subscale and Back Beliefs Questionnaire (Hurley et al., 2015). There was limited evidence of no difference among groups for fear beliefs 3-month post-intervention (Hurley et al., 2015), 3-month and 6-mont post-randomization (Ryan et al., 2010), either 6-month post-intervention (Hurley et al., 2015) or post-randomisation (O'Keeffe et al., 2020), and either 12-month post-intervention (Harris et al., 2017; Hurley et al., 2015) or post-randomisation (O'Keeffe et al., 2020).

3.3.8 Other outcome comparisons

Most studies reported outcome measures in addition to those describing disability, quality of life and pain (**Table 3.5**). One study showed limited evidence that cognitive functional therapy was superior in pain self-efficacy, risk of chronicity, and coping compared to group-based exercise (O'Keeffe et al., 2020). The remaining other outcome measures had limited evidence of no difference between the group and individual programs (**Table 3.5**).

Table 3. 5 Levels of evidence for summary statements for each intervention.

Level of evidence	From n studies	Changes	Data Collection Time-point	Groups compared
Pain (Numeric pain Rating Scale and Visual Analogue Scale)				
Limited	1(Daulat, 2016)	No difference	Post-intervention	Exercise Group vs. Individual Treatment
Limited	1(Masharawi & Nadaf, 2013)	A lower score for Group Exercise	4-week post-intervention	Group Exercise vs. Control group
Conflicting	3(Johnson et al., 2007; Ryan et al., 2010; Sahin et al., 2011a)	Inconsistent	3-month post-intervention	Exercise &Education vs. Education Group Exercise vs. Pain Biology Back school + Exercise + Physical therapy vs. Control
Limited	1(Daulat, 2016)	No difference	6-month post-intervention	Exercise Group vs. Individual Treatment
Limited	1(Ryan et al., 2010)	A lower score for Group Exercise	0, 3, & 6-month post-intervention	Exercise &Education vs. Education
Limited	1(Johnson et al., 2007)	No difference	9-month post-intervention	Active Intervention vs. Control
Limited	1(Johnson et al., 2007)	No difference	15-month post-intervention	Active Intervention vs. Control
Limited	1(Hurley et al., 2015)	No difference	3-month post-randomization	Walking vs. Exercise Class vs. Usual Physiotherapy
Moderate	2(Hurley et al., 2015; O'Keeffe et al., 2020)	No difference	6-month post-randomization	Walking vs. Exercise Class vs. Usual Physiotherapy Group-based exercise + education vs. Cognitive functional therapy
Moderate	2(Hurley et al., 2015; O'Keeffe et al., 2020)	No difference	12-month post-randomization	Walking vs. Exercise Class vs. Usual Physiotherapy Group-based exercise + education vs. Cognitive functional therapy
Disability				
Limited	1(Lewis et al., 2005)	A lower score for individual intervention	Post-intervention	Group Intervention vs. Individual Intervention Group Exercise vs. Pain Biology

Limited	1(Masharawi & Nadaf, 2013)	A lower score for Group Exercise	4-week post-intervention	Group Exercise vs. Control group
Strong	4(Carr et al., 2005; Johnson et al., 2007; Ryan et al., 2010; Sahin et al., 2011a)	No difference	3-month post-intervention	Active Intervention vs. Control Group Exercise vs. Pain Biology Back school + Exercise + Physical therapy vs. Control Group Exercise vs. Individual Physical Therapy
Limited	1(Lewis et al., 2005)	A lower score for individual intervention	6-month post-intervention	Group Intervention vs. Individual Intervention
Limited	1(Ryan et al., 2010)	No difference	0, 3-month, & 6-month post-intervention	Exercise &Education vs. Education
Limited	1(Johnson et al., 2007)	No difference	9-month post-intervention	Active Intervention vs. Control
Limited	3(Carr et al., 2005; Harris et al., 2017; Lewis et al., 2005)	Inconsistent	12-month post-intervention	Walking vs. Exercise Class vs. Usual Physiotherapy Group Exercise vs. Individual Treatment Group Exercise vs. Individual Physical Therapy
Limited	1(Johnson et al., 2007)	No difference	15-month post-intervention	Active Intervention vs. Control
Limited	1(Sherman et al., 2005)	Lower scores in Yoga group	6-week post-randomization	Yoga vs. Conventional Therapeutic Exercise Classes vs. Self-care Book
Conflicting	2(Hurley et al., 2015; Sherman et al., 2005)	Inconsistent	3-month post-randomization	Walking vs. Exercise Class vs. Usual Physiotherapy Yoga vs. Conventional Therapeutic Exercise Classes vs. Self-care Book
Conflicting	3(Hurley et al., 2015; O'Keeffe et al., 2020; Sherman et al., 2005)	Inconsistent	6-month post-randomization	Walking vs. Exercise Class vs. Usual Physiotherapy Yoga vs. Conventional Therapeutic Exercise Classes vs. Self-care Book Walking vs. Exercise Class vs. Usual Physiotherapy
Limited	1(O'Keeffe et al., 2020)	A lower score for Cognitive functional therapy	12-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy

Lumbar Spine Flexibility (Flexion, Extension, and Lateral Flexion)				
Limited	1(Lewis et al., 2005)	No difference	Post-intervention	Exercise Class vs. Individual Treatment Group Intervention vs. Individual Intervention
Limited	1(Masharawi & Nadaf, 2013)	A higher score for Group Exercise	4-week post-intervention	Group Exercise vs. Control group
Limited	1(Masharawi & Nadaf, 2013)	A higher score for Group Exercise	8-week post-intervention	Group Exercise vs. Control group
Limited	1(Lewis et al., 2005)	Higher ROM for lumbar extension and side bending and no difference for flexion	6-month post-intervention	Exercise Class vs. Individual Treatment Group Intervention vs. Individual Intervention
Limited	1(Lewis et al., 2005)	No difference	12-month post-intervention	Exercise Class vs. Individual Treatment
Fear Beliefs				
Limited	1(Ryan et al., 2010)	No difference	0, 3-month, & 6-month post-intervention	Exercise &Education vs. Education
Limited	1(Hurley et al., 2015)	No difference	3-month post-intervention	Walking vs. Exercise Class vs. Usual Physiotherapy
Limited	1(Hurley et al., 2015)	No difference	6-month post-intervention	Walking vs. Exercise Class vs. Usual Physiotherapy
Limited	2(Harris et al., 2017; Hurley et al., 2015)	No difference	12-month post-intervention	Brief Intervention vs. Brief Intervention + Cognitive Behavioral Therapy vs. BI + Physical Group Exercise Walking vs. Exercise Class vs. Usual Physiotherapy
Limited	1(Ryan et al., 2010)	No difference	0, 3-month & 6-month post-randomization	Walking vs. Exercise Class vs. Usual Physiotherapy
Limited	1(O'Keeffe et al., 2020)	No difference	6-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Limited	1(O'Keeffe et al., 2020)	No difference	12-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Health Surveys				

Limited	1(Daulat, 2016)	No difference	Post-intervention	Exercise Group vs. Individual Treatment
Strong	2(Carr et al., 2005; Johnson et al., 2007)	No difference	3-month post-intervention	Active Intervention vs. Control Group Exercise vs. Individual Physical Therapy
Limited	1(Daulat, 2016)	No difference	6-month post-intervention	Exercise Group vs. Individual Treatment
Limited	1(Johnson et al., 2007)	No difference	9-month post-intervention	Active Intervention vs. Control
Limited	1(Carr et al., 2005)	No difference	9-month post-intervention	Active Intervention vs. Control
Limited	1(Johnson et al., 2007)	No difference	12-month post-intervention	Group Exercise vs. Individual Physical Therapy
Limited	1(Sherman et al., 2005)	No difference	6-week post-randomization	Yoga vs. Conventional Therapeutic Exercise Classes vs. Self-care Book
Limited	1(Sherman et al., 2005)	No difference	3-month post-randomization	Yoga vs. Conventional Therapeutic Exercise Classes vs. Self-care Book
Limited	1(Sherman et al., 2005)	No difference	6-month post-randomization	Yoga vs. Conventional Therapeutic Exercise Classes vs. Self-care Book
Functional Rating Index				
Limited	1(Daulat, 2016)	No difference	Post-intervention	Exercise Group vs. Individual Treatment
Limited	1(Daulat, 2016)	No difference	6-month post-intervention	Exercise Group vs. Individual Treatment
Participant Satisfaction Reporting Scale				
Limited	1(Daulat, 2016)	No difference	Post-intervention	Exercise Group vs. Individual Treatment
Limited	1(Daulat, 2016)	No difference	6-month post-intervention	Exercise Group vs. Individual Treatment
Pain Self-efficacy				
Limited	1(Johnson et al., 2007)	No difference	3-month post-intervention	Group Exercise vs. Individual Physical Therapy
Limited	1(Johnson et al., 2007)	No difference	12-month post-intervention	Group Exercise vs. Individual Physical Therapy
Limited	1(O'Keeffe et al., 2020)	No difference	6-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Limited	1(O'Keeffe et al., 2020)	A lower score for Cognitive functional therapy	12-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Risk of Chronicity				

Limited	1(O'Keeffe et al., 2020)	No difference	6-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Limited	1(O'Keeffe et al., 2020)	A lower score for Cognitive functional therapy	12-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Coping				
Limited	1(O'Keeffe et al., 2020)	No difference	6-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Limited	1(O'Keeffe et al., 2020)	A lower score for Cognitive functional therapy	12-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Number of Pain Sites				
Limited	1(O'Keeffe et al., 2020)	No difference	6-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Limited	1(O'Keeffe et al., 2020)	No difference	12-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Risk of Chronicity				
Limited	1(O'Keeffe et al., 2020)	No difference	6-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Limited	1(O'Keeffe et al., 2020)	No difference	12-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Sleep, Depression, and Anxiety				
Limited	1(O'Keeffe et al., 2020)	No difference	6-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Limited	1(O'Keeffe et al., 2020)	No difference	12-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Stress				
Limited	1(O'Keeffe et al., 2020)	No difference	6-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Limited	1(O'Keeffe et al., 2020)	No difference	12-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Satisfaction				
Limited	1(O'Keeffe et al., 2020)	No difference	6-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy

Limited	1(O'Keeffe et al., 2020)	No difference	12-month post-randomization	Group-based exercise + education vs. Cognitive functional therapy
Short Form Health Survey – Physical Component				
Limited	1(Johnson et al., 2007)	No difference	3-month post-intervention	Group Exercise vs. Individual Physical Therapy
Limited	1(Johnson et al., 2007)	No difference	12-month post-intervention	Group Exercise vs. Individual Physical Therapy
Short Form Health Survey – Mental Component				
Limited	1(Johnson et al., 2007)	No difference	3-month post-intervention	Group Exercise vs. Individual Physical Therapy
Limited	1(Johnson et al., 2007)	No difference	12-month post-intervention	Group Exercise vs. Individual Physical Therapy
Increased work participation				
Limited	1(Harris et al., 2017)	No difference	12-month post-intervention	Brief Intervention vs. Brief Intervention + Cognitive Behavioral Therapy vs. Brief Intervention + Physical Group Exercise
Hospitality Anxiety and Depression Scale				
Limited	1(Harris et al., 2017)	No difference	12-month post-intervention	Brief Intervention vs. Brief Intervention + Cognitive Behavioral Therapy vs. Brief Intervention + Physical Group Exercise
Subjective Health Complaints Inventory				
Limited	1(Harris et al., 2017)	No difference	12-month post-intervention	Brief Intervention vs. Brief Intervention + Cognitive Behavioral Therapy vs. Brief Intervention + Physical Group Exercise
Utrecht Coping List				
Limited	1(Harris et al., 2017)	No difference	12-month post-intervention	Brief Intervention vs. Brief Intervention + Cognitive Behavioral Therapy vs. Brief Intervention + Physical Group Exercise
Instrumental Mastery-Orientated Coping				
Limited	1(Harris et al., 2017)	No difference	12-month post-intervention	Brief Intervention vs. Brief Intervention + Cognitive Behavioral Therapy vs. Brief Intervention + Physical Group Exercise
Physical activity (International Physical Activity Questionnaire)				
Limited	1(Hurley et al., 2015)	No difference	3-month post-randomization	Walking vs. Exercise Class vs. Usual Physiotherapy

Limited	1(Hurley et al., 2015)	No difference	6-month post-randomization	Walking vs. Exercise Class vs. Usual Physiotherapy
Limited	1(Hurley et al., 2015)	No difference	12-month post-randomization	Walking vs. Exercise Class vs. Usual Physiotherapy
Exercise Self-efficacy Questionnaire				
Limited	1(Hurley et al., 2015)	No difference	3-month post-randomization	Walking vs. Exercise Class vs. Usual Physiotherapy
Limited	1(Hurley et al., 2015)	No difference	6-month post-randomization	Walking vs. Exercise Class vs. Usual Physiotherapy
Limited	1(Hurley et al., 2015)	No difference	12-month post-randomization	Walking vs. Exercise Class vs. Usual Physiotherapy
Readiness to Change Questionnaire				
Limited	1(Hurley et al., 2015)	No difference	3-month post-randomization	Walking vs. Exercise Class vs. Usual Physiotherapy
Limited	1(Hurley et al., 2015)	No difference	6-month post-randomization	Walking vs. Exercise Class vs. Usual Physiotherapy
Limited	1(Hurley et al., 2015)	No difference	12-month post-randomization	Walking vs. Exercise Class vs. Usual Physiotherapy
Patient Satisfaction Questionnaire				
Limited	1(Hurley et al., 2015)	No difference	3-month post-randomization	Walking vs. Exercise Class vs. Usual Physiotherapy
Left and Right Straight leg raising test				
Limited	1(Lewis et al., 2005)	No difference	6-month post-randomization	Exercise Class vs. Individual Treatment
Limited	1(Lewis et al., 2005)	No difference	12-month post-randomization	Exercise Class vs. Individual Treatment
Repeated sit-to-stand test/ Fifty-foot walk test/5-minute walk test/ Step-count for 1 Week				
Limited	1(Ryan et al., 2010)	No difference	Post-intervention	Exercise &Education vs. Education
Limited	1(Ryan et al., 2010)	No difference	6-month post-intervention	Exercise &Education vs. Education
Pain self-efficacy Questionnaire				
Limited	1(Ryan et al., 2010)	More favourable results for the ED group	Post-intervention	Exercise &Education vs. Education

Limited	1(Ryan et al., 2010)	More favourable results for the ED group	6-month post-intervention	Exercise &Education vs. Education

3.4 Discussion

3.4.1 Main findings

The present systematic review identified strong evidence of no difference in disability level and pain scores 3-month post-intervention in people with chronic low back pain group-based exercise compared with controls that underwent other non-pharmacologic interventions. We also identified moderate evidence of no difference between group exercise and cognitive functional therapy for 6-month post-randomization and 12-month post-randomization. We could not find any strong or moderate evidence for or against the use of group-based exercise in the rehabilitation of people with chronic LBP for other time-points and health measurement outcomes.

These findings are consistent with findings of a recent systematic review conducted by O'Keeffe et al. that compared individual exercise to group exercise for all musculoskeletal conditions including LBP (O'Keeffe et al., 2017). O'Keeffe et al found that for disability and pain, no clinically significant differences were found between the group and individual physiotherapy including exercise for all musculoskeletal conditions (O'Keeffe et al., 2017). They also found seven studies that specifically related to LBP that also noticed no clinically significant differences in disability and pain when comparing group and individual physiotherapy involving exercise (O'Keeffe et al., 2017).

While our results suggest there is no difference between group exercise and non-pharmacological interventions, there was one study that demonstrated limited evidence that cognitive functional therapy was superior in self-administered disability measures 6 and 12-month post-randomization compared to baseline. The same study indicated that cognitive functional therapy was superior in pain self-efficacy, risk of chronicity, and coping compared to group-based exercise 12-month post-randomization compared to 6-month post-randomization (O'Keeffe et al., 2020).

Some secondary outcomes demonstrated interesting findings but were not frequently used in the included studies. These included fear-avoidance, QoL and cost. Based on one study investigated here, group-based exercise reduced fear-avoidance scores (Moffett, Carr, & Howarth, 2004), improved quality of life measures compared to usual general practitioner care (Johnson et al., 2007) and lowered costs (Lewis et al., 2005). Based on these studies, further exploration of these outcomes in relation to group-based exercise performance is warranted.

3.4.2 Study limitations

This review solely included studies published in English, and no search was conducted of the grey literature. These two factors may have caused a potential bias in selecting relevant studies. As discussed previously, the papers identified here were highly heterogeneous which prevented meta-analysis. Unfortunately, the literature was not sufficiently rich to limit our review to studies to head-to-head comparisons of group-based exercise with individual-based exercise and other specific interventions.

Further, in terms of our specific summary statements, some of these studies conflicted with each other depending on the time-points compared (**Table 3.5**). The majority of conflicts were observed for timepoints with two or three studies (each study weighted 50% or 33.33% in the summary statement, respectively). This indicates that even a different observation from a low-quality study could drastically change the level of evidence for a specific summary statement. The limited evidence summary statements often showed no difference among interventions. The studies compared were heterogeneous in terms of the population studied (different ages, different time points, different pain and disability level among participants) or because of other methodological considerations, which may have contributed to the frequent conflicting evidence summary statements and limited our ability to observe consistent effects of group-based exercise.

3.5 Conclusion

We identified strong evidence of no difference between group exercise and other non-pharmacological LBP interventions for disability level, quality of life, and pain. The remaining evidence was not of sufficiently high quality to permit further conclusions. With this equivocal finding, group-based exercise may be a preferred choice given advantages in other domains not reviewed here such as motivation and cost. Further research in this area is needed to evaluate this possible strategy.

Acknowledgement

The authors would like to thank Liz Dennett, University of Alberta Public Services Librarian, for her help in the database search.

Funding: None

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CHAPTER 4: THE FEASIBILITY OF IMPLEMENTING AN ENGLISH LANGUAGE VERSION OF GLA:D BACK®

A version of this chapter has been published. Lemieux J., Kawchuk G., Kongsted A., Hartvigsen J., Abdollah V., Jones A. The feasibility of implementing an English language version of GLA:D® Back BMC Pilots and Feasibility Studies 2021 7:38

Abstract

Background: Evidenced-based clinical guidelines for the treatment of low back pain (LBP) consistently suggest educating patients about their back pain, its natural course, and providing advice to keep active and continue working. Despite this evidence, clinicians routinely do not follow these recommendations resulting in ineffective and fragmented care. GLA:D® Back, a standardized care package, was originally developed in Denmark to assist clinicians in implementing evidence-based care. This study will evaluate the feasibility of implementing the English version of Danish GLA:D® Back program in Alberta, Canada.

Methods: Thirty-five clinicians from nineteen clinics in Alberta, Canada participated. Feasibility of program implementation, our primary objective, was evaluated within 3 months. Feasibility success was defined as 50% clinician/clinic adoption in addition to 66 - 88 enrolled participants registered in the database. Our secondary objectives included collecting data pertaining to clinician confidence, attitudes, and behaviour of treating patients, perceived barriers, and facilitators of program in addition to collecting patient- data regarding pain, function, general health, and self-efficacy.

Results: The majority of the clinics (15/19, 79%) offered GLA:D® Back to their patients within the study period. Of the participating clinicians, GLA:D® Back was delivered by (25/35, 71%) of

clinicians. In total, 78 patients were enrolled in the program and (69/78, 88%) participants attended the final assessment. Secondarily, clinicians demonstrated a biomedical and behavioural orientation along with high confidence when treating LBP patients while patient outcomes trended toward improvement.

Conclusion: The English translation of the Danish GLA:D® Back program was feasible for Albertan clinicians to implement into practice in both urban and rural settings.

4.1 Key messages regarding feasibility

1) What uncertainties existed regarding the feasibility?

- Is the English version of GLA:D® Back feasible when taught and tested in English?
- Can clinicians trained in GLA:D® Back successfully implement the program?

2) What are the key feasibility findings?

- The majority of clinicians trained in GLA:D® Back employed the program in clinical practice.
- Participating clinicians had positive impressions of the program.
- Clinicians' ratings of program content, usefulness, and novelty were high.
- Clinicians were satisfied with the translated materials and the program itself.

3) What are the implications of the feasibility findings for the design of the main study?

- Training materials translated from Danish to English can be used to successfully train English-speaking clinicians.
- Trained clinicians can successfully implement GLA:D® Back in practice.
- Patient recruitment was difficult in shift workers or those with insufficient resources and/or insurance coverage.

4.2 Introduction

Low back pain (LBP) is a common, chronic recurrent symptom that is responsible for more years lived with disability than any other condition worldwide (Theo Vos et al., 2017). As a result, the societal, health care and economic burdens associated with LBP are equal to or greater than those of other high cost conditions such as cancer, cardiovascular disease, autoimmune diseases and mental health (Maniadakis & Gray, 2000).

Evidence-based clinical guidelines for the treatment of LBP consistently suggest educating patients about what back pain is, its natural course, and giving advice about staying active and

at work (N. Foster et al., 2018). In addition, most of these guidelines recommend supervised exercise, manual therapy alone or in combination with exercise and discourage routine imaging, administration of opioids and reserve surgery for a few with specific indications (Slade et al., 2016). Regardless, clinicians of various professions remain unclear about how to manage LBP (N. E. Foster, Hill, Doyle, & Young, 2014) as evidenced by their ongoing use of treatments and procedures not recommended by the guidelines themselves (Amorin-Woods, Beck, Parkin-Smith, Lougheed, & Bremner, 2014; Mafi, McCarthy, Davis, & Landon, 2013) which often results in ineffective and fragmented care (Buchbinder, Tulder, et al., 2018; N. E. Foster et al., 2018b; Hartvigsen, Hancock, Kongsted, Louw, Ferreira, Genevay, Hoy, Woolf, et al., 2018).

Standardized care packages based on guideline recommendations are suggested as a tool to assist clinicians in implementing evidence into clinical practice (Skou & Roos, 2017). One such program is Good Life with Osteoarthritis in Denmark (GLA:D®) for people with knee or hip pain. The GLA:D® program, described in detail elsewhere (Skou & Roos, 2017), is a standardized program that consists of group-based patient education together with 6 weeks of twice weekly supervised group exercise while patient outcomes are collected systematically in a clinical registry (Skou & Roos, 2017). Between 2013-2017, more than 1100 trained clinicians have entered 30,000 patients in the GLA:D® knee and hip registry in Denmark alone (Kjaer et al., 2018). This program has made standardized evidence-based care widely available and has been successful in a variety of ways including reducing disability, pain and medication use (Roos et al., 2018). GLA:D® knee and hip is now available in Canada, Australia, Switzerland, and New Zealand (Roos et al., 2018).

Based on the success of this approach, GLA:D® Back was created to address people seeking care for persistent or recurrent back pain with the goal of promoting self-management and patient empowerment. The GLA:D® Back program maintains the same core components of

patient education, supervised group exercise classes and a registry to record patient and clinician outcomes throughout the program. The program itself is taught to clinicians from approved professions (presently chiropractic and physiotherapy) in a 2-day seminar format which then qualifies attendees to offer to program in their community.

To date, the GLA:D® Back program has been launched in Denmark with 619 clinicians trained and approximately 2800 patients registered (April 2018 – December 2019) ("Annual Report 2019 GLA : D ® Back," 2019). Early indications from Danish pilot data suggest that GLA:D® Back is capable of reducing disability, pain and medication use while increasing physical capacities (Kongsted, Hartvigsen, et al., 2019). To build on this success internationally, it is necessary to translate the GLA:D® Back program materials into English and evaluate the success of this translation in an English setting.

This paper reports on a feasibility study where the Danish GLA:D® Back program was translated into English and then subsequently delivered in private physiotherapy and chiropractic clinics in Alberta, Canada. Although cultural, professional and legislative differences may exist between implementation of the program in Denmark versus an English-speaking country, we hypothesize our results would be similar to those described in the Danish pilot (Kongsted, Hartvigsen, et al., 2019).

The primary objective of this feasibility study was the following:
To evaluate the adoption of GLA:D® Back in clinical practice among Canadian clinicians volunteering to the feasibility study.
In addition, our secondary objectives included:

1. To evaluate clinician perception of GLA:D® Back training and GLA:D® Back implementation.

2. To evaluate the potential change in clinicians' beliefs and behaviours about back pain after completion of the program.
3. To describe the patient participants characteristics who enrolled in GLA:D® Back as well as patient self-reported outcomes related to function, pain, general health, and self-efficacy.

4.3 Methods

4.3.1 Overview

The feasibility study of the GLA:D® Back program was overseen at the University of Alberta and implemented by trained community clinicians based in urban and rural based physiotherapy and chiropractic clinics in Alberta. Pre-implementation training of clinicians occurred over a 2-day training course at the University of Alberta. Following training, clinicians delivered GLA:D® Back at their clinics on a voluntary basis. During the course of the study, clinician and patient's data were collected at baseline and at subsequent intervals via electronic questionnaires administered through Research Electronic Data Capture (REDCap). This study was approved by the Human Research Ethics Board of the University of Alberta (Pro00085118). GLA:D® is a non-profit initiative whose name is trademarked by the University of Southern Denmark (SDU). For an overview of the study's events and chronology, please refer to **Figure 4.1**.

Figure 4. 1 Study Flow. Overview of activities and data collections at the level of the clinicians and patients. Please refer to text for exact time periods

Clinicians	December 2018	February 2019	March/April 2019	May 2019	June 2019
Activity	Recruitment	2-Day training course	Teach GLA:D Back	Teach GLA:D Back	Phone Interviews
Surveys		Pre-and post-course			4-month follow-up
E-mail feed-back		E-mail Feedback	E-mail Feedback	E-mail Feedback	E-mail Feedback
Patients	**December 2018**	**February 2019**	**March/April 2019**	**May 2019**	**June 2019**
Activity		Recruitment	Attend GLA:D Back	Follow-up	
Surveys				3-Month follow-up	

4.3.2 Clinician education

Clinicians were recruited to the study using content approved for distribution on the Alberta College and Association of Chiropractors website (albertachiro.com), the Physiotherapy Alberta College + Association website (physiotherapyalberta.ca), as well as through personal contacts. All participating clinicians provided their consent for data to be collected and used for research purposes prior to training. On February 16-17th, 2019, enrolled clinicians participated in the 2-day course. The course was taught by developers of GLA:D® Back and adapted from the Danish training program, which consisted of a mixture of lectures and practical workshops aimed to develop the clinicians' ability to deliver the program. Goal setting, clinical tests, patient education, supervised exercises, and data registration were introduced during the training workshop (Kjaer et al., 2018). Role-playing and skills training were used to familiarize clinicians with the educational component, performance-based tests, and exercises. Participants worked in groups to practice delivering key messages from the education content as they would in a real patient education session. Upon completion of the course, participants were given access to the REDCap data registry which also acted as a repository. Materials included standardized patient education sessions (PowerPoint with manuscript, exercises to support patients'

reflections, two posters with patient education key messages), exercise programs, content for patients and primary care physicians about the feasibility project itself.

4.3.3 Patients

Patients were recruited directly by trained clinicians within the boundaries set by their respective provincial regulatory bodies. Adult patients were eligible for the GLA:D® Back program if presenting with persistent or recurrent low back pain without or with leg pain with no known specific pathology and a perceived need for improved self-management skills. Execution of inclusion and exclusion criteria as well as collection of informed, written consent were performed by the clinician. Patients were required to pay $100 CAN for the initial assessment and $30 for subsequent sessions for a total of 20 sessions totaling $640 to complete the full program. Patients' fees for three of the rural clinics were fully subsidized by the provincial health care program (Alberta Health Services).

4.3.4 The GLA:D® Back intervention

GLA:D® Back is designed to assist and promote patient self-management and self-efficacy by providing knowledge of pain mechanisms, reducing fear of movement and supporting patients in gaining control of pain, function and also to promote physical activity and exercise (Kjaer et al., 2018). In brief, an individual assessment provided by the trained GLA:D® clinician is completed to determine patient eligibility. If eligible, four clinical tests are then performed: standing forward bending test (Bach, 1985; Gauvin, Riddle, & Rothstein, 1990), trunk flexor endurance test (Arab, Salavati, Ebrahimi, & Mousavi, 2007; Moreland, Finch, Stratford, Balsor, & Gill, 1997), Ito back extensor endurance test (Arab et al., 2007; Ito et al., 1996; Moreland et al., 1997), and sit to stand in 30 seconds (Andersson, Lin, & Smeets, 2010; Strand et al., 2011). Personal goals (S.M.A.R.T. rehabilitation goal setting) (Bovend'Eerdt, Botell, & Wade, 2009) are discussed then established and the starting level of 8 separate groups of exercises is determined (Kjaer et al.,

2018). The participant is then scheduled for two 1-hour group-based education classes and bi-weekly 1-hour supervised group exercise sessions for 8 weeks (Kjaer et al., 2018). Group size was recommended by the GLA:D® developers to be 4-8 participants with a maximum group size of 10 (Kjaer et al., 2018). The program ends with a final assessment where personal goals are revisited, and the four clinical tests are repeated. A more detailed description of the theory and development of GLA:D® Back has been published previously in the Kjaer et al protocol paper (Kjaer et al., 2018).

GLA:D® Back was developed around social cognitive theory and cognitive behavioural theory (Kjaer et al., 2018). As such, education and movement (exercises) are used to support the promotion of self-efficacy (Kjaer et al., 2018). Key messages in the patient education, (i.e. LBP is common, pain intensity does not reflect tissue injury, and the spine is strong and designed for movement) are displayed throughout the education sessions and these messages are further incorporated into the exercise sessions one per week (8 keys messages total) (Kongsted, Ris, et al., 2019). Throughout the group exercise sessions, the participants' existing beliefs and concerns are discussed.

The exercise section of GLA:D® Back incorporates strength, endurance, and flexibility training divided into eight groups with four levels of difficulty in each (Kjaer et al., 2018). The starting level for each exercise is agreed on by the GLA:D® Back clinician and the patient as suitable for the participant's tolerance (Kongsted, Hartvigsen, et al., 2019). Participants are encouraged throughout the exercise sessions to explore a variety of movements rather than doing the exercise in one "correct" way (Kjaer et al., 2018). Participants self-progress under guidance to more difficult exercises throughout the hour sessions, while clinicians guide the performance of exercises and the choice of exercise level to the degree needed (Kjaer et al., 2018). Thus, the exercise program is both standardised and highly individualised.

4.3.5 Feasibility outcomes

Four months after training, clinicians were asked the following questions: When did you start offering GLA:D® Back in the clinic? How many cohorts have you started? What is the number of patients in the registry? Based on the GLA:D Back 2019 Danish Annual Report (Ris I, Kongsted A, Hartvigsen J, Kjaer P, 2019), our criteria for feasibility success was pre-defined as 50% of clinics/clinicians conducting the program within 3 months of completion of the training course resulting in 66-88 participants registered in the database. During the study period, clinicians provided the investigators with ongoing, informal feedback via a private smart app channel as well as asking for help or information on any aspect of the GLA:D® Back program. Clinicians were also free to express concerns or ask questions of the investigators via e-mail.

4.3.6 Clinician outcomes

Clinicians were surveyed at three-time points: 1 week prior to participating in the 2-day GLA:D® Back workshop immediately after the GLA:D® Back training course, and 4 months after completing the GLA:D® Back training course.

Specifically, the pre-course survey included closed-ended questions about clinician demographics (age, sex, profession, years of clinical experience, role at clinic i.e. clinic owner, self-employed, employee, previous experience with GLA:D® knee/hip) as well as an assessment of their confidence with handling back pain patients (Practitioner Confidence Scale-PCS) and their attitudes and beliefs about back pain (Pain Attitudes and Beliefs Scale-PABS). The PCS and PABS were repeated by an electronic survey 4 months following the training course. The PCS is a 4-item scale measuring confidence in managing people with back pain (Smucker, Konrad, Curtis, & Carey, 1998). Each item is scored on a 5-point scale. (1=” strongly agree” to 5=” strongly disagree”) with the resulting sum score ranging between 4 to 20 where a

higher score indicates a lower confidence (Smucker et al., 1998). The PABS is used to assess the predominance of two treatment orientations toward the management of back pain: biomedical orientation or behavioural orientation (Houben et al., 2005; Ostelo, Stomp-van den Berg, Vlaeyen, Wolters, & De Vet, 2003). The biomedical subscale consists of 10 items (sum score 10-60) and the behavioural subscale of 9 items (sum score 9-54). Each item is scored on a 6-point scale. (1=" totally disagree to 6=" totally agree". Higher scores reflect a more biomedical or behavioural orientation respectively (Houben et al., 2005; Ostelo et al., 2003). Immediately following the GLA:D® course, clinicians were asked to rate the course with respect to course content, novelty, and usefulness with each of these domains scored on a scale of 0 to 10 (from 0=" very poor" to 10=" very good"). Clinicians were also asked to answer survey questions related to question from the DIBQ (Determinants of Implementation Behaviour Questionnaire) that were adapted for use in GLA:D® Back (Ris I, Schröder K, Kongsted A, Abbott, A, Nilsen P, Hartvigsen J, n.d.).

To better identify and understand barriers and facilitators of implementation, 4 months following the training course, the lead author (J.L.) conducted one-on-one semi-structured telephone interviews with all clinicians. The interview guide was centered on perspectives regarding the content of the clinical intervention and the implementation at their clinic with perspectives on patient recruitment for the program. The telephone interviews were twenty minutes in duration, audio recorded, transcribed verbatim and quotes related to various themes of GLA:D® Back were identified by J.L.

4.3.7 Patient outcomes

Patients who expressed interest in the study voluntarily provided their email address and received detailed information about the study as well as an electronic form to provide consent to be enrolled. If enrolled, they then received an automatically generated link to a baseline survey

on the day of the first consultation and 3 months later following completion of the GLA:D® program. If there was no response within 3 days, an automated reminder was sent.
The baseline survey collected demographic information, information on LBP history, previous treatment, and self-reported risk factors for a poor prognosis (The STarT Back Screening Tool) (Hill et al., 2008).

Both at baseline, and at the 3-month follow-up, a series of patient reported outcome measures were collected including pain intensity via a numerical pain rating scale (0-10 NRS), activity limitation (Oswestry Disability Index (ODI); 0-100), illness perceptions (the Brief Illness Perceptions Questionnaire (B-IPQ); 0-80), fear of movement (Fear Avoidance Beliefs Questionnaire (FABQ); 0-24), quality of life (SF-36 subscales) and “perceived physical fitness” (0-40) via self-assessed strength, endurance, cardiovascular fitness, balance. Use of pain medication was documented as a binary yes/no response.

At 3-months after completion of the program, the above patient reported outcome measures (PROMS) were collected again in addition to reporting of usage of non GLA:D® interventions (e.g. spinal manipulative therapy, massage therapy). Participants were also asked if they were satisfied with the GLA:D® Back program using a 5-point Likert scale (1- “not at all” to 5- “to a great extent”).

Finally, results for clinical tests conducted before and after GLA:D® Back were included in the participants database. These measures included physical performance assessed by a standing forward bending test (4-no pain with normal movement, 3-pain and normal movement, 2-no pain with abnormal movement, 1-pain and abnormal movement, 0-test not completed), the Ito extensor endurance test (static extension from 0 seconds minimum up to a maximum of 3 min),

the trunk flexor endurance test (0 seconds up to a maximum of 2 min in static sit-up position) and the sit to stand test (stand number of repetitions of standing from seated in 30 sec). Patient adherence was measured by the number of sessions attended.

4.3.8 Sample size

In this feasibility study, we limited participation to 20 clinics who each conducted a single GLA:D® Back intake of no more than 10 participants/ clinic. Clinician participation was capped to 20 clinics due to the size of our training facility. As for the limit of 10 patients per GLA:D class, this is the number described as optimal by the GLA:D® Back originators. As such, no formal sample size calculation was performed.

4.3.9 Analyses

Descriptive statistics were performed for all quantitative data collected.
Feasibility of adoption was based on multiple measures including the 1) number of clinics that offered the GLA:D® Back program and registered participants into the clinical registry within the first 3 months of the feasibility study, 2) number of clinicians that did the same, 3) the total number of participants enrolled in GLA:D® Back in that time period and 4) participants that finished the course with a final exit assessment and 5) the number of completed participants questionnaires at the 3-month follow-up.

Clinicians' attitudes and beliefs about back pain were measured by describing group medians, 25^{th} and 75^{th} percentiles on the PCS, and the PABS-PT at baseline and 4-month follow-up. To evaluate the with-in clinician change on the PABS, the median change scores were calculated together with first and third quartiles.

Subsequent inferential analyses were carried out in an exploratory manner using R software (Version 3.6). We employed the Wilcoxon signed rank test to evaluate the change in both clinician and participants' measures as many of these outcomes did not meet established assumptions for parametric testing.

For the qualitative feedback collected through semi-structured interviews, the use of thematic analysis was employed pragmatically by grouping quotes into themes relating to the clinician course, participants education, participants exercise, participants recruitment and the logistics of implementing the program in clinic. All clinicians were accommodating to the procedure and the interview feedback resulted in rich information to improve upon the GLA:D® Back program.

4.4 Results

4.4.1 Participating clinicians

Thirty-five clinicians (n=25 physiotherapists, n=10 chiropractors) with varying clinical experience (56% had 11-20 years clinical experience) participated in the 2-day course. All clinicians 100% (35/35) completed the GLA:D® Back pre-course survey and the post-course survey. At 4-months, 77% (27/35) of clinicians completed the follow-up survey. Sixteen clinics were represented by two clinicians and the three rural clinics were represented by one clinician each. Six out of the fifteen clinics were concurrently offering the GLA:D® knee and hip program and 13/35 (36%) of clinicians have referred patients to the GLA:D knee and hip program (**Table 4.1**).

Table 4. 1 Clinician characteristics and select outcomes

	n (%) (unless other specified)
Age, mean (range)	38 (24-58)
Female	15 (42%)
Physiotherapist	25 (71%)
Chiropractor	10 (29%)
Clinic Owner	12 (33%)
Self-employed in a clinic own by someone else	11 (31%)
Employee	12 (33%)
Clinical experience	
0-5 years	10 (28%)
6-10 years	6 (17%)
11-20 years	10 (28%)
>20 years	10 (28%)
Previous experience with GLA:D for knee/hip	
No experience	15 (42%)
Have referred to GLA:D in house	10 (28%)
Have referred to GLA:D in another clinic	3 (8%)
Have instructed GLA:D groups	2 (6%)
Evaluation of the GLA:D Back Training course, median (range)	
Content (0-10)	9 (5-10)
Usability (0-10)	9 (5-10)
Novelty (0-10)	9 (1-10)
Overall impression of the GLA:D Back programme	
Very Good	6 (24%)
Good	15 (60%)
Neither good nor bad	4 (16%)
Bad	0
Very Bad	0
Satisfaction with patient education materials	
Very Satisfied	6 (24%)

Satisfied	19 (76%)
Neither satisfied nor dissatisfied	0
Dissatisfied	0
Very dissatisfied	0

4.4.2 Clinician demographics at baseline

Clinicians were 42% female, 38 years old on average and were split into clinic owners (33%), self-employed (31%) or employees (33%) at a clinic with (71%) being physiotherapists and (29%) chiropractors. Most clinicians had greater than 11 years experience (56%) in clinical practice. Six percent (6%) had prior experience teaching GLA:D® knee/hip program and 58% were familiar with the GLA:D® knee/hip program (**Table 4.1**). Clinicians had a moderate biomedical and high behavioural orientation at baseline (PABS) and moderately high confidence when treating patients with back pain at baseline (PCS) (**Table 4.2**).

Table 4. 2 Clinician outcome measures evaluated by Wilcoxon Sign Test.

Variable	Pre-Training Median	Pre-Training Q1, Q3	Post-Training Median	Post-Training Q1, Q3	Difference in Median (Post-Pre)	Pseudo-median	p
PCS (4-20)	10.5	10.0, 11.0	9.0	9.0, 10.0	-1.5	1.5	< 0.001
PABS Biomedical (10-60)	27.0	23.0, 33.5	23.0	18, 29.5	-4.0	4.00	0.005
PABS Behavioural (9-54)	39.5	36.5, 42.0	42.0	37.5, 44.0	2.5	-1.50	0.023

p indicates p value

Q1: First Quartile, Q3 Third Quartile

Note: P values for differences are from Wilcoxon signed-rank test

Abbreviations: PCS (Practitioner Confidence Scale), PABS (Pain Attitudes Belief Scale)

4.4.3 Patient demographics at baseline

Most participants (60%) had experienced LBP for more than one year and had prior treatment for more than 4 weeks duration (69%). The average age of patient participants was 56 (SD=13) years old with 66% (n=49) being females (**Table 4.3**). At the time of enrollment, 50% (n=39) of participants were taking over the counter or prescription medications and had slightly higher than moderate B-IPQ scores median difference: 6.5, (p= 0.015) (**Table 4.3**). Almost half of the participants were classified as high risk (33/74, 45%) for risk factors of a poor prognosis according to the STarT Back Tool (Hill et al., 2008). (**Table 4.3**) Participants at baseline scored moderately high for fear avoidance behaviour with a value of 15 (range 0-24) and a median decrease at post-intervention of: 5.0, (p<=0.001), and had a medium perception of physical fitness at baseline with a value of 19 (range 0-40) and a median increase of 3 (p=0.031) (**Table 4.3**). No adverse effects were reported in this study.

Table 4.3 Patient baseline characteristics

	GLA:D Back Group (n= 74) Baseline
Sociodemographic	
Females, n (%)	49 (66%)
Age, mean (SD)	55.5 (13.4)
Height	167.6 (10.5)
Weight	80.22 (17.7)
No qualification	0
Vocational Training	18 (24%)
Higher education <3 years	32 (44%)
Higher education >3 years	8 (11%)

Ordinary work n=69	26 (38%)
Unemployed	0 (0%)
Rehabilitation	0
Retired	20 (29%)
Student/housewife/other n=69	12 (17%)
Clinical symptoms	
Pain duration n=72	
<4 weeks	12 (17%)
4-12 weeks	4 (6%)
3-12 months	13 (18%)
> 1 year	43 (60%)
Previous episodes n=74	
0	16 (22%)
1	10 (14%)
2-3	12 (16%)
>3	36 (49%)
Time since treatment-initiated n=71	
< 2 weeks	10 (14%)
2-4 weeks	12 (17%)
>4 weeks	49 (69%)
No. of health care visits for present LBP n=69	
1	29 (43%)
2-5	32 (47%)
6-10	4 (6%)
>10	3 (4%)

Pain medication	n=82
None	41 (50%)
Over the counter	25 (30.5%)
Prescription	14 (19%)
START Back risk	
Low	12 (16%)
Medium	29 (39%)
High	33 (45%)
Sick leave last 3 months*(n=45)	
0 days	28 (62%)
1-14 days	12 (29%)
> 15 days	4 (9%)
EQ-5D 0-100(SD)	68.9 (18.0)

4.5 Feasibility outcomes

The majority of the clinics (15/19, 79%) offered GLA:D® Back to their patients within the study period. Four clinics, three urban clinics and one rural clinic, did not start the program because of difficulty recruiting patients from colleagues at their clinics (referrals), a perceived lack of the ideal patient for the program, or their clinic was not ready to start the program in the first 3 months following training. GLA:D® Back was delivered by (25/35, 71%) of clinicians. The 10 clinicians who did not deliver the intervention expressed the intention to deliver the program in the future. One clinician who delivered the program reported that they would not offer the program again in the future as “it does not fit with my practice style”. The 15 clinics that actively participated in delivering the program enrolled a total of 78 participants who also attended the initial assessment (range 1-7 participants per group) within the first 3 months after having taken the course. Out of these fifteen clinics, ten clinics had a group size of at least 4 participants. Of

these seventy-eight participants, (69/78, 88%) attended the final assessment with nine participants dropping out for various reasons including a change in diagnosis of their condition (i.e. ankylosing spondylitis), worsening of symptoms unrelated to the back (i.e. shoulder), worsening of back symptoms, moved locations, or experienced a change in their work schedule. Of the enrolled seventy-eight participants, (52/78, 67%) completed the 3-month follow-up survey.

4.5.1 Clinician outcomes

Participating clinicians had a relatively high confidence rating on the PCS before the course and a slight increase in confidence with treating low back pain at 4-months post course (median difference: -1.5, $p<0.001$). The PABS indicated the clinicians had a combined biomedical and behavioural orientation with more of a preference for behavioral before the course. Clinicians showed significant differences in the PABS Biomedical Subscales (median difference: 4, $p=0.005$) and PABS Biopsychosocial (median difference: 2.5, $p=0.023$) which indicated clinicians were moving towards a behavioural orientation (**Table 4.2**).

The clinician's overall impression of the program was positive, and they were generally satisfied with the educational materials and exercise program (**Table 4.1**). Still, three clinicians were disappointed with the selection of exercises. A little more than half of the clinicians (19/35, 56%) were satisfied or very satisfied with the overall content of the exercise program, and all very satisfied/ satisfied with the educational materials (**Table 4.1**).

Clinician interview results

Thematic analysis of content from one-on-one interviews resulted the following two themes relating to program barriers and facilitators.

Identified barriers

Program cost and length were often commented to be limitations by patients interested in taking the program but ultimately not committing to it.

Statements about participants financial barriers from clinicians included:

> "…one difficulty for people was financial… that was probably the biggest one. When recruiting, people they were really excited… That sounds amazing. That's going to work for me. And then when it came down to the financial part of it, they just couldn't do it".

Or

> "…so, I think we had a few factors from our end was pricing. I think we had quite a few interested but a few just couldn't make it work in their budget."

There were some challenges for a few of the clinicians to recruit participants. Some clinicians suggested that they had difficulty with participants commitment to joining the program after being initially approached by clinicians and staff to join the program. Some additional reasons included timing of the classes (during the day or evening or weekends), cost of the program and committing eight weeks for the entire program.

Statements about barriers included scheduling issues and length of the program:

> "…we surveyed patients and asked what would work best; either afterwork or sometime mid day…I think in general we took the mid day one because we had more people (available) from that end…but I think timing [of the program] was

> one of those[negative] factors…a third factor was we found some people just couldn't commit for eight weeks"

A few clinicians informed us that they would not be able to perform recruitment for various reasons including having too few patients with the required profile and having very few patients interested in the program with statements such as:

> "…we ran a Facebook campaign for almost two months with no response…we decided external referrals were not happening…then had a meeting to decide if we're going to recruit candidates internally"

Identified facilitators

Clinicians evaluated the course with high scores for each of content, usefulness, and novelty (**Table 4.1**). This view was supported by one-on-one semi-structured interviews when clinicians were asked about rating the course. Representative statements included:

> "I thought the 2- day course flowed very well…the instructors are very knowledgeable. I felt like we had some fun doing it. I thought the course was very well done…I would rate the course as excellent"

Patient Recruitment: Clinicians found the 2-day clinician GLA:D® course made them more aware of which participants would benefit from the program with statements such as:

> "I also plan on… flagging patients who I think are moving into, or already have moved into chronic or recurrent back pain and making sure that I'm discussing this possibility [of GLA:D® Back] with them. And …immediately, my mindset is,

> okay…let's make sure I funnel these patients that way [into the GLA:D® program]".

Clinician Participants experience with GLA:D® Back: When asked about patients' experiences, clinicians made statements such as:

> "it is a novel form of treatment that allows the patients to take care of their own issues…by using GLA:D® , it's the exercises and knowledge that gives them [the patient participants] a long term tool that they can take home with them…showing them that movement is good and it's not necessarily one inherent movement that is going to cause them to mess their back up…but the more movement the better…understanding that movement is good".

Group exercises: Clinicians communicated about group exercise with statements such as:

> *"*The first couple of weeks, everyone was warming up to each other in the group…now it's a lot of fun. Everyone is really interacting with each other and enjoying each other. And it's cool because there is now a team dynamic of learning".

Increasing capacities with exercises: As for the effect of exercise, clinicians made statement similar to these comments:

> "…we had one patient that had a positive straight leg raise coming into [the program] and couldn't sit for more than 20 minutes and three quarters of the way through the program she drove 5 hours…. I asked how was sitting for that long…

She just looked at me with a blank look… Then she said… you know I just realized that I didn't have a problem".

4.6 Patient outcomes

4.6.1 Patient adherence

After the GLA:D® Back intervention, 84% of the 78 participants reported that they attended two of the education sessions and 74% of participants attended 11-16 exercise sessions throughout the 16-session program. A small proportion of participants (n=2) reported that they did not receive the education portion of the program and key messages during the exercise sessions which may have a negative effect on post intervention outcomes seen after the intervention.

4.6.2 Objectively assessed physical function

From baseline to 3 months, participants (n=52) had a median improvement of 1 repetition on a chair sit to stand for 30 seconds ($p<0.001$), a median improvement of 32 seconds ($p<0.001$), on the trunk flexor test (range 0-120 sec), and a median improvement of 80.5 seconds ($p<0.001$) on the Ito extensor endurance test (range 0-180 sec) (**Table 4.4**).

4.6.3 Self-reported measures

From baseline to 3 months participants had a large median improvement of 5 ($p<0.001$), on the FABQ (range 0-24) and a small median improvement of 6.5 ($p=0.015$), on the B-IPQ surveys. (**Table 4.4**)

From baseline to 3 months, participants had a minimal median improvement of -5 ($p<0.001$) on the ODI and moderate median improvement of 2 on NPS Back pain (<0.001) and moderate improvement of 1 on NPS Leg pain ($p<0.001$) (**Table 4.4**).

At the 3-month follow up, most patient participants (76%) were satisfied or greatly satisfied with the GLA:D® Back program and (37/50) or 74% of participants used the GLA:D® Back at home although this is not a requirement of the program. The program was well tolerated by the participants with only 3/48 or 6.25% of participants experiencing worsening or new symptoms from the GLA:D® Back exercise sessions (**Table 4.1**). The largest change in outcome measures were seen with fear avoidance (FABQ) and the trunk flexor endurance, Ito extensor endurance and the sit to stand in 30 seconds. Disability measures observed a minimal effect on ODI measures from pre to post intervention and moderate changes were seen with leg pain and back pain (**Table 4.4**).

Table 4. 4 Patient outcome measures evaluated by Wilcoxon Sign Test

Variable	Pre-Training Median	Pre-Training Q1, Q3	Post-Training Median	Post-Training Q1, Q3	Difference in Median (post-Pre)	Pseudo-median	P
FABQ (0-24)	15	9, 18	10	3, 12	5	6.50	< 0.001
B-IPQ (0-80)	50.5	45.0, 56.0	44	39, 54	6.5	4.00	0.015
Perceived Physical Fitness (0-40)	19	16, 24	22	15, 27	3	-1.50	0.031
Standing Forward Bending Test (0-4)	3	2,4	4	4,4	1	-1.50	<0.001
Trunk Flexor Endurance (0-120sec)	39.5	19.0, 74.0	71.5	39.0, 120.0	32	-27.00	< 0.001

Extensor Endurance (0-180sec)	60	22, 120	140.5	75.0, 180.0	80.5	-70.00	< 0.001
Sit to Stand In 30 secs	11	9, 13	14	12, 17	3	-3.00	< 0.001
ODI	25	16, 34	20	10, 28	-5	6.00	< 0.001
Back Pain (0-10)	5	3, 7	3	1, 4	-2	2.50	< 0.001
Leg Pain (0-10)	2	0.5, 5.0	1	0, 3	-1	2.00	< 0.001

4.7 Discussion

This study evaluated the feasibility of implementing GLA:D® Back, a structured group education and exercise program for people with persistent or recurrent back pain in the Canadian healthcare setting. Based on our success criteria, the program was found to be feasible in this setting.

4.7.1 Facilitators of GLA:D® Back adoption

GLA:D® trained clinicians were confident and motivated to implement this program which suggests that this may be a group of motivated, experienced clinicians. This group also volunteered for this study which implies that they had an affinity to this mode of treatment delivery.

Interestingly, the feasibility of the program was not heavily influenced by the current requirement that patients pay a substantial fee to participate. This requirement is a common one within this Canadian jurisdiction as most rehabilitation services are paid for out-of-pocket. Therefore, this circumstance is familiar to the Canadian public and as a result, was not in direct competition

with programs that could be accessed at no cost to patients. Still, this financial restriction would most likely prevent access to many potential participants whose demographics and case history may be significantly different from those enrolled in this study. Consequently, caution should be exerted should these results be generalized to non-participants with low back pain within the same health care region.

Table 4. 5 Proportion of patients who reported they had received listed interventions or care from various professions in the last month other than from the GLA:D® Back clinician

	GLA:D® Back group (n=53)
GP	15%
Chiropractic	7.5%
Physiotherapy	5.6%
Massage	7.5%
Other	3.7%
OTC Medication	18.9%
Prescription Medication	20.8%
Number of visits in the last month	
One Time	28.6%
2-5 Times	57.1%
6-10 Times	14.3%
More than 10	0%
Satisfaction with the GLA:D Program	
To a great extent	31.5%
Greatly	40.7%

Somewhat	22.2%
To a small extent	0%
Not at all	1.9%
Do not know	3.7%

4.7.2 Barriers of GLA:D® Back adoption

Patient recruitment was seen by clinicians as difficult especially with patients who may work in shifts or individually expressed concern about having the financial resources to participate. This financial inequity may be a driver of the observation that patients with low socioeconomic status when measured by education, past occupation, income, subjective economic situation, and wealth, are more predisposed to experience low back pain when compared to those with high socioeconomic status (Ikeda et al., 2019).

Other program barriers mentioned included that the clinic was not organizationally ready to start the program due to logistical barriers such as timing, schedules of therapists, low recruitment or associate clinicians moving to a new clinic location or other life circumstances such as being pregnant and going on maternity leave.

For those clinicians who were not successful in starting and running the program with participating patients it is possible that they had other motivations for participating in the study. This may include expectations of more patient referrals from physicians and researchers as well as potential subsidy from the provincial healthcare system; only 10/19 (53%) were able to form a group of at least four patient participants.

4.7.3 Clinician outcomes

Clinicians' evaluation of the course was positive which may have been associated with our successful adoption rate. Also, clinicians held a moderately high orientation for a behavioral approach to care both before and after the 2-day course which also may have contributed. Small changes were observed in clinician PABS-PT scores indicating that clinicians held a strong belief both for biomedical orientation and behavioural before the course. Congruence between clinician beliefs and the underlying principles of the GLA:D® Back problem also favoured adoption. Interestingly, practitioner's confidence was relatively unchanged from baseline to 4-months following the training course which may relate to the experience level of the clinician cohort, the practice orientation of this cohort of clinicians, the quality of the training session or other factors not measured here. As such, these results are for a fairly short period following clinician training. Longer term studies will be needed to determine if these changes are sustained.

Clinicians mentioned in the interviews that GLA:D® Back built a strong group dynamic that could be an important factor for development of self efficacy through vicarious experience by observing other people in a similar situation. Clinicians also suggested that the program builds up physical capacities to match daily demands of participants' activities. These two observations are important in this type of evidence-based program which is based on the Social Cognitive Theory (SCT) targeting patients' goals. SCT provides opportunities for social (group) support through instilling expectations, self-efficacy, and using observational learning and other reinforcements to achieve behavior change, while considering their individual capacity for performance (Bandura, 2004).

4.7.4 Participants outcomes

Most participants enrolled in GLA:D® Back (60%) had LBP for greater than one year indicating that the majority of participant reports of the duration of pain was congruent with the inclusion criteria for the program. This is important because clinicians were appropriately targeting patients with recurrent or persistent LBP which is the condition the program was designed to address. This suggests that through intentional enrollment by clinicians, curiosity by patients or a combination of both, the majority of those in the program had persistent or recurrent LBP. Further studies should be considered to evaluate how the GLA:D® Back program may perform when used with similar populations but in different situations such as pre-surgery waitlists or post-surgical recovery.

All patient factors evaluated were done so as an exploratory exercise given the lack of a sample size calculation in this feasibility study. The B-IPQ and SF-36 did not demonstrate a significant change over time. In this case, the measurement duration may not have been enough to counteract multitude of factors that may impact a person's beliefs and quality of life. The FABQ also showed significant improvement which suggests the education and exercise components of the program may directly address this concept. In this study, patient capacity improved as demonstrated by the four performance measures. Combined, these results may motivate clinicians and patients similarly and endorse this mode of program delivery.

4.7.5 Lessons learned

Feasibility may depend on clinicians properly informing patients of what to expect in the course in terms of fees, group setting and availability. Although some clinicians from this study had difficulties running the program, we found that the most motivated clinicians with a large heterogeneous LBP population were the greatest adopters of the GLA:D® Back program. Both GLA:D® Back programs in Alberta and Denmark had similar challenges with adoption.

Unfortunately, as the only program outside of Denmark conducting GLA:D® Back thus far, lessons of how to improve uptake are still evolving. These lessons may include offering a wider range of program times to accommodate a range of patient schedules, emphasis placed on the potential benefits of group vs individualized programming and identifying ways to decrease out-of-pocket costs for patients to take the course.

4.7.6 Study strengths and limitations

This was a feasibility study and therefore was not designed or powered to fully evaluate clinician/participants outcomes. We did not evaluate the fidelity in treatment delivery and do not know to what extent the program was delivered as intended. A future trial to evaluate the efficacy or effectiveness of GLA:D® Back is a potential consideration. This work represents the first publication of data related to an English implementation of the GLA:D® Back program which provides a basis for its use in Canada and other English-speaking jurisdictions.

4.7.7 Implications for future studies

Possible directions for future studies would be to transition to a study design that evaluates the effectiveness of GLA:D® in terms of pain, disability, and self-efficacy.

4.8 Conclusion

The English translation of the Danish GLA:D® Back program was feasible for Albertan clinicians to implement into practice in both urban and rural settings.

Declarations

Ethics approval and consent to participate

The data collection has obtained authorisation from the University of Alberta ethics. This study was approved by the Human Research Ethics Board of the University of Alberta (Pro00085118).

When registered by the clinician, the patient receives an email with a link to a patient-reported survey. Written information about the study, data protection, and participants' rights are in the survey with a request to confirm consent for using data for research purposes.

Consent for publication

N/A

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

N/A

Funding

No funding was obtained.

Author' contributions

All authors contributed to study design. JL and VA did the data analysis, and JL was responsible for data collection and drafted the manuscript. All authors contributed to subsequent revisions, read, and approved the final version of the manuscript. GK, AK, and JL were involved in teaching the translated GLA:D® Back course.

Acknowledgements

The authors would like to thank Inge Ris Hansen, Line Thomassen and Jasper Hoeg for their help in translating Danish GLA:D® Back content and in conducting the clinician training session. We would also like to thank clinicians and patients for participating in this study.

Conflict of Interest

None.

4.9 References

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CHAPTER 5: DISCUSSSION

The purpose of this thesis was to investigate if an evidenced-based group exercise program, founded on best practice guidelines, could be feasibly implemented into physiotherapist and chiropractic practices around urban and rural Alberta. Two papers published as part of this thesis explored the effectiveness of a group education and exercise class for the management of chronic low back pain. The first paper, in the third chapter, compares the effectiveness of group-based exercise to other non-pharmacological interventions for chronic low back pain: A systematic review (Lemieux, Abdollah, Powelske, & Kawchuk, 2020). The second paper, in the fourth chapter, investigated the feasibility of implementing an English language version of GLA:D® Back (J Lemieux et al., 2020).

5.1 Summary and interpretations

The two published papers in this thesis, found in chapter three and four, explored the possibility of a group exercise being used as an effective program for patients with persistent recurrent LBP. With this in mind, we performed a systematic review that explored the possibility of group exercise being equally effective for pain and disability measures as one-on-one interventions for chronic LBP. The results of the systematic review indicated that group exercise can be as effective for the management of persistent LBP as individual non-pharmacological care for pain and disability measures.

We also conducted a feasibility study to see if GLA:D® Back could be successfully implemented into clinical practice and measure whether participant outcomes improved. The information pertaining to clinicians found that they were satisfied with the translation of the course material and were highly satisfied with the 2-day course overall. The results found that the clinicians trended towards increased confidence (PCS) in treating LBP and belief in the behavioural nature

(PABS) of the GLA:D® Back program after the 2-day training session. In addition, many clinicians found that teaching GLA:D® Back was a positive experience and was achievable in everyday clinical practice. The results met the expectations supported by the hypothesis that 50% of clinicians would recruit between 66-78 participants for this feasibility study. Our clinicians did better than expected and 71% of the clinicians recruited 78 participants within 4-months which confirms that the program was feasible. When looking at secondary measures related to PROM's the study found that patients improved on fear avoidance (FABQ), physical capacity, pain (NPRS) and disability (ODI) measures. These results confirmed that a group exercise program based on LBP guidelines was feasible and could be an effective program for patients with persistent recurrent LBP. Thus, group exercise programs, in particular GLA:D® Back, may be an effective way to integrate evidence-based care into clinical practice.

5.2 Strengths and Limitations

The importance of this thesis is that it contained a framework that can help implement evidence-based guidelines (EBG) into clinical care. It also has the potential to change how healthcare is delivered, as it shifts from a focus on individual care to one on group care and from a biomedical to a biopsychosocial focus. Thus, a strength of this thesis is that it indicates that group care for LBP is a viable option for people with LBP. This study can also provide the foundation for a larger-scale study.

A limitation of this thesis is we assumed that group exercise programs were a better option than usual physiotherapy care, including exercise, but we have not conducted a RCT as confirmation.

Another limitation of this study was that it was confined to an Alberta based cohort. As a result, we do not know if these findings are generalizable to other regions. An evaluation of the external validity of other populations not using English, such as Quebec, or non-Canadian English, such

as Australia or New Zealand, would help us determine the likelihood of this program's success around other jurisdictions.

5.3 Implications

Healthcare faces enormous challenges in the future, with the financial burden of costs related to LBP growing exponentially, many stakeholders are striving to initiate change. Recent evidence suggests that current practice orientation is discordant with the guidelines and only exacerbating the existing problem. Many experts are encouraging a significant change in the application of care for LBP from “low-value” care to “high-value” care. Programs like Choosing Wisely Canada encourage health care professionals to take the lead in reducing unnecessary treatments, procedures, and tests (Canadian Spine Society, n.d.). This initiative aims to identify tests and treatments commonly utilized in many medical specialties which fail to observe guidelines and put patients at risk. Choosing Wisely along with many international guidelines for low back pain have recommended against routinely imaging patients with LBP unless red flags are evident, against the use of epidural steroids for axial LBP and against the use of opioid medication as a first-line treatment for acute mechanical or chronic LBP Along with Choosing Wisely, the Alberta Institute of Health Economics recommends evidence-based guidelines for non-specific chronic back pain, and its mission is to help decision-makers get the most value from the health system (IHE, n.d.). According to this, a change will demand a cultural shift in LBP beliefs and practice.

This shift would include patient-centered care in which those with LBP are empowered and given tools to promote self-management skills, such as those provided by GLA:D® Back. This program would offer creative ways to reduce expenditures on managing LBP and assist health authorities to make changes. Thus, this program provides a great opportunity to initiate a shift from non-discordant individual back care to evidence-based group care for LBP.

5.4 Speculation

The thesis provoked speculations for patients regarding costs. If evidence-based group exercises are as effective at treating pain and disability as individual non-pharmacological interventions, then they may be a means of providing “high-value” care to underserved low-income individuals. With this program, health care authorities may have the ability to bridge the socioeconomic gap between those with high income and those with low income by providing a lower cost alternative. Since LBP and its associated costs have increased worldwide, notably in low- and middle-income countries, there is now an urgent need for more affordable evidence-based care (Buchbinder, Underwood, Hartvigsen, & Maher, 2020; Hartvigsen et al., 2018). In the future, LBP as well as the majority of MSK conditions may be treated through the development of more affordable, cost-effective group programs with equal effectiveness (Lemieux et al., 2020; O’Keeffe et al., 2017). As these group programs become more popular, we may see alternative care pathways for LBP and other MSK conditions. Thus, a primary focus for healthcare authorities should be to provide funding for these “high-value”, cost-effective group programs. Programs, such as GLA:D® Back, which teach self-management skills and adhere to the guidelines may be ideally positioned to provide care to the majority of patients with persistent recurrent LBP (Kongsted et al., 2019; J Lemieux et al., 2020). This work may give us insight on understanding the mechanisms aimed at developing patient self-management skills

.

Additionally, this thesis offers clinically relevant data for clinicians to consider when treating patients with low back pain. Many health-care providers continue to provide care within a biomedical framework. This practice orientation negatively impacts adherence to clinical practice guidelines, which advocate for a biopsychosocial model of care (Domenech, Sánchez-Zuriaga, Segura-Ortí, Espejo-Tort, & Lisón, 2011). Thus, the GLA:D® back program is positioned to fill a

gap by utilizing the recommended evidenced-based elements and packaging them into a program that is ready for use. The NICE guidelines suggest people with low back pain consider a supervised group exercise program of 10 or more participants for 12 weeks to manage their condition ("Low back pain: early management of persistent non-specific low back pain Full guideline May 2009 National Collaborating Centre for Primary Care," 2009). A one-to-one supervised exercise program is only recommended in the event the group program is not suitable for the individual ("Low back pain: early management of persistent non-specific low back pain Full guideline May 2009 National Collaborating Centre for Primary Care," 2009). Furthermore, the above guidelines along with our systematic review, indicated that there is no evidence that one-to-one based exercise is superior to group exercise. The NICE group also observed that group exercise could be delivered at a lower cost than one-to-one treatment ("Low back pain: early management of persistent non-specific low back pain Full guideline May 2009 National Collaborating Centre for Primary Care," 2009). In other words, by using a group exercise program such as GLA:D® Back, clinicians can shift to the BPS model while providing more effective care. GLA:D® Back is in line with these guidelines, and it has been thoughtfully developed and piloted in Denmark with continued success. We have also tested the viability of the English version of GLA:D® Back throughout Alberta and found it to be feasible in clinical practice. For clinicians, it is more practical and efficient to offer a group program to maximize the number of patients that a clinician can care for per session. Another positive effect of a group program is that they utilize active care as opposed passive care often seen in one-to-one care. The expectations in group programs shift so that participants take a more active role in their own care and can build greater self-efficacy.

The results of the systematic review and feasibility study as a whole constitute a significant step because they allow us to go to the next stage of development for GLA:D® Back. With this information, the program can be modified to address those concerns. Together, these findings

could transform the future of care for LBP in addition to many MSK conditions and represent a significant paradigm shift.

5.5 What does this mean for clinicians?

Evidence from the GLA:D® Back feasibility study supported the idea that pre-packaged evidence-based group programs could be used to assist clinicians to integrate an evidence-based program into clinical practice. From this valuable information we have established a baseline of a program by which to compare new programs.

The information in this thesis is also important because it substantiated that evidence-based group programs are equally effective as individual care for chronic LBP (Lemieux, Abdollah, Powelske, & Kawchuk, 2020). It may also influence clinical practice and shift it to include group exercise and behavioral programs. Even Though, Non-GLA:D® certified clinicians may think they can provide an alternative to GLA:D® Back, they may fail to provide the same amount of guideline-based care to their patients. Although GLA:D® back is not the only way to integrate evidence into practice, it is founded on research and provides a pre-packaged program for clinicians to successfully implement.

5.6 Future studies

One promising direction for future studies would be to evaluate GLA:D® Back's long-term effectiveness on patients' pain, disability, and self-efficacy in randomized control trials (RCTs) in an English setting. Although the GLA:D® Back study from Denmark found promising results it remains to be seen if these results can be generalized to an English version of GLA:D® Back in Canada. One reason that this work has not been done is that a feasibility study was needed to determine if it was possible to implement GLA:D® Back on a larger scale.

Second, the GLA:D Back feasibility study did not include a fidelity check to evaluate how closely clinicians followed the program material; a future study could address this as well as a trial to test long-term implementation in terms of reach, efficacy, adoption, implementation, and maintenance (RE-AIM) (Glasgow, McKay, Piette, & Reynolds, 2001). RE-AIM is used to guide program planning by systematically examining strengths and weaknesses of chronic illness management interventions and help improve the implementation of health interventions into practice (Glasgow et al., 2001). This information is important because it will measure whether the program as intended is implemented and maintained over time.

Another direction for future studies may explore a system that could identify subgroups of patients that are ideally suited to experience the greatest effect of this type of group program. This system could also identify patients that are not ideally suited to participate in the GLA:D® Back program and triage them toward more appropriate care for their back pain.

Researchers that authored the Lancet LBP series a “call to action” to reduce “low-value” care for LBP ask for solutions that implement best practice and redesign clinical pathways (Buchbinder et al., 2020). In this regard, researchers could examine the GLA:D® program as a part of a comprehensive “high-value” care pathway that can facilitate patients’ selection of the best treatment options and would compare the overall costs of the patients' medical care compared to non-discordant care.

One interesting development that occurred in the past year was Tele-GLA:D® Back. Since the COVID-19 pandemic, all in-person programs were suspended, which created a significant barrier to continuing studies. To overcome this barrier developers of GLA:D proposed the idea of a Tele-Health platform for GLA:D® Back. Tele-GLA:D® Back is a version of GLA:D® back that is

performed via the video-conferencing application Zoom. The assessments and follow-ups are performed one-on-one through Zoom then the group logs in to participate in the group education and exercise sessions. The participants and the practitioner meet through Zoom at the scheduled session times in groups of 4-8 participants. In the past year research has begun to inquire whether this Tele-Health version of GLA:D® Back is feasible and can be implemented with GLA:D® Back providers across Alberta. This version of GLA:D Back has promising applications for the future in rehabilitation and may result in reaching more areas of the country that are less accessible to care.

Thus, this thesis provided valuable information that may shape the future of chronic recurrent low back pain care. It provided evidence that a group program is as effective as individualized non-pharmacological interventions, and that an evidence-based program can assist clinicians in implementing “high-value” care into clinical practice.

The major goal of this thesis was to obtain knowledge about the feasibility of GLA:D® Back program in preparation for a larger, more comprehensive RCT/implementation study, comparing GLA:D® Back with usual care with respect to medication usage, healthcare costs, and effectiveness. In conjunction with these studies, a national roll-out of the program will be initiated.

5.8 Conclusion

GLA:D® Back has been thoughtfully designed to assist clinicians in delivering well established evidence-based group exercise programs to people suffering from persistent recurrent LBP. Thus, GLA:D® Back represents a potential opportunity for stakeholders to shift away from “low-value” care to “high-value”, cost-effective, evidence-based care. This shift represents what world experts are recommending as a call to action from the 2017 Lancet LBP series of papers (Buchbinder et al., 2018). The most recent update to the Lancet series proposed that healthcare funders should

stop paying for ineffective care and harmful tests; rather, they should change payment systems and legislation to encourage delivery of the most appropriate high-value care (Buchbinder et al., 2020). Thus, GLA:D Back aims to provide the knowledge about how to implement best practices based upon a theoretical framework that is supported by evidence-based guidelines. Consequently, it may bridge the gap between evidence-based guidelines and practice, providing patients with alternative care options.

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Appendix I: Library search keywords

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily 1946 to July 23, 2019
Date searched: June 26, 2020
Results: 206

1. (Good adj (life or living) adj2 osteoarthritis adj Denmark adj (back or lumbar)).mp.
2. (("GLA:D" or GLAD) adj8 (back-pain or lbp or lumbar-pain)).mp.
3. happy-back.mp.
4. ((Group* not (control-group* or intervention-group* or between-groups)) adj5 (exercise* or strengthening or physical-activity or strength-training)).mp.
5. ((chronic or persistent or long-standing or long-duration or ((duration or lasting) adj months)) and (back-pain or lbp or lumbar-pain)).mp.
6. 4 and 5
7. 1 or 2 or 3 or 6

EMBASE 1974-July 23, 2019
Date searched: June 26, 2020
Results: 280

1. (Good adj (life or living) adj2 osteoarthritis adj Denmark adj (back or lumbar)).mp.
2. (("GLA:D" or GLAD) adj8 (back-pain or lbp or lumbar-pain)).mp.
3. happy-back.mp.
4. ((Group* not (control-group* or intervention-group* or between-groups)) adj5 (exercise* or strengthening or physical-activity or strength-training)).mp.
5. ((chronic or persistent or long-standing or long-duration or ((duration or lasting) adj months)) and (back-pain or lbp or lumbar-pain)).mp.
6. 4 and 5
7. 1 or 2 or 3 or 6

CINAHL Plus with Full Text (EBSCOhost platform)
Date searched: June 26, 2020
Results: 262

S1: (Good N1 (life or living) N2 osteoarthritis N1 Denmark N1 (back or lumbar)) OR (("GLA:D" or GLAD) N8 (back-pain or lbp or lumbar-pain)) OR happy-back
S2. ((Group* NOT (control-group* or intervention-group* or between-groups)) N5 (exercise* or strengthening or physical-activity or strength-training)) AND ((chronic or persistent or long-standing or long-duration or ((duration or lasting) N1 months)) AND (back-pain or lbp or lumbar-pain))
S3. S1 OR S2

Scopus
Date searched: June 26, 2020
Results: 506

TITLE-ABS-KEY ((Good W/1 (life or living) W/2 osteoarthritis W/1 Denmark W/1 (back or lumbar)) OR (("GLA:D" or GLAD) W/8 (back-pain or lbp or lumbar-pain)) OR happy-back) OR TITLE-ABS-KEY ((Group* W/5 (exercise* or strengthening or physical-activity or strength-training)) AND ((chronic or persistent or long-standing or long-duration or ((duration or lasting) W/1 months)) AND (back-pain or lbp or lumbar-pain)))

Key words
GLA:D
Back
Lumbar
Back pain, LBP, lumbar-pain
Happy-back
Group
Exercise, Strengthening, physical-activity, Strengthening-training
Chronic, persistent, long-standing, long-duration

Appendix II: Systematic Literature Review Data Extraction Form

Click here to choose a reviewer
Click here to enter a date.
Study description

ID No.	

STUDY SELECTION CRITERIA

Inclusion	**Exclusion**
☐ English	☐ Other languages
☐ Group Exercise VS Usual Care	☐ Conference Proceedings
☐ Original study	☐ Specific LBP
☐ Low Back Pain	☐ Case Series < 10 Subjects
☐ Full text available	☐ Case Studies
	☐ Systematic Reviews
	☐ Narrative review
	☐ Protocols

DECISION:☐ Included ☐ Excluded ☐ Unclear

Study goals, type and timeline

Goal of the study	
Type of the study	
Timeline of study	Click to select the timeline of the study

Subject selection criteria.

Inclusion Criteria?	☐ Not reported ☐ Unclear ☐ Yes, Specify:
Exclusion Criteria?	☐ Not reported ☐ Unclear ☐ Yes, Specify:
Subject recruitment	☐ Random ☐ Consecutive ☐ Volunteers ☐ Purposeful.

Groups (definition) or define reported group and subgroups

Group name:			
No of participants			
Age			
Diagnosis			
Pain duration			
Pain intensity			
Pain location			
Height			
Weight			
Gender	# of male: # of female:	# of male: # of female:	# of male: # of female:

Exercise information (copy as needed if multiple methods were employed)

Type of exercise	
Duration	

List of measurements outcomes (for every subgroup/time-point/measure)
Mean:
SD:
SE:
Range:
Min:
Max:
Other, specify:

Results of statistical test of differences within and between groups:
Name of the test used:
Variables compared:
Groups or times compared:
P-value (for each comparison of interest):
Report of the mean difference and variability for each pairwise comparison:

Results of statistical test of correlations between the effects of group exercise and other variables of interest:
Name of the association test used:
Variables tested:
Group tested:
Association estimate (correlation coefficient, regression equations)
P-values:

Results of statistical test for diagnostic accuracy
Name of the diagnostic statistical test used:
Name of the gold standard test:
Name of the variable of interest:
Diagnostic test estimate:
P-value or confidence interval:

Appendix III: Appraisal Form

Criterion	Yes	No	NA	Comments
Subjects recruitment				
Are the characteristics of the participants included in the study clearly described?	☐	☐	☐	
Were the demographic characteristics of the sample reported for each group analyzed?	☐	☐	☐	
Were the subjects asked to participate in the study representative of the entire population from which they were recruited?	☐	☐	☐	
Were those subjects who were prepared to participate representative of the entire population from which they were recruited?	☐	☐	☐	
Was an attempt made to blind study subjects to the intervention they received?	☐	☐	☐	
Were study subjects randomized to intervention groups?	☐	☐	☐	
Were participants' characteristics stable during research?	☐	☐	☐	
Examiners				
Were the training and qualifications of the examiner(s) reported?	☐	☐	☐	
Was/were the examiner(s) blinded to the results of the comparator test when comparing different test measurements?	☐	☐	☐	
Was/were the rater(s) blinded to the results of previous measurements performed by the same or different examiner(s) (e.g. blinded to pre-enrollment condition)?	☐	☐	☐	
Was the randomized intervention assignment concealed from health care staff until recruitment was complete and irrevocable?	☐	☐	☐	
Methodology				
Are the exposures/interventions of interest clearly described?	☐	☐	☐	

Criterion	Yes	No	NA	Comments
Was the sample size included in the analysis adequate?	☐	☐	☐	
Is replication of the assessment procedure possible? (description sufficiently detailed)	☐	☐	☐	
Are the distributions of principal confounders in each group of subjects to be compared clearly described?	☐	☐	☐	
Was there an adequate adjustment for confounding in the analyses from which the main findings were drawn?	☐	☐	☐	
Outcomes				
Is the hypothesis/aim/objective of the study clearly described? Must be explicit (Only focus on objective related to the study of the effect of group exercise).	☐	☐	☐	
Validity reported for the main outcome measure	☐	☐	☐	
Handling Missing Data (Concurrent and Criterion Validity)				
Compliance acceptable in all groups (80% acceptable)	☐	☐	☐	
Was the percentage of missing items given (Only for the analysis of the effect of group exercise)?	☐	☐	☐	
Withdrawal/dropouts rate described and acceptable	☐	☐	☐	
Have the characteristics of participants lost to follow-up been described?	☐	☐	☐	
Was compliance with the intervention/s reliable?	☐	☐	☐	
Was there a description of how missing items were handled?	☐	☐	☐	
Were hypotheses regarding correlations or mean differences formulated a priori (i.e. before data collection)?	☐	☐	☐	
Was the expected direction of correlations or mean differences included in the hypotheses?	☐	☐	☐	

Criterion	Yes	No	NA	Comments
Statistical Analysis				
Have actual probability values been reported (e.g. 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?	☐	☐	☐	
Sample size described for each group	☐	☐	☐	
Were design and statistical methods adequate for the hypotheses to be tested?	☐	☐	☐	
Has confidence interval for pre- and post-intervention or change in outcomes from before to after intervention been reported?	☐	☐	☐	
Have effect sizes for outcomes been reported or can be computed by the reviewer?	☐	☐	☐	
Results				
Are the main findings of the study clearly described?	☐	☐	☐	
Have all important adverse events that may be a consequence of the intervention been reported?	☐	☐	☐	

Overall Score: out of 32 (%)