PATIENT LIFTING DEVICE USE BY CAREGIVERS IN A HOSPITAL SETTING:

A PROPOSED RESEARCH PROGRAM

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ABSTRACT

The literature cites several recurrent barriers that contribute to the under-utilization of patient lifting devices (PLDs) by caregivers (CGs), resulting in the profession being at high-risk for musculoskeletal injury. There is considerable evidence that training is a barrier to PLD use, due to the staff shortages and time constraints that result when CGs attend (provincially mandated) off-site hands-on practical training. Therefore, the current research program aims to contribute towards a better understanding of the barriers to the chronic concern of low PLD use by CGs, and, to evaluate an alternative approach that could be used to reduce the time CGs spend off the floor and enhance musculoskeletal health and well-being. Study 1 will conduct focus groups and administer a Theory of Planned Behaviour (TPB)-based questionnaire to better understand the barriers between (a) CGs' knowledge (training/education) and intent to use PLDs, and (b) CGs' intent to use PLDs and actual PLD use (i.e., behaviour). Also, patients and their family members will be interviewed to better understand the role of the patient as a potential barrier to PLD use. Study 2 will conduct focus groups with: (i) hospital staff who design, develop and deliver PLD training programs, (ii) unit managers, and (iii) new CG hires. Via questionnaire, Preceptors will evaluate the impact of the barrier subcategories identified on the perceived overall effectiveness of a PLD training program. Study 3 will explore the feasibility of implementing vicarious learning through observation (two intervention groups) as an effective alternative to off-site hands-on learning (control group) for new CG hires, with Preceptors evaluating the three groups' effectiveness via a questionnaire. It is hypothesized that (a) training is an important barrier to the under-utilization of PLDs by CGs (Study 1), (b) there is a need for an effective alternative to off-site hands-on learning that does not remove CGs from units (Study 2), and (c) vicarious learning through observation is as effective as hands-on learning for the utilization of PLDs by new CG hires.

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DECLARATION OF ACADEMIC ACHIEVEMENT

I, Kathy Kawaja, declare this thesis to be of my own work. I am the sole author of this document and gathered the literature independently. I was involved in all aspects of the work. To my knowledge, this work does not infringe on the copyrights of others. Dr. Jim Potvin assisted the conceptualization of the project ideas and the design of the experimental protocols. Dr. Jim Potvin edited and reviewed all written work.

CHAPTER 1: GENERAL INTRODUCTION

1.1 Conducting Research in a Global Pandemic

For graduate students world-wide, attempting to conduct research during a global pandemic proved to be very challenging. The fortunate students who were able to continue their research were required to adhere to community health guidelines under COVID-19. Accessing human participants, materials and equipment became a barrier as was navigating technical issues associated with Virtual Private Networks; not to mention the elevated stress levels and daily concerns about the pandemic's effect on study timelines and the uncertainty of the pandemic duration.

In my case, the timing of the pandemic was dreadful since it began one month after I had just spent 10 months obtaining dual research ethics, which tested my patience and resiliency to the limit. I was so excited to begin recruiting CGs for my study. I conducted a walkthrough of the units at Princess Margaret Hospital on March 6th 2020, just days before the World Health Organization would declare COVID-19 a global pandemic. Little did I know at the time, but the next 20 months would test my patience and resilience even further, since, as I was about to find out, studying CGs in a large hospital setting during a global pandemic was nothing short of impossible.

In March 2020, UHN announced that all non-essential research would be put on hold due to the rising case numbers of COVID-19 infection. Except for my UHN Principal Investigator, I was cut-off from all hospital contacts as priorities shifted and front-line health care workers experienced the highest levels of stress, burnout, exhaustion, and turnover of their careers. Despite emails and phone calls to touch base over the next two months, there was no time at the hospital to support a student researcher. After the first wave of COVID-19 passed, I was hopeful that my study could re-start and I could begin recruiting participants. I would watch the UHN Intranet site closely which posted daily COVID-19 patient numbers at each of UHNs' four hospitals.

The number of COVID-19 patients at Princess Margaret Hospital were consistently low, which gave me further hope. With the Summer of 2020 looking bleak for making any progress, I applied for, and was approved for, a Leave of Absence from my research study. In late July 2020, I was finally able to meet virtually with the Chief Nursing Officer at Princess Margaret Hospital in the hopes of discussing a study re-start date. However, she informed me that her staff were dealing with very sick patients since

cancer treatments were put on hold due to the pandemic. Feelings of being overwhelmed, overworked, exhausted, and burned out were just some of the contributing factors to CGs leaving the hospital in droves. The cumulative effect of staff shortages, new (untrained) contract CGs being hired on mass, and veteran CGs finally being allowed time off, forced the Chief Nursing Officer to take steps to *"protect the mental health and well-being of my staff"* and suggest that *"maybe in September 2020 we could revisit the study"*. The subsequent Wave 2 (Fall 2020) and Wave 3 (Winter 2021) of the pandemic resulted in the same cycle of high hopes followed by disappointment as non-essential research at UHN would stop and then go through various phases of re-start. Thankfully, I was successful in applying for a second Leave of Absence from my graduate studies program, this time for the Winter 2021 term.

From January to March 2021, UHN developed online tools to support the pivot from in-person research to virtual methods and any researcher who could conduct their research virtually was strongly encouraged to do so. Like many institutions, the introduction of virtual research methods was unprecedented and, as a result, UHN was learning on the fly. From the hastily formed COVID-19 research committees emerged long instruction manuals containing new procedures for virtual research. I had no choice but to amend my study protocol and resubmit to the UHN REB. My intensely diligent ethics coordinator was far more reasonable with the first amendment submission; however, revisions were requested.

While on another LOA (Summer 2021 term), a virtual meeting with one of my McMaster supervisors, Dr. Jim Potvin, UHN Principal Investigator, and key hospital personnel was held to discuss the feasibility of pivoting to virtual research and the possibility of another re-start in September 2021. On this call, a study pivot was (wisely) suggested by Dr. Potvin which involved removing patients and family members from the study to focus solely on CGs. It was agreed on that the study purpose would be maintained and having patient/family member participants was a "nice to have" but not a "need to have" and that patient-related barriers to PLD use would likely emerge from focus groups and individual interviews with CGs. An additional revision to the study scope involved changes to the CG eligibility requirements because of the severity of staff turnover since the start of the pandemic. Following the approval from my

Supervisory Committee to remove patients and family members from the study, an amendment for virtual research was submitted to the UHN REB and ethics approval was obtained in October 2021.

With a 4th wave of COVID-19 emerging in mid-October 2021, my Supervisory Committee suggested I pivot my thesis deliverable to a proposed research program. While I was disappointed that my original study would not be conducted, I was extremely relieved to be back in control of the requirements needed to graduate. My Supervisory Committee reassured me that although my original research questions would not be answered, the upside of designing a proposed research program would be more valuable than a single experiment. I knew they were right, and I became more and more comfortable with the decision to take this route. After all, how was I going to virtually recruit busy and short-staffed CGs who were exhausted, overwhelmed, as well as mentally and physically stressed? Apparently, I wasn't, according to a new study on soaring burnout rates after a 20-month pandemic.

So, given the new direction due to COVID-19, the dissertation that follows will be a proposal of a series of three studies to understand and overcome the barriers to patient lifting device use by caregivers in a hospital setting.

1.2 General Introduction to the Proposed Research Program

Years of biomechanics research has shown that manual patient handling contributes greatly to the high musculoskeletal injury rate in caregivers (CGs), especially to the neck, low-back and shoulder areas. For instance, the CG profession is in the top 10 occupations at highest risk for musculoskeletal disorders (MSDs) (PSHSA, 2010) along-side workers in construction, mining, and manufacturing (Nelson et al., 2003; BLS., 2007). As well, CGs lose time from work at a rate 1.5 times that of the average Canadian worker (PSHSA, 2010). An engineering ergonomics solution to the high physical demands of manual methods of patient handling has been the widespread implementation of patient lifting devices, which, have been shown to reduce mechanical loads significantly and, thereby, reduce MSD risk considerably.

However, what seemed like a straight-forward prevention strategy has fallen short, as evident by soft tissue injuries that continue to plague the CG profession due, in part, to low PLD use behaviours. For example, a study in the Netherlands reported only 27%

of hospital CGs had sustained behaviours of using PLD equipment (Koppelaar et al., 2013) and, more recently, in a review of 4,674 patient handling injury cases, lifting equipment was only used 18% of the time (Gomaa et al., 2014).

There are many factors that affect the adoption of PLDs as part of daily caregiving practice. These factors can be broken down into issues that impede (barriers) and promote (facilitators) PLD use. Recurrent barriers cited in the literature include: (i) a lack of perceived need for PLDs, (ii) insufficient/inadequate training in PLD use, (iii) a lack of time to use PLDs, (iv) low staffing levels, (v) unique patient characteristics, and (vi) organizational and cultural aspects of work (Evanoff et al., 2003; Koppelaar et al., 2009; Schoenfisch et al., 2011). While the literature does not specify, the barrier of 'insufficient/inadequate training' likely implies that CGs do not have adequate knowledge and/or ability to adopt PLDs as part of daily practice. To investigate this further, the researcher developed a conceptual framework for the potential barriers to CGs' adoption of PLDs (Figure 1). As shown in black text, the assumption is that CGs must: (1) be trained in the benefits and proper use of PLDs before they are knowledgeable, (2) be knowledgeable of the benefits of PLDs before having intent to use them, and, (3) have intent to use PLDs before adopting the actual behaviour of doing so. CGs' decision-making that follows the 'Yes' choices, from Training to Behaviour, is considered best practices, and this information can be used to better understand the current gaps between CGs' knowledge and actual practice (i.e., behaviour) towards the adoption of PLDs. CGs' decision-making that follows the 'No' choices will facilitate a study of the barriers to intention (B_1) and the barriers to behaviour (B_2) that may hamper the adoption of PLDs. Note: 'barriers to learning', and the three interventions in grey text on the right side of the figure, will not be evaluated in the current research program; however, they contribute to an overall understanding of the framework.

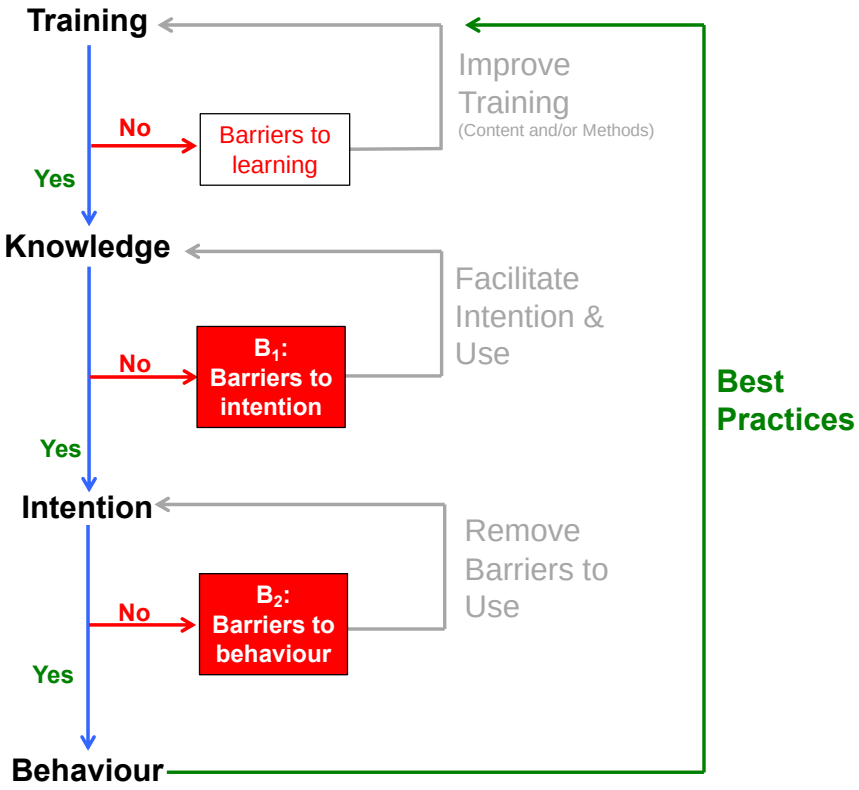

Figure 1. A conceptual framework for the study of CGs' adoption of PLDs as part of their care practices.

As shown in the literature, training is likely to be an important barrier to the under-utilization of PLDs by CGs. In addition, there are likely several barrier subcategories, within PLD training programs, that further contribute to training as a barrier to PLD use. One such barrier subcategory is the resultant staff shortages that occur when CGs leave the unit to participate in (provincially mandated) hands-on practical training. While hands-on practice is important, a lack of adequate staffing levels on the unit is a major contributor to the under-utilization of PLDs in busy clinical environments (Nelson, 2006; Koppelaar et al., 2009, Schoenfisch et al., 2011) which further compounds MSD injury risk.

Vicarious learning, through observation, may provide a novel intervention to allow for effective PLD training that does not contribute to CG staffing shortages. The concept of

learning by observing is the basis of the Social Learning Theory (Bandura, 1977), and assumes that much of human learning is vicarious. That is, we learn by observing someone else's behaviour and its consequences. Bandura contends that, just as we learn individual behaviours, we learn new behaviour patterns when we see them performed by other people or models. A simple everyday example of vicarious learning through observation is watching a YouTube "how-to" video that elaborately demonstrates how to perform a series of tasks, thus enhancing the observer's skills.

This proposed research program contains three studies with the following objectives:

i) The purpose of Study 1 is to identify the barriers between CGs' knowledge (training/education) and intent to use PLDs, and CGs' intent to use PLDs and actual use of PLDs (i.e., behaviour).

ii) The purpose of Study 2 is to further evaluate the specific role of training methods as a barrier to PLD use and evaluate the impact of barrier subcategories within training on the perceived overall effectiveness of a PLD training program.

iii) The purpose of Study 3 is to explore the feasibility of implementing vicarious learning through observation as an effective alternative to off-site hands-on learning.

1.3 Steps in the Execution of a Successful Research Grant (WorkSafeBC)

This proposed research program includes an application for a research grant from WorkSafeBC (see Appendix B). A successful grant award would have many benefits for the caregiving profession as detailed in each of the three studies. A flowchart representing the steps for the execution of the proposed research program supposing a successful research grant application is shown below in Figure 2.

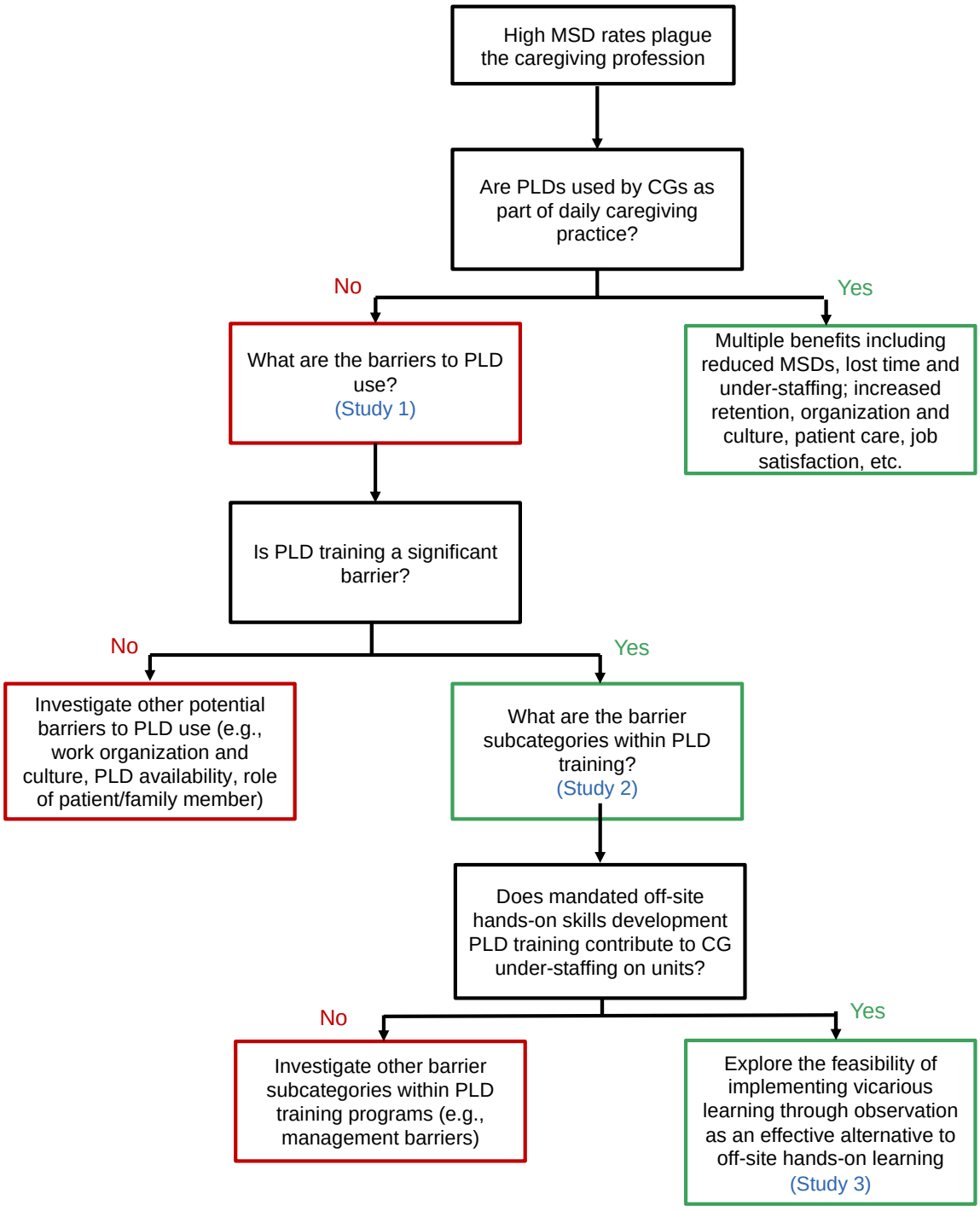

Figure 2. A flowchart representing the steps for the execution of the proposed research program on patient lifting device (PLD) use by caregivers (CGs) in a hospital setting.

CHAPTER 2: REVIEW OF LITERATURE

2.1 Introduction

The historical nature of the literature concerning the primary prevention of musculoskeletal disorders in health care is a testament to its complexity. For over a half century, researchers from around the world have been investigating the challenges associated with patient handling in hospitals and long-term care facilities. Much progress has been made in terms of gaining a better understanding of the benefits of mechanical lifting devices and barriers to their effective implementation. However, the fact that patient lifting device use is not yet a universally accepted practice by health care workers is a signal to the scientific community, ergonomics practitioners, and health care institutions of the need for on-going study.

2.2 Lab Evidence

Many of the early investigative studies that began in the laboratory revealed, with confidence, that biomechanical exposures due to manual patient handling contribute greatly to the high MSD rate in health care workers. A laboratory study by Marras et al., (1999) assessed the force to the spine resulting from various patient handling tasks using lumbar motion monitors, and confirmed that such tasks are high-risk for low-back disorders, even when two people are handling the patient. Actual worker injury statistics from hospitals and long-term care facilities, particularly in CGs, validated the early experimental findings, and clarified the need for better methods than manually handling patients. In the field of ergonomics, engineering controls, such as the implementation of mechanical lifting devices, is a preferred solution since it creates permanent changes that help reduce risks at the identified source. For example, Zhuang et al. (1999) showed that different types of lifting devices reduced spinal compression forces by two-thirds. This finding is supported by a number of lab-based studies that demonstrate the ability of ergonomic devices in reducing mechanical loads during patient handling (Garg et al., 1991; Silvia et al., 2002; Schibye et al., 2003; McGill and Kavcic, 2005; Marras, 2009).

2.3 PLD Interventions

With biomechanical evidence as support, a major MSD prevention focus was instituted by hospitals and long-term care facilities around the world through the implementation of PLD initiatives. In Canada, from 2003 to 2006 the province of Ontario

released $103 million (CDN) to purchase and install over 12,000 new mechanical lifts in more than 650 health care institutions (PSHSA, 2010). Other participating countries, with similar initiatives, included Australia, the United States and the United Kingdom.

The resounding message, from years of research and a variety of attempts to reduce the risk of manual handling injury for CGs, is that the intervention of PLDs has not been as successful as would be expected at mitigating musculoskeletal injuries. While some studies have demonstrated a decrease in the number of injuries as a result of interventions that include PLDs (Evanoff et al., 2003; Li et al., 2004; Collins et al., 2004; Engkvist, 2007), others have reported less successful outcomes (Hartvigsen et al., 2005; Kneafsey, 2000). In the case of PLD interventions that have not been successful, Burdorf et al., (2013) suggests that timing and the integrated implementation of lifting device use into the actual work situation may be one of the biggest challenges facing the healthcare industry. Low rates of use of newly installed equipment have been reported (Garg and Owen, 1992; Evanoff et al., 2003) and studies show that PLD use is not part of regular practices among many CGs (Gomaa et al., 2014; Lee et al.; 2013, Lee et al., 2015). Examples include a study in the Netherlands that reported only 27% of hospital CGs had sustained behaviours of using PLD equipment (Koppelaar et al., 2013) and, more recently, in a review of 4,674 patient handling injury cases, lifting equipment was not used 82% of the time (Gomaa et al., 2014). In the Discussion sections of their papers, the researchers use adjectives such as “frustrating” and “surprising” to describe the lack of strong evidence in the scientific literature for the ability of PLDs to reduce musculoskeletal injuries. These responses are well substantiated since decision makers (e.g., facility managers, ergonomists) must rely on evidence-based research to determine what does and does not work for their workplace (Amick et al., 2006).

2.4 Systematic Reviews: A focus on methods

Researchers conducting systematic reviews use explicit methods aimed at minimizing bias to produce more reliable findings that can be used to inform decision-making. One major benefit of systematic reviews is the presentation of summaries of the research evidence which are useful tools to help researchers, health and safety practitioners, employees, employers, and policymakers remain current with the

evidence. (Amick et al., 2006). This section focuses on the methods applied by five key researchers from 2003 to 2010. All the research collected and critically analyzed by these researchers is based on learning more about the effectiveness of various intervention methods aimed at reducing musculoskeletal injures associated with manual patient handling. I will summarize the methods used in each review and then integrate the findings in a section on the evidence for intervention strategies for MSD reduction.

2.4.1 Review by Hignett (2003)

Conducting the first international systematic review of its kind, Hignett (2003) found 63 papers (from a total of 2,796) from the period 1960 to 2001 that relate to intervention strategies whose aim was to reduce the risk of musculoskeletal injuries associated with patient handling activities. Her landmark review was the first to group papers into three main intervention categories; an approach that future researchers would model for years to follow. These categories included: i) multi-factor interventions, ii) single-factor interventions, and iii) technique training-based interventions. Multi-factor interventions, defined as those that include any combination of two or more intervention strategies (e.g., equipment provision, education and training, work environment re-design), were examined in two groups: those that included a risk assessment program (identification of risks by CGs) and those that did not. Single-factor interventions were also examined in two distinct groups: those that were based on the provision of equipment, and those that were based on a lift team approach. Last, technique training-based interventions were defined as those that focus on teaching healthcare workers good work practices to promote safe patient handling.

Several aspects of Hignett's methods added strength to her findings. For example, a very comprehensive approach is evident in the inclusion of all languages in the search to the extent that 30 papers were translated to English from 11 different languages. In addition, the review included both quantitative and qualitative studies which is relevant to, and supportive of, this research program based on the semi-quantitative approaches being proposed. In addition to being thorough in locating potential papers, Hignett designed several steps to limit the entry of papers into the review process. Two important steps included ensuring inter-rater reliability among six reviewers before the main review process started, and having each paper read by two reviewers and given a

quality rating score. If the difference in the quality rating scores exceeded an established limit, the paper was sent to a third reviewer for conflict resolution.

A very useful aspect of Hignett's study design, which took place after the 63 papers were grouped into tasks, equipment, and interventions, was having reviewers combine the papers to produce summary statements and then allocate evidence levels to each paper in the form of strong evidence (++++), moderate evidence (+++), limited or contradictory evidence (++), and poor or no evidence (+). The rating system helped to quickly identify high-quality papers for further review.

2.4.2 Review by Amick et al., (2006)

A second systematic review was conducted by Amick et al., (2006) and comprised a review team of 10 researchers from Canada, the U.S., and the U.K. This review collected studies from 1978 to 2005 with a purpose to identify studies that evaluated the effects of occupational safety and health interventions on musculoskeletal health among healthcare workers. The research team identified 16 studies from a potential pool of 8,465 articles. They were surprised to be the first researchers to identify studies that evaluated MSD prevention or control programs in health care workers, especially since, by this time several intervention strategy initiatives were already in place in hospitals and long-term care facilities.

A unique strength of this study was the inclusion of stakeholders from the health care industry and the solicitation of feedback from representatives from hospitals, caregiving homes, government agencies, professional associations, insurance companies and lift manufacturing companies. Engagement consisted of meetings in Canada and the U.S. where stakeholders were solicited for input into i) the research question, ii) search terms, iii) information that stakeholders would want to make decisions, and iv) the quality assessment process to evaluate the literature. Conversely, a limitation of this review was that, unlike Hignett (2003) who had papers translated to English from 11 different languages, due to time constraints, the review was limited to articles in three languages other than English. In refection, Amick et al., (2006) acknowledged that articles in other languages may have provided additional important evidence to answer their study question.

2.4.3 Review by Koppelaar et al., (2009)

In contrast to Hignett (2003) and Amick et al., (2006), the systematic review by Koppelaar et al., (2009) was a different type of investigation. Whereas Hignett (2003) investigated intervention strategies to reduce MSD risk associated with patient handling, and Amick et al., (2006) reviewed papers to evaluate prevention programs as a whole, the aim of Koppelaar et al., (2009) was to identify specific barriers and facilitators during the implementation of prevention programs on patient handling and assess the influence of the barriers/facilitators on the effectiveness of the interventions. Out of a total of 815 articles collected for the period 1988 to 2007, 19 papers were included in the systematic review. These studies were categorized into four types of intervention: i) engineering intervention (an intervention targeting the physical work environment), ii) personal intervention (an intervention addressing personal behaviour through education and training), iii) administrative intervention (an intervention focusing primarily on organizational strategies targeting work practices and policies), and iv) multiple interventions (a combination of two or more of the above interventions). Barriers and facilitators were classified as either individual or environmental factors that influenced the implementation of an intervention in a negative (barriers) or positive (facilitators) manner (Table 1).

Table 1: Classifications of Barriers and Facilitators (Koppelaar et al., 2009)

INDIVIDUAL FACTORS	
Motivation	• willingness of individuals to undertake the necessary actions to commit to the intervention
Ability	• capability of individuals to do something that requires specific skills, knowledge, experience and attitude
ENVIRONMENT FACTORS	
Social support	• supportiveness of family, friends, co-workers and other towards the intervention
Convenience and easy accessibility	• availability of resources such as enough time to transfer patients, enough lifting devices, trained staff, etc.
Management support	• commitment of employers to the intervention
Supportive management climate	• organisation of work in ways that promote rather than hinder the intervention
Wide appeal	• attractiveness of the intervention to a wide variety of workers

Interactivity	• reinforcement of the intervention by other work practices
Patient-related factors	• no description was included in the paper

Although several barriers, to the effective implementation of PLDs, have been identified in intervention studies (e.g., time constraints, patient aversion, insufficient number of available devices) (Nelson, 2006), there was little insight into their impact on the effectiveness of these interventions (Roquelaure, 2008; Denis, 2008; Zwerling, 1997). Therefore, the potential value of Koppelaar and colleagues' research was considerable since it would suggest that we require a better understanding of how to more successfully implement PLDs. Conversely, study limitations included: i) a literature search using only two electronic databases, ii) English publications only, iii) exclusion of qualitative papers, and iv) potentially limiting findings of barriers and facilitators from the research literature due to the classification system used.

2.4.4 Review by Tullar et al., (2010)

There was a delay in the publication of the systematic review by Amick et al., (2006) to the extent that a member from the research team conducted an updated search to ensure the level of evidence had not changed since the original search. The updated systematic review was conducted by Tuller et al., (2010) who examined the literature from 2006 to 2009. Overall, the methods were similar to Amick et al., (2006) with two notable differences. First, the updated search yield contained one less database and, second, the search was expanded to include papers in languages other than English. The latter is considered a strength to the study. Similar quality control checks for selection bias, as performed in Amick et al., (2006), were carried out in the updated search including, but not limited to, rotation of reviewer pairs, a review guide, and consensus between reviewers.

The literature search resulted in 2,918 articles from which 16 studies answered the question *"Do occupational safety and health interventions in healthcare settings have an effect on musculoskeletal health status?"* From the 16 studies, three papers received a quality rating of high and medium-high allowing them to move forward for full data extraction and evidence synthesis. This brought the total number of high and medium-

high quality papers from the original search (Amick et al., 2006) and the updated search (Tuller et al., 2010) to nineteen.

2.4.5 Beyond Systematic Reviews

The methods designed in several key studies from 2010 to present signify the continued effort on the part of the scientific community to better understand the barriers and facilitators that influence CGs' behaviour regarding the use of patient handling equipment. Koppelaar et al., (2010) was one of the first researchers to quantitatively evaluate the influence of individual and organizational factors on CGs' behaviour to use lifting devices. In a large Dutch cross-sectional study involving caregiving homes and hospitals, through the instrumentation of structured interviews with 247 CGs, Koppelaar et al., (2010) was able to identify individual barriers, while questionnaires completed by supervisors helped to determine organizational obstacles regarding PLD use. Similarly, 221 CGs in California were surveyed to examine safe patient handling behaviours and lift use and the potential relationships with organizational safety practices, physical and psychosocial job factors, and perceptions about lift use (Lee and Lee, 2017).

Studies by Holman et al., (2010) and Myers et al., (2012) introduced, what appears in the literature at the time, to have been a new area of examination which was the influence of cultural facilitators and barriers on CGs' adoption of PLD equipment. Through postal surveys, Holman and colleagues evaluated CGs' perceptions of how work culture influences a patient transfer. Meanwhile, Myers and colleagues (2012), conducted focus groups with CGs working in two acute care hospitals over a three-year period. The focus groups were conducted two- and five-years post-implementation of a minimal manual lift policy.

To learn more about the factors that affect CGs' adoption of PLD interventions from a behavioural perspective, Park et al., (2014) applied a behaviour change model known as the transtheoretical model. This model assesses an individual's readiness to act on a new healthier behaviour, and provides strategies, or processes of change to guide the individual. Eighteen participants from three caregiving homes, who have had opportunities to use PLDs, completed a survey and were later interviewed. Four physically demanding tasks where PLDs would benefit the healthcare provider were

examined regarding their adoption stages and the factors that affect their use (Park et al., 2014).

2.5 Intervention Strategies for MSD Reduction

The persistently high prevalence of MSDs among CGs internationally (Kneafsey and Haigh, 2007) has challenged the effectiveness of traditional injury prevention methods within the healthcare industry. As a result, a wide range of primary preventive interventions have been developed to reduce physical load related to patient handling and therefore decrease the occurrence of MSDs (Koppelaar, et al., 2009). The three main categories of intervention strategies for reducing musculoskeletal injuries include: i) technique training-based interventions, ii) single-factor interventions and, iii) multi-factor interventions.

2.5.1 Technique Training-based Interventions

A traditional strategy to reduce pain and work-related injuries among healthcare workers is education and training in lifting and transferring techniques (Yassi et al., 2001; Nelson and Baptiste, 2006; Garg and Kapellusch, 2012). However, the systematic literature reviews have repeatedly demonstrated the inadequacy of training programs for injury prevention, particularly when adopted as the primary or sole intervention (Dawson et al., 2007; Hignett, 2003; Martimo et al., 2008; Verbeek et al., 2011). More specifically, a strong level of evidence has been shown for the ineffectiveness of education and training on: i) working practices (Hignett, 2003; Amick et al., 2006; Martimo, 2008), ii) injury rates (Hignett, 2003; Amick et al., 2006), iii) occupational back pain or back injury (Clemes et al., 2009; Dawson et al., 2007; Martimo et al., 2008; Verbeek et al., 2011), and iv) specific lifting techniques (Nelson et al., 2003; Martimo, 2008). Evidence, that techniques taught in training sessions are not always applied in the work setting, is best heard from CGs themselves, which was the aim of a paper on the experiences shared by CGs and their manual handling experiences by Kay et al., (2015). Her research team found that the majority of CGs reported that the advice provided in training programs was not well-suited for adoption in clinical settings (Kay et al., 2015) and that this confirms reports by other researchers (Charney et al., 2010; Hignett, 2003; Koppelaar, et al., 2009).

These outcomes from the scientific literature are useful messages for health care providers whose main approach to managing risks and injuries associated with patient handling activities may involve technique training only (Hignett, 2003). Koppelaar et al., (2013) proposed that, although training has not been shown to be effective as a primary prevention measure to decrease the occurrence of back pain (Hignett, 2003; Martimo et al., 2008), *"training could be used as a first step to increase knowledge in order to stimulate CGs' behaviour to use lifting devices"*. It seems, however, that Koppelaar's suggestion is likely to experience limited success since cognitive behaviour training alone (i.e., targeting attitudes and beliefs to change behaviour), has been found, with only moderate evidence, to be effective in improving musculoskeletal health (Haslam, 2002; Tullar et al., 2010).

2.5.2 Single-factor Interventions

Implementing lifting devices, as a sole engineering intervention, is a common approach in healthcare; however, its effectiveness is supported by less-than-convincing results. Yassi et al., (2001), whose paper received a medium-high quality ranking in systematic reviews, found in a randomized control trial that healthcare staff provided with mechanical lifting equipment showed no differences in the number of musculoskeletal injuries, rates, or costs for all musculoskeletal injuries, as reported in workers' compensation claims. A similar conclusion was drawn several years later for the inability to reduce MSD injury claims by solely implementing patient handling equipment (Burdorf et al., 2013). In addition, it has been shown in two systematic reviews that providing employees with assistive devices was not an effective intervention, by itself, for preventing reports of back pain in healthcare workers (Hignett, 2003; Verbeek et al., 2011).

Patient handling equipment has the potential to be an effective single-factor intervention strategy. We know that *"a reduction in the occurrence of low-back pain in healthcare settings can only be achieved by interventions which result in a big decrease in mechanical load"* (Burdorf et al., 2013). The bigger challenge is the latter part of Burdorf's conclusion that there must be *"a high level of implementation in the population at risk"*. Noting the results from a study, where PLDs were used 59% of the time that

they were deemed necessary in hospitals (Koppelaar, 2010), it appears that successful intervention strategies need to address more than just the lift!

2.5.3 Multi-factor Interventions

It has been theorized that the complexity of manual handling tasks in healthcare has resulted in a shift from single-factor interventions (e.g., technique training only or PLDs only) towards an emerging multi-factor approach (Kay et al., 2013). These multi-factor interventions have several aspects which are combined into one program, rather than the introduction of a single-factor solution to manual handling challenges (Kay et al., 2013). There have been numerous studies investigating the effect of multi-factor patient handling interventions on MSD prevalence. From these studies, the systematic reviews reveal moderate evidence for a positive effect of multi-factor patient handling programs in reducing musculoskeletal injuries (Amick et al. 2006; Dawson et al., 2007; Martimo et al., 2008; Tullar et al., 2010; Clemes et al., 2009 and Verbeek et al., 2011).

From early reviews, the two most common features of intervention strategies for MSD reduction in healthcare workers was “equipment provision/purchase” and “education and training” and the least common feature was “work organization/practice change” (Hignett, 2003). A few years later, Nelson and Baptiste (2006) designed intervention strategies that included: i) state-of-the-art lift equipment, ii) education and training (e.g., risk assessment, use of equipment, patient assessment), iii) risk assessment, policy and procedures, iv) patient assessment, v) re-designed work environment, and vi) a change in practices. Whereas neither Hignett (2003) nor Dawson (2007) identified key characteristics of a multi-factor patient handling intervention, Amick et al., (2006) was able to identify important features of multi-factor patient handling interventions such as: i) a worksite policy change (e.g., zero lift), ii) new patient handling equipment (ceiling/floor lifts), and iii) training on the equipment and patient handling. However, in a study by Amick et al., (2006), they draw attention to the inability to comment on the effectiveness of one component of a multi-component patient handling intervention because the elements were “bundled” based on qualitative terms. That is, none of the studies quantified the impact of single components of the intervention on effectiveness nor on compliance and adherence to the intervention.

Similar to Nelson and Baptiste (2006) and Amick et al., (2006), the intervention feature of “policy”, as part of a multi-factor strategy, was studied by Tullar et al., (2010). Tuller’s research revealed a multi-factor intervention approach that included a policy that defined an organizational commitment to reducing injuries associated with patient handling, purchase of appropriate lift or transfer equipment to reduce biomechanical hazards, and a broad-based ergonomics training program that included safe patient handling and/or equipment usage (Tullar et al., 2010). Shortly afterwards, Garg and Kapellusch (2012) demonstrated that ergonomics programs, implemented in seven caregiving facilities with participatory ergonomics teams and modern patient-handling devices, were highly successful in reducing patient transferring injuries, lost workdays, modified-duty days, and workers’ compensation costs associated with patient handling activities.

Researchers have been critical that only a moderate level of evidence has been found for the effect of multi-factor interventions and they have questioned the requirements necessary for an intervention to be successful within an organization. Kay et al., (2013) questioned whether strong evidence is lacking because key elements for sustainable solutions to reduce CGs’ manual handling injuries have not yet been identified. She also questioned whether consensus is lacking regarding the implementation and appropriate evaluation of injury prevention programs. In contrast, Haslam (2002) and Park et al., (2014) suggest that, regardless of the intervention, it cannot be assumed that the intervention will be adopted and that the employees involved will follow the new routines.

Since many barriers and facilitators have been acknowledged as causing failure of the effective implementation of primary interventions on patient handling, there is a clear need to quantify the impact of these barriers and facilitators on the effectiveness of primary preventive interventions in healthcare (Koppelaar, 2009).

2.6 Barriers and Facilitators Affecting the Adoption of PLDs

Implementation of ergonomics interventions requires significant effort that involves the consideration of individual, occupational, and organizational factors that are believed to affect an adoption process (Park et al., 2014). There have been numerous studies investigating factors that affect the adoption of mechanical lifting devices in

healthcare settings. A pre-post intervention study by Evanoff et al., (2003), at four hospitals and five long-term care facilities, identified barriers to the use of mechanical PLDs. From their study, which involved interviews with 190 health care workers, the three most common barriers included: (i) lack of perceived need for PLDs, ii) insufficient training in PLD use, and iii) lack of time. In a systematic review by Koppelaar et al., (2009), the key factors of 'motivation' and 'convenience and easy accessibility' emerged as barriers to the implementation of patient handling interventions. More specifically, for the category 'convenience and easy accessibility' the authors were alluding to issues of time required to transfer patients, staff situations, and availability of lifting devices (Koppelaar et al., 2009). Schoenfisch et al., (2011) collected qualitative feedback related to the adoption of PLDs in two hospitals over a five-year period. With the caveat that *"adoption is a dynamic process that can be complex to assess"*, they noted several factors affecting PLD adoption such as time, knowledge/ability, staffing, patient characteristics, and organizational and cultural aspects of work.

Tables 2 and 3 summarize the barriers and facilitators as identified in the literature that affect the adoption of PLDs in healthcare settings.

Table 2: Barriers to PLD use

BARRIERS	AUTHORS
Lack of mandatory no-manual-lifting policy or specific protocol	McGuire et al., 1996; Charney, 2006; Li et al., 2004; Koppelaar et al., 2009; Koppelaar et al., 2013; Schoenfisch et al., 2011
PLD in selected units and not entire caregiving facility	Nelson et al., 2006; Lee and Lee, 2017
Inadequate or not readily available devices	Bell, 1987; Garg et al., 1992; Jensen, 1987; McGuire et al., 1996; Owen et al., 2000; Engkvist, 2007; Koppelaar et al., 2009; Koppelaar et al., 2013; Schoenfisch et al., 2011; Lee and Lee, 2017
Inadequate training of caregiving personnel on PLDs	Bell, 1987; Garg et al., 1992; Jensen, 1987; McGuire et al., 1996; Li et al., 2004; Takala and Kukkonen, 1987; Owen et al., 2000; Schoenfisch et al., 2011; Engkvist, 2007; Koppelaar et al., 2009; Koppelaar et al., 2013
Concerns for patient safety and comfort	Collins et al., 2004; Li et al., 2004

BARRIERS	AUTHORS
Time: longer transfer time with devices than with manual methods	Collins et al., 2004; Bell, 1987; Garg et al., 1992; Jensen, 1987; Li et al., 2004; Nelson and Baptiste, 2006; Engkvist et al., 1992; Engkvist, 2007; Evanoff et al., 2003; Koppelaar et al., 2009; Koppelaar et al., 2013; Schoenfisch et al., 2011; Park et al., 2014; Lee and Lee, 2017
Lack of management cooperation, commitment, and visible support	Evanoff et al., 2003; Li et al., 2004; Engkvist, 2007
Reluctance to use mechanical devices for patient transfers/lack of employee buy-in	Garg and Owen, 1992; Li et al., 2004; Engkvist, 2007
Policy and PLD-only in place	Schoenfisch et al., 2011
Training and PLD-only in place	Schoenfisch et al., 2011
Supportive management climate and PLD-only in place	Koppelaar et al., 2010; Lee and Lee, 2017
Patient condition (e.g., weight, connected to too many lines)	Moody et al., 1996; Schoenfisch et al., 2011; Engkvist, 2007; Evanoff et al., 2003
Perceptions of patients being transferred	Garg et al., 1991; Zhuang et al., 1999
Social pressure to perform tasks immediately	Schoenfisch et al., 2011

Table 3: Facilitators to PLD use

FACILITATORS	AUTHORS
Risk assessment program in place	Hignett, 2003; Nelson and Baptiste, 2006
Education and training on risk assessment	Hignett, 2003; Nelson and Baptiste, 2006
Education and training on safe patient handling/equipment usage	Hignett, 2003; Guthrie et al., 2004; Nelson and Baptiste, 2006; Kutash et al., 2009; Wardell, 2007; Amick et al., 2006; Tullar et al., 2010
Policy and procedures (include device maintenance and regular check of device availability)	Hignett, 2003; Guthrie et al., 2004; Kutash et al., 2009; Wardell, 2007; Nelson and Baptiste, 2006; Amick et al., 2006; Koppelaar et al., 2009; Koppelaar et al., 2010
Patient assessment system	Hignett, 2003; Nelson and Baptiste, 2006
Presence of a lift team	Guthrie et al., 2004; Kutash et al., 2009; Wardell, 2007; Nelson and Baptiste, 2006
Purchase of mechanical lifting equipment (new/state-of-the-art), maintenance, and replacement	Hignett, 2003; Guthrie et al., 2004; Kutash et al., 2009; Wardell, 2007; Nelson and Baptiste, 2006; Amick et al., 2006; Tullar et al., 2010; Stevens et al., 2013
Organizational commitment to reducing patient handling injuries; management support; supportive management climate	Hignett, 2003; Dugan, 2010; Tullar et al., 2010; Koppelaar et al., 2009; Stevens et al., 2013
High lift use availability and positive perceptions about lift use	Lee et al., 2013; Lee and Lee, 2017
Re-designed work environment	Hignett, 2003; Nelson and Baptiste, 2006
Change in practice	Hignett, 2003; Nelson and Baptiste, 2006
CG motivation to use lifting devices	Koppelaar et al., 2009

FACILITATORS	AUTHORS
Back injury in past 12 months	Koppelaar et al., 2009
Convenience and easy accessibility	Koppelaar et al., 2009
Peer coaching program; unit-based program champions; unit-based peer leaders	Hignett, 2003; Dugan, 2010; Alamgir et al., 2011; Stevens et al., 2013
Patient-related factors (e.g., acceptance to device)	Koppelaar et al., 2009
Focus on/problem solve system barriers	Hignett, 2003; Dugan, 2010; Stevens et al., 2013
Using data to analyze effectiveness of the program	Hignett, 2003; Dugan, 2010
Provide feedback to CG on program effectiveness to sustain culture of safety	Stevens et al., 2013

2.6.1 Special Interest Barriers

In addition to the barriers discussed and tabled above, a review of the literature for three barriers of particular interest to this research program are discussed below.

2.6.1.1 Caregivers' say in the matter

It is not surprising that 'lack of buy-in' is a well-established barrier for the adoption of PLDs by CGs (Garg and Owen, 1992; Li et al., 2004; Engkvist, 2007) since risk prevention strategies to avoid MSDs have historically overlooked the inclusion of CGs' input into the development and implementation of interventions (Kay et al., 2013). Instead, the dominant focus has been on ensuring CGs' compliance with policy directives, with deviations in performance thought to explain manual handling injuries (Clemes et al., 2009; Hignett et al., 2003; Koppelaar et al., 2013). According to a qualitative research study by Kay et al., (2013), exploring CGs' perceptions and experiences, related to manual handling, may uncover new knowledge about the complexities of manual handling in healthcare and improve the occupational well-being of CGs.

2.6.1.2 Role of the patient

Patient-related factors were identified by Koppelaar et al., (2009) as a barrier that may influence the appropriate implementation of primary preventive interventions. In their systematic review, they found that CGs may have positive intentions to use PLDs but the patient can act as a barrier to PLD use (Koppelaar, 2009). Some researchers

suggest that patients act as a barrier to CGs' adopting PLDs because the patient: i) feels unsafe in the lift (Evanoff, 2003), ii) is too heavy for the lift (Engkvist, 2007), iii) has a condition making lift use difficult/impossible (in isolation, stiff body, connected to many lines) (Evanoff, 2003; Engkvist, 2007), iv) is uncooperative (aggressive, has dementia and doesn't understand, poor attitude of patient and/or family member toward using lift, impaired by drug effects) (Engkvist, 2007; Waters, 2007), or v) exhibits unpredictable behaviour (Nelson and Baptiste, 2006). In contrast, Garg and Kapellusch (2012) found that a vast majority of patients described the PLD as comfortable (72%) and 70% stated that they felt safe for the total duration of the transfer. They also identified that a small minority of patients and their family members preferred manual lifting to the use of PLDs (Garg and Kapellusch, 2012).

2.6.1.3 Caregiving's 'culture of caring'

Research into the cultural aspects of caregiving has allowed for a shift of perspective away from the traditionally measured MSD and sickness absence (Fray and Hignett, 2013) to include an organizational and behavioural focus as part of a multi-faceted approach to lifting device intervention. Myers et al., (2012) revealed that CGs working in an acute care hospital reported culture (i.e., "the way things are done around here") as a barrier to change, affecting the use of PLDs. To better understand this finding, the culture of caregiving, also known as the "culture of caring" (Leininger and Gilead, 1984), values patient care to the extent that CGs see patients' needs as often coming before their own. The data collected by Myers et al., (2012) suggests that CGs define PLDs as things meant to protect CGs from patient handling injuries; they are not widely interpreted as having significant benefits for patients. It is possible, therefore, that the defined purpose of such devices may collide with CGs' cultural meaning of caregiving and the acceptable methods of delivering care. In other words, PLDs may actually stand in contradiction to some cultural elements of caregiving (Myers et al., 2012). The research by Haslam (2002) states that a worker's decision to follow a new routine, and no longer handle patients manually, would depend on their level of acceptance of the change which is affected by one's knowledge, attitudes and beliefs which are important

components of workplace culture and warrant consideration during intervention development and implementation (Kay et al., 2013).

2.7 The Theory of Planned Behaviour

The Theory of Planned Behaviour (Ajzen, 2006) is one of the most widely used behaviour models and has been highly influential in explaining relationships between attitude, intention, and behaviour (Armitage and Connor, 2001; Godin et al., 2008). In Study 1 of this research plan, the TPB will be applied to predict CGs' intention to use PLDs (i.e., their behaviour) to better understand why PLDs are under-utilized in healthcare.

The essence of the TPB can be explained by referring to Figure 3. According to the TPB, human action is guided by three kinds of considerations: behavioural beliefs, normative beliefs, and control beliefs.

- ***Behavioural beliefs*** relate to the person's belief about a consequence of a particular behaviour (i.e., *what will happen?*) which then produces a favorable (positively valued) or unfavorable (negatively valued) attitude toward the behaviour.

- ***Normative beliefs*** relate to the person's perception of the social pressures regarding whether they should, or should not, perform the behaviour (e.g., *should I do it?)* and are shaped by the judgement (approval/disapproval) of the behaviour by those that influence them (e.g., co-worker, manager, friend, teacher). The theory assumes that normative beliefs in combination with a person's motivation to comply determines the subjective norm.

- ***Control beliefs*** refers to the person's perception of the ease or difficulty of performing a given behaviour (i.e., *can I do it?).* The theory assumes that control beliefs, in combination with the perceived power of each control factor to act as a barrier or facilitator to the performance of the behaviour, determines the perceived behavioural control. Conceptually, perceived behavioural control can be equated with self-efficacy. The concept of perceived behavioural control is that it is expected

to moderate the effect of intention on behaviour (see dotted line in Figure 3); however, only when perceived behavioural control is strong (i.e., high self-efficacy).

In combination, attitude toward the behaviour, subjective norm, and perception of al control lead to the formation of intention. Intentions influence motivational factors (e.g., how hard a person is willing to try and how much effort will be exerted) that influence behaviour. As a general rule, the more favorable the attitude and subjective norm, and the greater the perceived control, the stronger should be the person's intention to perform the behaviour in question.

Immediately following intention is behaviour which is the observable response in a given situation. Behaviour is a function of compatible intentions and perceptions of behavioural control in that perceived behavioural control is expected to moderate the effect of intention on behaviour, such that a favorable intention produces the behaviour only when perceived behavioural control is strong.

Finally, the extent to which a person has the skills, resources, and other requirements needed to perform a given behaviour is called actual behavioural control. Successful performance of the behaviour depends not only on a favourable intention but also on a sufficient level of behavioural control. If perceived behavioural control is accurate, it can serve as a substitute of actual behavioural control and can be used for the prediction of behaviour.

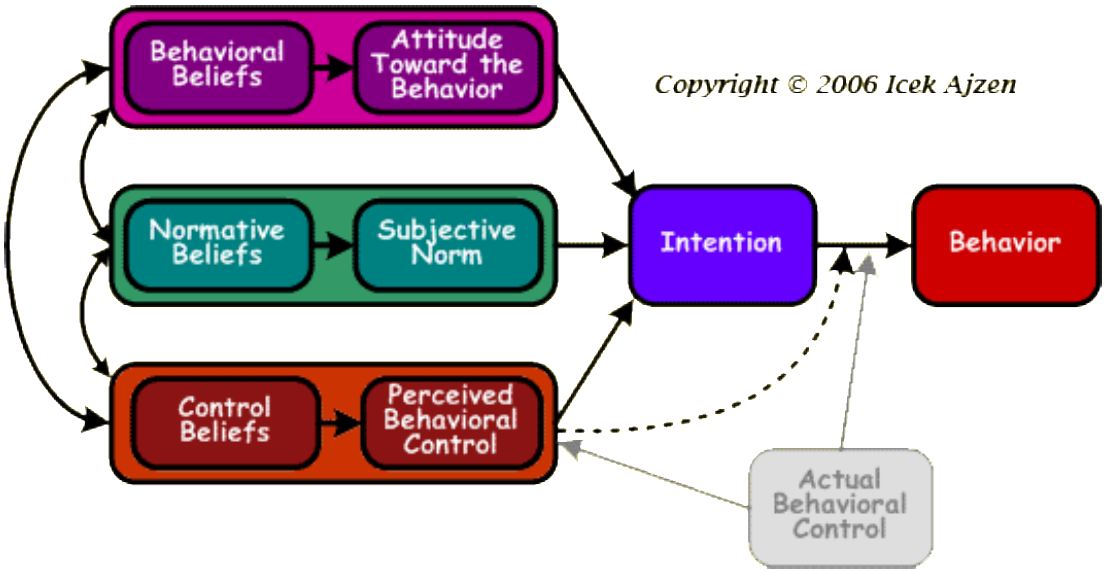

Figure 3. Schematic representation of the Theory of Planned Behaviour (Ajzen, 2006).

The TPB basically states that, if there is a more favourable attitude towards a behaviour, it is accepted socially, and the person has more control over that specific behaviour, they are more likely to perform that behaviour. For example, joining in a cheer at a football game, even if you aren't necessarily a huge fan or a loud person (Kendrick, 2011).

2.7.1 Research Applications

The TPB has been used successfully to predict and explain a wide range of health behaviours and intentions including smoking, exercise, health, breastfeeding, and substance use. Through the application of the TPB, researchers have been able to better understand how to change people's behaviour which, in turn, may positively modify their lifestyle and promote better health. The theory has also been applied to studies of the relations among people's beliefs, attitudes, intentions and behaviours with respect to: wearing of protective equipment (Quine, et al., 2001), food hygiene (Clayton and Griffith 2008), and manual handling (Johnson and Hall, 2005). For non-health behaviours, the TPB has been applied to predict behaviours, such as cheating justifications to predict academic misconduct, decisions of union workers to participate in employee involvement, and internet purchasing. The following sections will review literature assessing the application of the TPB to predict gambling behaviour, nurses'

intention to integrate research evidence into clinical decision-making, and intention to receive a COVID-19 vaccine.

2.7.1.1 Predicting gambling behaviour

In a study of gambling behaviour, Martin et al., (2010) was successful in applying the TPB to predict gambling behaviour in university undergraduate students; however, St. Pierre et al., (2017) was not successful in applying the TPB to evaluate a high school-based gambling prevention program for adolescents. While Martin et al., (2010) and St. Pierre et al., (2017) both examined the traditional TPB constructs of intention, attitude, subjective norm, and perceived behavioural control, St. Pierre et al., (2017) extended the TPB model to include the predictor variable “negative anticipated emotions”. St. Pierre and colleagues presumed that negative anticipated emotions, such as regret and guilt, play a role in influencing participation in high-risk or addictive activities (e.g., gambling) and, therefore, in addition to the usual TPB constructs, the researchers believed that negative anticipated emotions may guide behavioural decision-making processes (St. Pierre et al., 2017).

In both studies, participants had gambled, either in the past year (i.e., nearly half of 785 university participants, or n = 377; Martin et al., 2010), or in the past three months (~40% of 280 high school participants, or n =112; St. Pierre et al., 2017). The university undergraduate participants were randomly selected to complete a classroom-based survey that included questions to measure gambling frequency, gambling attitudes, subjective norms of peers/friends/family members, ability to control gambling behaviour, and intentions to gamble. In St. Pierre et al., (2017) high school participants (n = 280) completed a baseline survey, followed by the intervention group (n = 140) watching a 25-minute docudrama video on the testimony of a problem gambler who described his various personal experiences with gambling. The intervention group then participated in a discussion session. In addition to the baseline survey, participants in both the control group and intervention group were assessed at post-intervention, and, 3-month follow-up via a questionnaire.

Despite reported limitations of bias (self-report, recall, selection), results from Martin et al., (2010) support the utility of the TPB in explaining gambling behaviour (note: more

so for how often respondents reported gambling [gambling frequency] vs. total times respondents estimated gambling in the past year). More specifically, the researchers found that friend and family norms, attitudes, and perceived behavioural control were significantly associated with gambling frequency and intention to gamble mediated the relationship. Applied to future programming to promote responsible gambling (e.g., decreasing gambling frequency), Martin and colleagues suggest targeting the TPB constructs of attitudes and perceived behavioural controls to reduce gambling intentions and, subsequently, decrease how frequently one gambles (Martin et al., 2010). Meanwhile, the results from St. Pierre et al., (2017) reveal that the docudrama video was not effective in producing desired changes in negative anticipated emotions, the key constructs of the TPB, or the frequency of gambling behaviour. Possible explanations for the ineffectiveness of the intervention video include:

- the video's risk messaging may not have been suitable for the sample of non-problematic gamblers
- the video did not target enough TPB-related beliefs since the adolescents were low-frequency or non-gamblers
- the video may be better suited to improving knowledge or decreasing misconceptions about gambling versus predicting behaviour
- the outcome measure of reduced gambling frequency may have differed from the aims of the video intervention, which was harm reduction in high-risk adolescents
- the short video was too straight-forward an intervention and may not have been effective in changing gambling intentions and behaviour, as it was prevention-focused

Interestingly, St. Pierre et al., (2017) was the first study to use an extended TPB model, including negative anticipated emotions, to evaluate a preventative intervention for adolescent problem gambling. Also, the findings are largely inconsistent with other research that has applied the TPB to the development or evaluation of preventive interventions for various adolescent risk or addictive activities (e.g., Buckley et al.,2010; Cuijpers et al., 2002; Guo et al., 2015; Jemmott et al., 1999, 2005; Poulter &McKenna, 2010), which may further support the question of suitability of the intervention video. A reflection on the successful outcome in Martin et al., (2010) compared to the failed attempt in St. Pierre et al., (2017) inspires the following questions: (i) could the ~3-times larger sample size in Martin et al., (2010) have enhanced the statistical power of the

significance testing, thereby contributing to the positive results?, (ii) are extended TPB models effective?, (iii) was the sample in St. Pierre et al., (2017) too young (mainly grade 9 and 10 students) given the purpose of predicting gambling tendencies?, and (iv) similar to the authors viewpoint, how relevant was the use of a prevention-based video for modifying the TPB (and negative anticipated emotions) constructs around gambling behaviours?

2.7.1.2 Predicting nurses' intention

A study conducted by Cote (2012) successfully applied the TPB to predict nurses' intention to integrate research evidence into clinical decision-making. Incorporating research findings into nurses' clinical practice is thought to have an important impact on the quality of care provided for patients (Scott et al., 2008). However, despite evidence supporting this practice, and the availability of high-quality research in the field of nursing (Kajermo et al., 2008), a gap remains between research and practice (Scott et al., 2008).

Using an extended TPB model, the purpose of the Cote (2012) study was to identify the factors that influence nurses' intention to integrate research evidence into their clinical decision-making. In addition to the usual TPB constructs, moral norm was added to contribute towards the prediction of intention. Moral norm refers to a person's feeling of moral obligation towards performing a given behaviour, and it is thought to be a determinant of behavioural intention (Triandis,1980). According to Godin et al., (2008) because moral norm takes into consideration the ethical dimension of healthcare professionals' behaviour, it is a relevant addition to the traditional TPB model. In addition to moral norm, 'past behaviour' was included in the extended TPB model. Based on the findings of Oulette and Wood (1998), along with attitudes and subjective norms, past behaviour may contribute to the prediction of intention when the behaviour is not well learned, or when it is performed in unstable or difficult contexts (e.g., dynamic and unpredictable health care work environments).

Cote (2012) administered a TPB-based questionnaire to 600 university hospital nurses to identify the factors that influence nurses' intention to integrate research evidence into their clinical decision-making. With a response rate of 56%, a total of 336

nurses participated in the study. The extended TPB model explained 70% of the variance in nurses' intention to integrate research evidence into their clinical decision-making, and moral norm was identified as the most important predictor of nurses' intention. Normative and control beliefs (which affect subjective norm and perceived behavioural control), and past behaviour, also contributed to predict nurses' intention. The strong positive correlation result (r = 0.64) between the moral norm and the normative beliefs could explain that, when nurses perceive the integration of research findings into their practice as morally correct, the approval of this behaviour by key persons seems self-evident and contributes only modestly to the observed variation in intention (Cote, 2012). In other words, for nurses to successfully integrate research findings into their daily clinical decision-making, a supportive work environment (e.g., nurses and physicians collaborating effectively) is very important. The only control belief that was significantly associated with nurses' intention to integrate research findings into their practices was the applicability of these findings to the reality of nursing practice (Cote, 2012). In practical terms, the adaptation of research findings to nursing practices, and their contextualization to the specific clinical setting, are deemed essential. Cote (2012) summarizes the results as follows: the more: (i) nurses feel a moral obligation to integrate research findings in the care delivered to their patients (moral norm), (ii) believe that people around them would approve their actions (normative beliefs), and (iii) perceive that they have a high degree of control over the integration of research findings into clinical decision-making (perceived behavioural control), the greater will be their intention to integrate research findings into clinical decision-making.

2.7.1.3 Predicting COVID-19 vaccine intention

Like the successful application of the TPB in Martin et al., (2010) (gambling) and Cote (2012) (nursing), a study conducted by Shmueli (2021) successfully predicted intention to receive a COVID-19 vaccine. At the time of the Shmueli study (June 2020), no vaccine for COVID-19 had become available and vaccines were estimated to emerge at the end of 2021. Shmueli (2021) predicted there would be vaccine hesitancy in Israel, therefore, it was important to understand the intentions, motivators, and barriers that may influence the general public to vaccinate against COVID-19. Such

understanding would help prepare intervention plans based on accessibility to the general public, while targeting populations that show a tendency not to get vaccinated.

The purpose of the study was to explore the intentions, motivators and barriers of the general public to vaccinate against COVID-19 using the Health Belief Model and the TPB model. The Health Belief Model suggests that an individuals' engagement (or lack of engagement) in health-promoting behaviour can be explained by their beliefs about health problems, perceived benefits of action and barriers to action, and self-efficacy.

Hypothesized predictors in Shmueli's extended behaviour theory model included sociodemographic variables (10) (e.g., age, gender, education), health-related variables (7) (e.g., smoking, having a chronic illness, overweight), Health Belief Model variables (6) (e.g., perceived benefits, perceived severity, health motivation) and TPB variables (4) (attitude, subjective norms, perceived behavioural control, self-efficacy). In total, 27 variables were applied to predict intention, motivation, and barriers to COVID-19 vaccination.

A national anonymous online survey was conducted among Israeli adults aged 18 years and older from May 24 to June 24, 2020. The survey was conducted following government restrictions (i.e., during a lockdown period) and vaccines were still under development. The survey included socio-demographic and health-related questions, questions related to the Health Belief Model and TPB dimensions, and intention to receive a COVID-19 vaccine.

From the findings, statistically significant predictor variables for socio-demographic and health-related variables, and willingness to get vaccinated, were age, gender, education level, suffering from chronic disease, overweight, and having received the influenza vaccine in the previous season. According to the Health Belief Model, those who intend to get the COVID-19 vaccine, on average, perceived COVID-19 to be a more serious illness than those who did not intend to take the vaccine. According to the TPB, those who intend to get the COVID-19 vaccine, on average, reported higher levels of subjective norms than those who did not intend to receive the vaccine. They also reported higher levels of self-efficacy regarding the vaccine. There was no significant difference between the two groups in terms of attitude and perceived behavioural control. A combination of the Health Belief Model, demographic factors, and health-

related factors explained 74% of the variance in intention to receive the vaccine. A combination of the TPB predictor variables, demographic factors, and health-related factors explained 64% of variance in intention to receive the vaccine. The TPB variables added 35% to the overall explained variance. From the TPB, subjective norms were significant predictors of intention to get vaccinated against COVID-19. From the Health Belief Model, self-efficacy was a significant predictor of intention to get vaccinated against COVID-19. A combination of the TPB predictor variables, the Health Belief Model variables, demographic factors, and health-related factors explained 78% of the variance in intention to get vaccinated against COVID-19. The TPB variables added only 4% to the overall explained variance.

The author notes this is the first study to use the TPB to predict intention to receive a COVID-19 vaccine. The results suggest that future vaccine programs should be designed to target females, non-academics, and those who did not vaccinate against influenza in the previous season. Also, Shmueli (2021) recommends that public health intervention programs place additional focus on increasing the perception of vaccination benefits and the perceived severity of the disease. Cues to action that should be considered include investing more resources in information campaigns by Israel's Ministry of Health and making vaccination available at the workplace. Related to subjective norms, efforts should be made to encourage individuals to share their positive thoughts and experiences on COVID-19 vaccination with friends and relatives (Shmueli, 2021).

2.7.2 Extended TPB Models - A Discussion Across the Papers

Extended TPB modeling has become increasingly popular as researchers consider evaluating additional aspects of human behaviour besides the traditional TPB constructs (i.e., attitude, subjective norm, perceived behavioural control, and intention). For example, three of the four research papers outlined above, spanning 2012 to 2021, applied an extended TPB model, of which two were considered successful (Cote, 2012 - nursing; Shmueli et al., 2021 - COVID-19) and one was considered unsuccessful (St. Pierre et al., 2017 - gambling). Based on Cote (2012) it appears that the variables added to extend the TPB model is an important factor for success and, therefore, should be chosen carefully. For example, Cote (2012) chose moral norm as an

additional construct to predict intention in nurses as Godin et al., (2008) found it was strong in individuals who care about the welfare of others. Godin's finding is highly applicable to nursing; therefore, it is not surprising that moral norm was the best predictor of intention. The addition of a construct that is based on guilt and regret (i.e., negative anticipated emotions in St. Pierre et al., 2017) appears to be highly relevant to a study on gambling behaviour. However, the choice of intervention video appears to have interfered with the researchers' ability to evaluate the negative anticipated emotions construct.

The epitome of extended TPB modelling can be found in Shmueli (2021) who added 23 predictor variables to the TPB's four, for a total of 27 variables to predict intentions to receive the COVID-19 vaccine. The variable to predict self-efficacy appeared twice in the extended model since it is represented in the TPB model as perceived behavioural control, and in the Health Belief Model. Ajzen (2015) suggests that adding a predictor variable that is similar to an existing TPB construct may improve the prediction of intention. The results from Shmueli (2021) showed that the combination of predictor variables from the Health Belief Model, demographic factors, and health-related factors explained 74% of the overall variance in intention to receive the COVID-19 vaccine. A combination of the TPB variables, demographic factors, and health-related factors explained 64% of the variance in intention to receive the COVID-19 vaccine, with the TPB predictor variables contributing 35% to the overall result. The combination of the TPB and Health Belief Model variables, demographic factors, and health-related factors explained 78% of the variance in intention to receive the COVID-19 vaccine, with the TPB predictor variables contributing 4% to the overall result. The low explained variance contribution from the TPB variables (4%) suggests that the TPB did not play a significant role in predicting intention to receive the COVID-19 vaccine for this extended TPB application.

2.7.3 A Debate on the Future of the TPB According to Social Psychologists

The TPB has been the dominant theoretical approach to guide research on health-related behaviour for the past three decades (Sniehotta et al., 2014). In 2014, a provocative editorial by Sniehotta et al., (2014) suggested that it was *"time to retire the Theory of Planned Behaviour"*. This resulted in a fruitful debate among social

psychologists in the form of five commentaries that supported or refuted the courageous statements by Sniehotta et al., (2014).

2.7.3.1 Introduction to the debate

In their controversial editorial, Sniehotta et al., (2014) suggest the TPB has lost its usefulness and, the health psychology domain has moved on from using it. However, in a contradictory statement, the authors acknowledge the TPB for showing a consistent prediction of behaviour from intention and perceived behavioural control, and that a large change in intentions has been found to produce changes in behaviour. Sniehotta's positive words for the TPB had the behaviour model's founder wondering what part of the TPB Sniehotta et al., (2014) was discrediting (Ajzen, 2015).

Defending the TPB, Schwarzer (2015) suggests that Sniehotta et al., (2014) could have targeted their criticism to any of the broader range of classic continuum theories, versus the most popular (i.e., TPB). For example, the Health Belief Model and the Social Cognitive Theory also apply to the criticisms raised in Sniehotta et al., (2014) Schwarzer, 2015). A commentary from Hagger (2015) stated that, like any theory, there are limitations and these were identified by Ajzen and Fishbein (1975; 1985) decades earlier (e.g., the role of past behaviour). Further, Hagger (2015) credits the TPB for creating a framework for behaviour theory development and, while many researchers acknowledge that the TPB has been superseded by more elaborate and comprehensive explanations (e.g., extended models), those explanations are influenced and retain some of the basic processes as outlined in the TPB.

Features of the TPB that Sniehotta et al., (2014) disregard include its: (i) limited predictive validity (e.g., longitudinal studies, non-university student participants, self-report), (ii) exclusive focus on rational reasoning (i.e., excluding unconscious influences on behaviour, role of emotions), (iii) inability to help practitioners to develop helpful interventions, and (iv) static nature of the model (e.g., how do four constructs - attitude, subjective norms, perceived behavioural control, and intention - help us understand the effects of behaviour on cognitions and future behaviour?). A commentary by Ogden (2015) fully supports Sniehotta et al., (2014) and, amusingly, the social psychologist suggests that if the TPB does not retire, then maybe she should! (Ogden, 2015). Her

dislike for the TPB began in 2003 and her paper on the problems with social cognition models contemplated that *"surely human behaviour is more complex than this!"* (Ogden, 2003). Ajzen (2015) provided a defensive reaction to the suggestion of Sniehotta et al., (2014) that his theory had outlived its usefulness in the health psychology domain. He referred to some of Sniehotta and colleagues' arguments as 'misguided' and 'resting on a poor understanding of the TPB and the nature of psychological research', while others were 'illogical' or 'patently wrong' (Ajzen, 2015). Ajzen went on to accuse Sniehotta et al., (2014) of displaying a profound misunderstanding of the theory itself, and a failure to appreciate the work needed to properly apply the theory in efforts to change behaviour; adding further, that Sniehotta et al., (2014) misinterpreted negative findings of poorly conducted studies as evidence against the theory (Ajzen, 2015). Meanwhile, the commentary by Conner (2015), a prevalent TPB researcher, criticized Sniehotta et al., (2014) for views he believed were either 'misplaced' or 'lacking strong evidence'. The following sections present Sniehotta and colleagues' main criticisms of the TPB and the responses from social psychologists (primarily Ajzen, 2015).

2.7.3.2 Limited predictive validity

The main focus of criticism from Sniehotta et al., (2014) has been the limited predictive validity of the TPB. They argue that not all theory-external influences on behaviour (e.g., age, socio-economic status, physical health) are mediated through the TPB (Sniehotta et al., 2013 - a study of physical activity behaviour). Further, they argue that there is considerable evidence that habit strength (Gardner et al., 2011), self-determination, and anticipated regret and identity (Conner and Armitage, 1998), or self-regulatory measures such as planning (Carraro and Gaudreau, 2013), regularly predict behaviour over and above the TPB measures (Sniehotta et al., 2014). Last, Sniehotta and colleagues criticize the TPB for being most predictive amongst the young, fit, and affluent, and when predicting self-reported behaviour over a short-term (McEachan et al., 2011, Sniehotta et al., 2013); which is less compatible with populations in which behaviour change theory is needed most (Sniehotta et al., 2014). Ajzen (2015) does not deny that the TPB cannot fully account for the variance in intentions and states that, *"even when the TPB measures are carefully constructed, reliabilities rarely exceed 0.80,*

suggesting that predictive validity for intentions may be getting close to the theoretical limit". Specifically, events occurring between the assessment of intentions and observation of behaviour can produce changes in intentions, and unanticipated obstacles can prevent people from carrying out their intentions. For example, in the morning, a person may have favourable beliefs about exercising after work; however, after a long day's work, this belief can change to unfavourable because the person is tired (Ajzen, 2015).

2.7.3.3 Exclusive focus on rational reasoning

Another weakness of the TPB noted by Sniehotta and colleagues' is its exclusive focus on rational reasoning, meaning that unconscious influences on behaviour are excluded from the model, including the role of emotions. Taking offense, Ajzen (2015) commented that *"nothing could be further from the truth"* since the TPB does not propose that people are rational or that they behave in a rational manner. Rather, he states, the theory requires that people's attitudes, subjective norms, and perceptions of control follow reasonably and consistently from their beliefs, no matter how the beliefs were formed, and, in this way, they influence intentions and behaviour (Ajzen, 2015).

Finally, Ajzen (2015) implies, based on this criticism, that Sniehotta and colleagues have not done their homework on the TPB theory with the gibe *"they must never have read any of my recent conceptual articles, chapters, or books dealing with the theory"* (Ajzen, 2015).

2.7.3.4 Unhelpful with interventions

One of Sniehotta et al. (2014) most severe criticisms of the TPB is its apparent failure to provide an adequate basis for behaviour change interventions. They argue that the TPB fails to specify how cognitions change, making it difficult to devise effective interventions to modify attitudes, subjective norms and perceptions of behavioural control (Sniehotta et al., 2014). Ajzen responded that the TPB is, in fact, not a theory of behaviour change. Instead, it is meant to help explain and predict people's intentions and behaviour (Ajzen, 2015). From his past research on behavioural interventions, Ajzen (2015) points out that the theory can serve as a useful framework for designing effective behaviour change interventions (Ajzen, 2011a). Sniehotta et al., (2014) criticize

the TPB's effectiveness when experimental (versus correlational) tests of behaviour change intervention are conducted, stating that *"the results from observations have not been in line with the theory."* Ajzen (2015) suggests that a great deal of preparation and formative research must take place before designing an effective behaviour change intervention (Ajzen, 2015), and criticizes Sniehotta (2009) for not taking such steps when they tested the TPB experimentally for attendance at university sports facilities.

Ajzen (2015) notes the following shortcomings of the Sniehotta (2009) study:

- No evidence was provided for the reliability and discriminant validity of the measures in the present context.
- No attempt was made to ensure that the interventions actually changed the beliefs at which they were directed; further, these beliefs were never assessed.
- The interventions seem to have been devised intuitively without any pilot testing.
- The above resulted in the results being disappointing and difficult to interpret.

2.7.3.5 Static nature of the model

Sniehotta et al., (2014) accuses the TPB model of being 'static'. By 'static' Sniehotta means that the model's four constructs (attitude, subjective norms, perceived behavioural control, and intention) do not interact with and/or affect one another. Since human behaviour is very dynamic, a human behaviour model that is static is considered flawed. In addition to being static, Sniehotta et al., (2014) questions how only four constructs help to explain the effects of behaviour on cognitions and future behaviour.

In response, Ajzen (2015) suggests that Sniehotta and colleagues are 'misguided' and have a poor understanding of the TPB and of the nature of psychological research. The TPB founder explains that the usual graphic representation of the theory is an oversimplification, which, among other things, omits feedback loops from behaviour to cognitions (Ajzen, 2015). An example of the consideration of feedback loops is: *"when a behaviour is carried out, it can result in unanticipated positive or negative consequences, it can elicit favorable or unfavorable reactions from others, and it can reveal unanticipated difficulties or facilitating factors. This feedback is likely to change the person's behavioural, normative, and control beliefs, and thus, affect future intentions and actions"* (Fishbein & Ajzen, 2010).

Ajzen concludes his response to the criticism by Sniehotta et al., (2014) that his model is 'static' by stating that *"this misconception may occur when a diagram of the TPB is inspected without reading the accompanying text"* (Ajzen, 2015).

2.7.3.6 Where to next for the TPB?

Sniehotta et al., (2014) conclude their editorial by recommending that new discoveries are needed to better explain health behaviour change. They suggest that a broader theoretical perspective is required and that the TPB should be retired. To Ajzen's (2015) point, while several alternative approaches are presented, Sniehotta et al., (2014) offer no evidence that the models they list overcome the criticisms they aim at the TPB. Conner (2015) agrees with Ajzen, and states that Sniehotta et al. (2014) appear to be premature in their desire to retire the TPB and replace it with other models that only have a fraction of the evidence base. Even Ogden (2015), a critic of the TPB, seems perplexed about what future models might look like, stating that the extended-TPB models have become 'too complex' and 'all-encompassing', and have become impossible to operationalize….. *"so, we struggle where to position ourselves on this tricky continuum"* (Ogden, 2015).

Regarding extended TPB modelling, Ajzen (2015) states that there is nothing in the TPB model to preclude the addition of new predictors, and he reminds the reader that the TPB was developed by adding a new construct (perceived behavioural control), to the original Theory of Reasoned Action. Similar to Ogden (2015), Ajzen comments that some of the predictor variables added by researchers to extend the TPB model may not help to predict intention. When extending the TPB model, Ajzen (2015) recommends adding a predictor variable that is similar to an existing TPB construct as this may improve the prediction of intention. For example, attitude is currently a predictor variable as part of the TPB model. By adding a second predictor variable that is associated with attitude (e.g., mood), it may be possible to improve the prediction of intention since mood may contain meaningful variance that may not be accounted for by the TPB model's predictor variable of attitude (Ajzen, 2015). Meanwhile, Schwarzer (2015) believes that extended TPB modeling is required due to the so-called 'intention-behaviour gap', meaning that researchers have identified a weak point in the theory,

namely the translation of intentions into action. He goes on to say there is a collective desire to learn more about processes that occur after individuals have formed an intention; in particular, planning (implementation intentions) has become the most prevalent extension of the TPB (Schwarzer, 2015).

Conner (2015) believes it is unlikely that new models will exceed the predictive power of the TPB across such a broad range of behaviours using such a limited number of variables, although he welcomed future tests of rival models. Hagger (2015) acknowledged that the debate has helped to highlight how theory and thinking of health behaviour has moved on from the static, short-term, correlational tests of the theory, and has provided some thoughtful suggestions as to how social and health psychologists can continue to advance knowledge and thinking of the processes and mechanisms that underpin health behaviour forward. Contrary to Sniehotta and colleagues' criticisms, the TPB founder concludes his commentary by stating that, *"the TPB is alive and well and gainfully employed in the pursuit of a better understanding of human behaviour"* (Ajzen, 2015).

Reflecting on this debate over the state of the TPB between regarded social psychologists, I believe that the TPB, a dominant theoretical approach for the past 30 years, will continue to be a promising method to predict human behaviour. In my opinion, the foundation of the TPB is strong and, as Conner (2015) states, rather than retiring the TPB, there is good reason to capitalize on the contributions it has made, and continues to make, and to consider ways in which it can usefully be extended in the health domain. In conclusion, I support the following quote by Hagger (2015), *"I believe that the TPB will continue to serve as a basis or root of a multitude of new theories, revision and extensions, demonstrating its lasting contribution and the recognition 'respect' by the scientific community that has helped shape thinking the processes underpinning health behaviour."*

CHAPTER 3: STUDY 1

PATIENT LIFTING DEVICE USE BY CAREGIVERS IN A HOSPITAL SETTING: AN APPLICATION OF THE THEORY OF PLANNED BEHAVIOUR

3.1 Introduction

Healthcare workers increase their susceptibility to musculoskeletal disorders by engaging in high-risk behaviours, such as manually handling patients despite the availability of mechanical lifting devices. This raises significant ergonomic concern since patient handling has long been recognized as a high-risk activity (Garg et al., 1991, 1992; de Looze et al., 1998; Evanoff et al., 2003; Keir and MacDonell, 2004; Nelson and Baptiste 2006; Waters, 2007). Over the past two decades, biomechanists have confirmed that compressive and shear loads on the lumbar spine are high during patient handling (Gagnon et al., 1987; Garg et al., 1991, 1992; Marras et al., 1999; Daynard et al., 2001) and that these forces often exceed the Action Limit (AL, 3400 N) and even the Maximum Permissible Limit (MPL, 6400 N) for lumbar spine compression set out by the National Institute for Occupational Safety and Health (NIOSH) (Waters et al., 1993). Even if healthcare workers use proper body mechanics when manually handling patients, it is not sufficiently effective in reducing MSD risk to acceptable levels (Nelson et al., 2006; Hignett, 1996; Daynard et al., 2001).

Not surprising is the substantial physical toll on healthcare workers caused by handling patients manually versus using mechanical assistance. The literature contains extensive evidence that manual patient handling is a major contributor to the high incidence of musculoskeletal injury (Hignett, 1996; Hoogendoorn et al., 1999; Ando et al., 2000; Warming et al., 2009) and, more specifically, the prevalence of neck, low-back and shoulder injuries (Lagerstrom et al., 1998; Myers et al., 2002; Edlich et al., 2005; Engkvist, 2004; Nelson et al., 2007; Buckle, 1987; Trinkoff et al., 2006; Engkvist et al., 2000; Smedley et al., 2003; Burdorf et al., 2013). In a two-year prospective cohort study of more than 900 hospital CGs, Smedley et al., (1997) found that, among CGs who performed patient transfers without assistive devices, the likelihood of having back pain increased as the frequency of patient transfers increased. In more recent studies that analyzed workers' compensation data, patient handling accounted for 31-72% of musculoskeletal disorder cases among hospital workers (Lipscomb et al., 2012; Pompeii et al., 2009). An alarming finding according to Kuehn (2013), is that every 30 minutes a health care professional experiences a musculoskeletal injury while lifting or transferring a patient.

Risky work practices aside, preventing MSDs in healthcare workers is becoming increasingly complex. In addition to the composite physical demands associated with handling high loads in awkward positions, the CG environment in acute care settings is considered cognitively demanding (Kalish and Aebersold, 2010; Trinkoff et al., 2008). In psychophysical studies, CGs have reported high perceived stresses on the low-back and shoulders during manual lifting and transferring of patients (Garg and Owen, 1992; Owen and Fragala, 1999; Owen et al., 2002; Village et al., 2005; and Yassi et al., 2001). Similarly, psychosocial factors, such as low job satisfaction, negative beliefs, effort-reward imbalance, lack of social support, and burnout are related to low-back pain among CGs (Lagerstrom et al., 1998; Smedley et al., 2003; Yip, 2001; Mitchell et al., 2008; Sorour and El-Maksoud, 2012; Urquhart et al., 2013, Bernal et al., 2015).

In addition to the inherent risk already present via individual and environmental influences, the healthcare industry faces new MSD-related challenges due, in part, to increasing patient care demands, including: i) an increase in chronic disease management due to an aging population, resulting in more patients in hospital for longer periods of time, thereby affecting CGs' exposure to patient handling tasks, ii) increased obesity rates, resulting in higher than usual loads when manually maneuvering patients, and iii) increased prevalence of dementia-related illnesses, resulting in more patients being unable to assist in their mobility or presenting behavioural challenges around mobility, further resulting in increased physical demands for the caregiver (PSHSA, 2010).

Not only is the patient population older, as of 2016, most registered nurses in Canada were between 35 and 54 years of age, with almost one-quarter of the workforce 55 years or older (Regulated Nurses, 2016). This is concerning, since older workers perform tasks differently than younger workers due to declines in muscle mass, quality, and strength (Davis and Jorgensen, 2005). As well, older workers are at increased risk of back injury (Jager and Luttmann, 1996).

Based on published research, there is substantial justification for greater efforts to reduce the impact of manual patient handling on CGs. For instance, the caregiving profession is in the top 10 occupations at highest risk for musculoskeletal disorders (PSHSA, 2010) along-side workers in construction, mining, and manufacturing (Nelson

et al., 2003; BLS., 2007). As well, healthcare workers lose time from work at a rate 1.5 times that of the average Canadian worker (PSHSA, 2010). Further, in 2005, in the largest, most comprehensive survey ever conducted on the working conditions of Canadian nurses, 60 per cent said their jobs presented them with high physical demands (At Work, 2007). On an individual level, low-back pain has been identified as a major reason why caregivers leave their profession (Nelson et al., 2003). Many of them experience chronic pain, long-term disability, and/or career-ending injuries caused by manual patient handling. This can begin a negative cycle of high turnover resulting in caregiving shortages due to retention issues, as well as challenges with recruitment.

Burdorf et al., (2013) suggested that “reducing the occurrence of low-back pain in healthcare settings can only be achieved by interventions which result in a large decrease in mechanical load and a high level of implementation in the population at risk”. Although this recommendation seems straight-forward, the major challenge of implementing such a strategy is evident in the on-going rates of soft tissue injuries that continue to plague the caregiving profession; often despite large hospital budgets and dedicated teams of internal resources whose focus is MSD prevention. It is justifiable to say that the mechanical load aspect of Burdorf’s advice has been addressed through the widespread implementation of PLD initiatives around the world; that is, engineering ergonomics solutions to reduce biomechanical stressors among CGs. Several studies have demonstrated the value of lifting devices and their associated decreases in spinal loads on workers (Daynard et al., 2001; Marras, et al., 2009; Schibye et al., 2003; Village et al., 2005; Zhuang et al., 1999). However, the unfortunate reality is that achieving the acceptance of lifting device interventions has varied considerably in the scientific evidence for, and the reported influence on, health outcomes, suggesting that evaluating the effects of lift assist involvement in the quickly changing environment of healthcare is complex (Straker et al., 2004; Burdorf et al., 2013).

Most of the health care literature suggests that workplace interventions involving mechanical PLDs, have only demonstrated moderate effectiveness as strategies to reduce musculoskeletal injuries associated with patient handling and that more robust research is needed (Hignett, 2003; Amick et al., 2006; Koppelaar et al., 2009; Tullar et al., 2010). Several barriers to the appropriate implementation of PLD interventions have

been identified at both individual and organizational levels (Koppelaar et al., 2009; Koppelaar et al., 2010) and many factors are considered to play a role (Schoenfisch, et al., 2011). A summary of the barriers to PLD use, as identified in the literature, is outlined in Chapter 2, Literature Review, Section 2.6.

Although research efforts have identified various factors that may influence the appropriate implementation of lifting device interventions, their impact on the effectiveness of the interventions have not been evaluated. A systematic review of the determinants of the implementation of primary preventive interventions on patient handling by Koppelaar et al., (2009) suggests that *"since barriers in implementation are often acknowledged as the cause of the ineffectiveness of patient handling devices, there is a clear need to quantify the influence of these barriers on the effectiveness of primary prevention interventions in healthcare"*. For example, Evanoff et al., (2003) found that the larger reduction in injuries, observed in some hospitals, was likely due to a policy of mandatory lift use, established care activities, and patient characteristics. However, because only a qualitative assessment was provided, it is difficult to determine the actual influence of these barriers on the primary intervention, as it is separated from the implementation process (i.e., information gathered later) (Koppelaar et al., 2009).

In 2010, Koppelaar et al., gained additional knowledge about the individual and organizational factors necessary for successful ergonomics interventions in healthcare settings. However, there continues to be a limited understanding of the reasons for the lack of PLD use despite CGs' knowledge that PLDs are effective in helping to reduce MSD risk. Some studies (Holman et al., 2010; Myers, 2012) suggest that caregiving culture may adversely affect the adoption of patient handling devices. To develop this theory further, Study 1 takes a behavioural focus by applying the Theory of Planned Behaviour (Ajzen, 2006) to better understand CGs' intentions, and to use this understanding to improve the effectiveness of lifting device interventions and, ultimately, effect the primary prevention of musculoskeletal disorders in healthcare.

3.2 Study Purpose and Hypotheses

The purpose of this study is to identify the barriers between: (1) CGs' knowledge (training/education) and intent to use PLDs, and (2) CGs' intent to use PLDs and actual

use of PLDs (i.e., behaviour). These barriers are shown in the conceptual framework for Study 1 (shown in Figure 4 below for convenience) as B_1: Barriers to intention and B_2: Barriers to behaviour. The first barrier of interest (B_1) can occur when CGs have been educated/trained on the positive aspects of using PLDs; however, despite their knowledge, they have no intent to use the devices (i.e., negative intention). The second barrier of interest (B_2) can occur when CGs with a positive intent to use PLDs, in actual practice, do not use them (i.e., negative behaviour).

In addition to an important contribution to identifying barriers to CGs' use of PLDs, it is anticipated that this study will help to: (i) contribute to the goal of reducing musculoskeletal injuries among healthcare workers, (ii) improve training/education content that CGs receive on PLDs, (iii) gain a better understanding of the role that the patient plays in CGs not using PLDs and, (iv) increase the likelihood of CGs using PLDs in the future.

Three research hypotheses will be posed to help identify potential barriers to PLD use by caregivers. These include:

i) CGs avoid using PLDs despite their knowledge that manually handling patients increases their risk of back injury.

ii) Some CGs, who intend to use PLDs in actual daily practice, do not use them.

iii) The patient is a potential barrier between CGs who intend to use PLDs, but in actual daily practice, they do not use them.

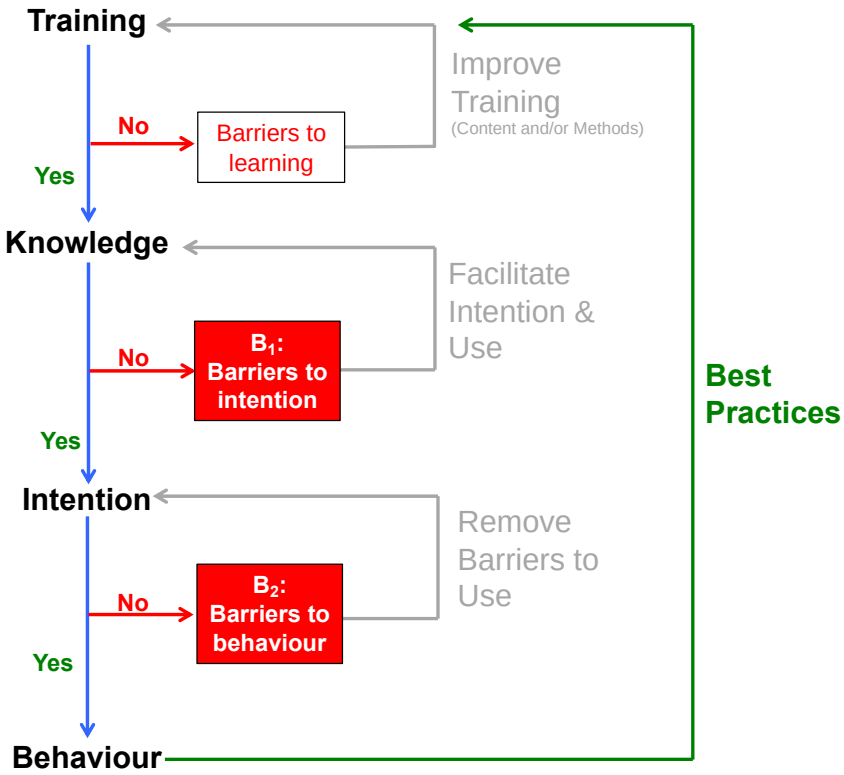

Figure 4. A conceptual framework for the study of CGs' adoption of PLDs as part of their care practices. As shown in black text, the assumption is that CGs must: (1) be trained in the benefits and proper use of PLDs before they are knowledgeable, (2) be knowledgeable of the benefits of PLDs before having intent to use them, and, (3) have intent to use PLDs before adopting the actual behaviour of doing so. CGs' decision-making that follows the '**Yes**' choices, from Training to Behaviour, is considered best practices, and this information will be used to better understand the current gaps between CGs' knowledge and actual practice (behaviour) towards the adoption of PLDs. CGs' decision-making that follows the '**No**' choices will facilitate a study of the barriers to intention (B_1) and the barriers to behaviour (B_2) that may hamper the adoption of PLDs. Note: 'barriers to learning', and the three interventions in grey text on the right side of the figure, will not be evaluated in the study; however, they contribute to an overall understanding of the framework.

3.3 Methods

3.3.1 Participants

This study will take place in a large hospital setting that provides clinical care to patients in need of being transferred with a ceiling mounted and portable PLD. A hospital unit with the following criteria will be considered for selection: (i) readily available ceiling mounted and portable PLDs, (ii) a significant amount of patient handling is required due to the patient's level of care and patients not able to assist much during lifts/transfers, (iii) CGs administer individual-based care (as opposed to team-based care) so that CGs' individual beliefs can be captured, and (iv) the frequency of CGs experiencing work-related musculoskeletal injuries is high relative to other units. Potential settings for consideration for Study 1 include a: Medical and Radiation Oncology Unit, Spinal/Neurosurgery Unit, Surgical Unit, Multi Organ Transplant Unit, and Medical Surgical Intensive Care Unit.

A convenience sample of 15 CGs will be recruited for focus group interviews (Group 1) and 15 CGs will be recruited for semi-structured interviews (Group 2). Note, the same participant can participate in Group 1 and Group 2. The eligibility criteria for CGs is that they have the qualifications of Registered Nurse (RN), Registered Practical Nurse (RPN), Occupational Therapist (OT), or Physiotherapist (PT) and are full-time employees with a minimum of six months experience working on a unit. In addition, CGs must be familiar with the PLDs currently in place on the units and transferring patients via PLDs will be an essential duty of their job.

Group 3 will consist of 10 patient volunteer participants who will be invited to participate in a semi-structured interview with the researcher. Patients' family members will not be directly recruited as participants in the study. However, if they are present when the interview is taking place with the patient, the family member will be asked to sign a consent form prior to participating in discussions. Patients will be eligible to participate if they are in stable health and require a PLD when being transferred. Also, patients must be English-speaking and literate individuals. Family members present at the time of the interview will be invited to participate pending verbal approval from the patient. Family members must be English-speaking and literate individuals.

All aspects of the research will be reviewed and approved by the research ethics board of the university and hospital (if applicable). All participants will be recruited on a volunteer basis and will sign a consent form prior to participating. To maintain anonymity, participant identification numbers will be assigned and will be used to identify responses. As appreciation for their involvement, participants will receive a Tim Horton's gift card valued at $10.

3.3.2 Instrumentation and Data Acquisition

The researcher will design a study information sheet that will be emailed to all CGs on the unit. The study information sheet will also be posted in the CG lounges on the unit. The study information sheet will contain the researcher's contact information and will request interested CGs to contact the researcher by email or phone if they want more information about the study. The researcher will design a checklist to help guide the naturalistic observations that will take place on the units.

A handheld digital voice recorder, that will ensure a high-quality recording, will be used to record participants' responses during focus group interviews and semi-structured interviews. The recorder will have the capability to transfer the recorded interviews from the digital voice recorder to a computer. Hard copies of the focus group questions will be available for reference by the researcher when facilitating the sessions. A hard copy of the questionnaire will be provided to participants in Group 2 along with a pen for recording answers. The researcher will always have a note-taking book and pen for recording information as needed.

The content of the responses from the audio-recordings from the focus group interviews will be transcribed verbatim to a computer. These data will be stored on a password protected computer. Only the researcher, or their supervisor, will have access to the data which will include audio files and transcripts. Further, to maintain participant confidentiality, all data will be anonymized. During data analysis, any files that are shared will be done via a secure file sharing service storage drive available to McMaster University students. Access to the storage drive is controlled by the researcher. Guests must request access to the storage drive and be approved by the researcher. At any time, the researcher can delete a guest from accessing the storage drive. A Virtual Private Network (VPN) feature will allow the researcher to access the storage drive

network while off campus using their personal laptop. Connecting to the server for access to the storage drive requires the researcher's McMaster identification name and password which is known only to the researcher.

3.3.3 Experimental Procedures and Protocol

3.3.3.1 Adapted study protocol

The proposed protocol for this study is adapted from the manual "Constructing Questionnaires Based on The Theory of Planned Behaviour: A manual for Health Services Researchers" by Francis et al., (2004). The manual has been applied directly to the procedures described below for Section 3.3.3.4 - Focus Group Interview, Section 3.3.3.5 - Semi-structured Interview with CGs, Section 3.3.4 - Data Analysis and Section 3.3.5 - Statistical Analysis. Similar to the purpose of this study, other researchers (Giles et al., 2007; Lee & Lee 2010; and Kothe et al., 2012) have applied the Francis et al. (2004) manual to their TPB-based research in an effort to better understand human behaviour. In my opinion, the steps outlined in this manual will contribute to better understanding CGs' intentions regarding PLD use.

3.3.3.2 Recruitment

Buy-in from the unit manager will be essential to the overall success of the study and their support for the study will influence CGs' willingness to participate. Therefore, the researcher will meet with the unit manager to ensure they are on board with their unit, and potentially their CGs, being involved in the study. Following an explanation of the study to the unit manager and their approval of the research taking place on their unit, the researcher will answer any questions they may have. Prior to data collection, the researcher will work with the unit manager to ensure that the details of the study are communicated to all CGs and patients on the unit, regardless of whether they are participating in the study.

The researcher will provide a 1-page study information sheet and ask the ward clerk (or other appropriate hospital staff) to email the study information sheet to all potential participants in Groups 1 and 2 (i.e., CGs). A supply of the information sheet will also be provided in the CG lounges on the unit. The study information sheet will contain the researcher's contact information and will request interested potential participants to

contact the researcher by email or phone if they want more information about the study. The researcher will respond to interested potential participants from each group by email or phone and will provide a copy of the consent and answer any questions that they may have about the study. Any potential participants for Groups 1 and 2, that are interested in participating in the study, will be asked to sign a consent form and their contact information will be recorded in the participant log. The signing of the consent form will be witnessed, and the participant will receive a copy of the signed consent.

Further to the email to potential Group 1 and 2 participants, the researcher will attend CG meetings (e.g., daily huddle, staff meeting) to briefly introduce the study and answer any questions. During this time, any CGs that are interested in participating in the study will be asked to sign a consent form and their contact information will be recorded in the participant log. The signing of the consent form will be witnessed, and the participant will receive a copy of the signed consent.

To recruit patients and family members for Group 3, the researcher will begin each day with a meeting with the CG in charge of the unit to discuss possible patient recruitment for that shift. Following the direction provided by the CG in charge, the researcher will speak with individual CGs to find out which of their patients can be approached, with regard to the clinical activities that the patient is undergoing. CGs will be asked to speak to the patient they are assigned to take care of that day, and find out if they are interested in hearing more about the study. If the CG confirms that a patient is interested, the researcher will provide the patient and family member (if present) with an information sheet that explains the research project in general and activities of patient and family participants. Only the researcher will answer any questions about the study from patients and family members. The CG will in no way be directly involved in recruiting patients and their family members for the study.

The researcher will provide the patient and family member with a copy of the consent and answer any questions that they may have about the study. If the patient and family member are interested in proceeding, the researcher will negotiate a mutually agreeable time to begin data collection (e.g., later the same day), ensuring that any remaining questions are answered, the consent is signed and witnessed for the

patient and family member, and that the patient and family member each receive a copy of the signed consent.

3.3.3.3 Naturalistic observations

Observations, sometimes referred to as shadowing, is a data collection technique where people are observed performing their regular day-to-day job duties in their normal work environment. Observational data tend to be complementary to other qualitative data like interview, focus group, or survey data. However, whereas interviews, focus groups and surveys are more useful for better understanding *why* things happen, observations are essential for understanding *how* things happen. It is important to observe rather than ask a person how something happens because it is common for people to perceive step-by-step processes differently than they happen in reality. This is due to inherent human limitations like cognitive biases and because people do not tend to think about well-known processes in discrete steps. Through observations, gaps can be identified between perceived actions and actual events in an appropriate level of detail (Cassano-Piché et al., 2015).

In a manner that is unobtrusive to CGs and their patients, observations will be made by the researcher to learn: (i) which CGs are interacting with PLDs, (ii) what tasks are being performed during PLD transfers, (iii) what other aspects of the environment are relevant to CGs deciding to use PLDs, and (iv) actual challenges, work-arounds, and strategies used by CGs that are happening in real time. In addition, the researcher will make observations about the physical layout of PLDs in rooms, the type of care delivered to patients on the unit, the condition of patients, the design of the PLDs, etc. The researcher will follow a prepared checklist to help guide the naturalistic observations and the data gathered will be recorded in a notebook. The notebook will be stored in a secure file cabinet.

3.3.3.4 Focus groups with CG participants

Focus groups help to gather the personal and group feelings, perceptions and opinions of people; hence, conducting focus group interviews with CGs on the units will allow for a broad range of qualitative information about their values and beliefs

regarding PLD use. In addition, focus groups will allow the researcher the opportunity to seek clarification on ideas and/or concerns that are shared.

Focus group interviews will be conducted to elicit the views of 15 CG participants from Group 1 to better understand the knowledge-to-practice/behaviour gaps for the use of overhead ceiling mounted and portable PLDs. An open and natural discussion format will be encouraged to allow for a wide variety of perspectives during the estimated duration of 45 minutes. The researcher will be flexible as to the timing and frequency of the focus groups; for example, facilitating the interviews before, during, or after a shift and/or facilitating two sessions with 4-5 CG participants in each session. However, the ideal timing and frequency of the sessions will be determined by the unit CG in charge. The researcher will consult with unit educators for their advice regarding logistics (e.g., session timing, room allocation, etc.) to help ensure that the sessions run smoothly. The audio-recorded sessions will take place in a room to be determined by the CG in charge and/or unit manager. Refreshments will be offered to participants.

The qualitative data collected from participant responses to set questions will be used to develop questions for the TPB-based questionnaire that will be administered during the semi-structured interviews with CG participants (Group 2). The question set for the focus group will be taken from the manual “Constructing Questionnaires Based on The Theory of Planned Behaviour: A manual for Health Services Researchers” by Francis et al., (2004). The focus group questions will include the following:

- What do you believe are the advantages of using PLDs to transfer patients every shift?
- What do you believe are the disadvantages of using PLDs to transfer patients every shift?
- Is there anything else you associate with your own views about using PLDs to transfer patients every shift?
- Are there any individual or groups who would approve of your using PLDs to transfer patients every shift?
- Are there any individual or groups who would disapprove of your using PLDs to transfer patients every shift?
- Is there anything else you associate with other people’s views about using PLDs to transfer patients every shift?
- What factors or circumstances would enable you to use PLDs to transfer patients every shift?
- What factors or circumstances would make it difficult or impossible for you to use PLDs to transfer patients every shift?

- Are there any other issues that come to mind when you think about using PLDs to transfer patients every shift?

A hard copy of a potential list of the themes, derived from the scientific literature, to explore during the focus group interviews will be available to the researcher only. To ensure that all of the themes are covered during discussions, CG participants may be prompted by the researcher with *"What about [INSERT THEME] and PLD use?"* Examples of themes include delivery of patient care, increased back injury risk, education/training, self-efficacy, management support, policies and procedures, ergonomics program, positive intention/negative behaviour, repercussions for not using PLDs, ensuring best practice, how to increase PLD use in future, patient role, patient assessment before transfer, nursing culture, increased well-being, and/or CG input during selection/implementation of PLDs.

3.3.3.5 Semi-structured interviews with CG participants

Approximately eight weeks after the focus group data have been collected, individual semi-structured interviews will be held with 15 CG participants (Group 2). The researcher will facilitate the interviews according to the CGs' schedule; for example, a phone interview could be conducted on a day off or held in-person before, during or after a shift.

The ~45-minute interview, which will be audio-recorded, will involve administrating a theory-based questionnaire to measure the TPB constructs of attitude, subjective norms, perceived behavioural controls and intent. The first section of the questionnaire will ask about demographic information (gender, birth year, qualifications, years' experience, musculoskeletal health history, weekly work hours, frequency of PLD use per shift, etc.). The second section of the questionnaire will contain ~40 questions that will be based on the themes emerging from the findings of the focus group interview. The researcher and CG participant will each have a copy of the questionnaire and will work through each question together. For the discomfort survey, CG participants will be asked to locate body areas where they may be experiencing discomfort and indicate the frequency and intensity of this discomfort. The CG participants completed questionnaire will be returned to the researcher once completed. The completed questionnaires will be

stored in a secure file cabinet. It will be up to the discretion of the CG participant as to whether they would like the interview to be held by phone or in-person. The TPB questionnaire will be designed and developed as per Francis et al., (2004) based on the following sections of the manual:

- Steps in the Construction of a TPB Questionnaire (Section 3)
- Measuring Behavioural Intentions (Section 4)
- Measuring Attitudes (Section 5)
- Measuring Subjective Norms (Section 6)
- Measuring Perceived Behavioural Control (Section 7)
- Steps in Managing a TPB Survey (Section 8)
- Example Questionnaire (Section 12.2)

Similar to the protocol for the focus group interviews, the researcher will consult with unit educators for their advice regarding logistics (e.g., in-hospital interview timing, room allocation, etc.) to help ensure that the interviews run smoothly.

3.3.3.6 Semi-structured interviews with patient participants

A final step in data collection will involve semi-structured interviews with patients to gain a better understanding of the role that the patient, and possibly their family members, play in CGs using PLDs as part of care practices. The family member will not be directly recruited as a participant in the study. As mentioned above, if they are present when the interview is taking place with the patient, the family member will be asked to sign a consent form prior to participating in discussions.

Semi-structured interviews will be held with 10 patient participants to gather focused, qualitative textual data on the experiences of patient participants that have been transferred by way of a PLD. This information will help to better understand the role of the patient participant as a potential barrier to the use of PLDs by CGs. The format of the interview will be open, allowing new ideas to be raised during the interview depending on the patient participant's responses. The 15-20-minute interview will be audio-recorded and will take place in the patient participant's private room or in a room on the unit that ensures privacy. Signage indicating that a meeting is in progress will help to control interruptions. Patient participants will be asked a series of questions and

they will be informed by the researcher that they are free to refuse to answer any of the questions at any time. Examples of potential questions will include the following:

- *What is your gender?*
- *In what year were you born?*
- *What is your primary language?*
- *Describe your experience(s) being transferred in a PLD. Did you feel comfortable? Did you feel safe?*
- *Did the health care worker explain what was going to happen before your transfer in the PLD started?*
- *Were you able to assist in any way during your transfer in the PLD?*
- *What is your preference for transfer: manual handling by a health care worker or by way of a PLD?*
- *Have you ever asked your health care worker not to transfer you by way of the PLD? If so, why?*
- {Questions directed to family member participant, if present and consented to participate}: *Describe the experience of your family member being transferred by way of the PLD. Have you ever asked a health care worker not to use the PLD to transfer your family member?*

3.3.4 Data Analysis

The proposed procedures for the analysis of data are outlined below.

3.3.4.1 Focus groups

The content of the responses from the focus groups (Group 1) will be analyzed independently by two researchers to increase the validity of the analysis. As such, the researcher will deductively analyze the content of the responses into themes and will list the themes from most to least frequently mentioned for (i) behavioural beliefs, (ii) normative beliefs (sources of social pressure), and (iii) control beliefs (see Appendix A, Section A in Tables 6, 7, & 8). Independent from the researcher, a graduate student who, experienced in qualitative methods, will be hired to assist with data analysis. The researcher and graduate student will then meet to review and assess accuracy and agreement on the coding of the themes.

3.3.4.2 Semi-structured interviews

Text data from the semi-structured interviews with patient participants (Group 3) will be deductively analyzed for common themes related to potential barriers and facilitators regarding PLD use and suggestions to improve best practice in the future. Similar to

above, the same graduate student that assisted with data analysis of the focus group data will conduct a second analysis of data from the semi-structured interviews with CG participants (i.e., coding themes independent of the researcher, assessing accuracy of coded themes, etc.).

3.3.4.3 Analysis of data for the measurement of predictor variables

Predictor variables include the constructs of attitude, subjective norm, perceived behavioural control and behavioural intention. The questionnaire administered to CG participants via semi-structured interviews will be designed to collect direct and indirect measurements for each predictor variable and these data will be analyzed as per the sections outlined below.

Summaries of the steps involved in data analysis, for the direct measurement and indirect measurement of each predictor variable (as per Francis et al., 2004), are provided in Appendix A, Tables 5, 6, 7 & 8. Note, for the examples from Francis et al., (2004), for direct measurement of the predictor variables, the behaviour under study is the decision to refer a patient for x-ray. For indirect measurement of the predictor variables, the example behaviour is the decision to measure blood pressure of patients with Type 2 diabetes.

Behavioural Intention

As per Francis et al., (2004), Section 4, there are three methods for the direct measurement of behavioural intention from which Method 2, Generalized Intention, will be applied. The rationale for selecting Method 2 is based on the fact that it is the most common method used for research about an individual's health-related behaviour (Francis et al., 2004), such as using PLDs to avoid musculoskeletal injury. Data analysis will involve calculating the mean of the three intention scores as per Section 4.2.2 – Scoring (Francis et al., 2004) and Appendix A, Table 5.

Attitude

A direct measurement of attitude will involve the use of bipolar adjectives (i.e., pairs of opposites) which are evaluative (e.g., good – bad). The procedure for designing the attitude items for measurement will follow Section 5.1.1 – Procedure, in Francis et al., (2004). As per Scoring – Section 5.1.2, items that have negatively worded endpoints on

the right of the scale (i.e., score of 7) will be recoded so that higher numbers always reflect a positive attitude to the target behaviour (i.e., PLD use). The mean of the 7-option response format item scores will be calculated to give an overall attitude score. See Appendix A, Table 5.

An indirect measurement of attitude will involve measuring behavioural beliefs and outcome evaluations as per Section 5.2 in Francis et al. (2004) and Appendix A, Table 6. As per Formula 5.1 in Francis et al., (2004), data analysis will involve weighting the outcome evaluation score (e.g., green circles in Figure 5) to the behavioural belief score (e.g., red circles in Figure 5) for each question. The sum of the weightings will produce an overall attitude score (e.g., +27 in Figure 5). A positive score will mean that, overall, the CG participant is in favour of using PLDs during transfers as part of care practices. A negative score will mean that, overall, the CG participant is against using PLDs during transfers as part of care practices.

Box 5.5 Example, scoring procedure

a	If I measure blood pressure (BP), I will feel that I am doing something positive for the patient.	Unlikely	1	2	3	4	***5***	6	7	Likely
B	It causes a lot of worry and concern for the patient if they are found to have high BP	Unlikely	1	***2***	3	4	5	6	7	Likely
C	If I measure BP, I will detect any problems at an early stage.	Unlikely	1	2	3	4	5	***6***	7	Likely
D	If I measure BP, I've got to see some patients more often.	Unlikely	1	***2***	3	4	5	6	7	Likely
e	Doing something positive for the patient is:	Extremely undesirable	-3	-2	-1	0	+1	+2	***+3***	Extremely desirable
F	Causing a lot of worry and concern for the patient is:	Extremely undesirable	-3	***-2***	-1	0	+1	+2	+3	Extremely desirable
G	Detecting problems for these patients at an early stage is:	Extremely undesirable	-3	-2	-1	0	+1	+2	***+3***	Extremely desirable
H	Having to see some patients more often is:	Extremely undesirable	-3	-2	***-1***	0	+1	+2	+3	Extremely desirable

Imagine that a participant has responded by circling the numbers indicated in ***bolded italics*** above.

The total attitude score is calculated as

$$A = (5) \times (+3) + (2) \times (-2) + (6) \times (+3) + (2) \times (-1)$$
$$= (+15) + (-4) + (+18) + (-2)$$
$$= +27$$

Figure 5. An example of the procedure for scoring indirect measurement of attitude (Francis et al., (2004). The red circles represent the behavioural belief scores and the green circles represent the outcome evaluation score. The yellow box of +27, represents the sum of the weightings and is considered the total attitude score.

Subjective Norm

A direct measurement of subjective norm will involve the use of questions referring to the opinions of important people to CG participants in general. The procedure for designing the subjective norm items for measurement will follow Section 6.1.1 – Procedure, in Francis et al., (2004). As per Scoring - Section 6.1.2, items that have negatively worded endpoints on the right of the scale (i.e., score of 7) will be recoded so that high scores consistently reflect greater social pressure to do the target behaviour

(i.e., use PLDs). The mean of the 7-option response format item scores will be calculated to give an overall subjective norm score. See Appendix A, Table 5.

An indirect measurement of subjective norm will involve measuring normative beliefs and motivation to comply as per Section 6.2, in Francis et al. (2004) and Appendix A, Table 7. As per Formula 6.1 in Francis et al., (2004) and like the method for attitude in Figure 5, data analysis for subjective norm will involve weighting the motivation to comply score to the normative belief score for each question. The sum of the weightings will produce an overall subjective norm score. A positive score will mean that, overall, the CG participant experiences social pressure to use PLDs during transfers as part of care practices. A negative score will mean that, overall, the CG participant experiences social pressure not to use PLDs during transfers as part of care practices.

Perceived Behavioural Control

A direct measurement of perceived behavioural control will involve the use of questions referring to CG participant's confidence that they can perform the target behaviour (i.e., using PLDs). This will be achieved by assessing CG participant's self-efficacy and their beliefs about the controllability of the behaviour. The procedure for designing the perceived behavioural control items for measurement will follow Section 7.1.1 – Procedure in Francis et al., (2004). As per Scoring – Section 7.1.2, items that have negatively worded endpoints on the right of the scale (i.e., score of 7) will be recoded so that high scores consistently reflect a greater level of control over the target behaviour (i.e., use PLDs). The mean of the 7-option response format item scores will be calculated to give an overall perceived behavioural control score. See Appendix A, Table 5.

An indirect measurement of perceived behavioural control will involve measuring control beliefs and their perceived power to influence behaviour as per Section 7.2, in Francis et al. (2004) and Appendix A, Table 8. As per Formula 7.1 in Francis et al., (2004), and similar to the method in Figure 5 for attitude, data analysis for perceived behavioural control will involve weighting the control belief power score to the control belief score for each question. The sum of the weightings will produce an overall perceived behavioural control score. A positive score will mean that, overall, CG participants feel in control of using PLDs during transfers as part of care practices. A

negative score will mean that, overall, CG participants do not feel in control of using PLDs during transfers as part of care practices.

CHAPTER 4: STUDY 2

PATIENT LIFTING DEVICE USE BY CAREGIVERS IN A HOSPITAL SETTING: BARRIER SUBCATEGORIES WITHIN TRAINING

4.1 Introduction

For decades in healthcare, a variety of intervention strategies have been implemented to protect caregivers (CGs) from musculoskeletal injury due to manual patient handling. These intervention strategies have ranged from single-factor approaches (e.g., PLDs only) to multi-factor approaches which combine several components into one program (e.g., PLD equipment, education and training, no-lift policy, re-designed work environment, etc.) to technique training which focuses on education and training on safe work practices. However, as evidenced from the systematic review carried out several years ago by Hignett (2003), to the up-to-date systematic review by Richardson et al., (2018), there is an on-going absence of high-quality papers that allow for the identification of the factor(s) responsible for improvements in outcomes (e.g., musculoskeletal injuries). More specifically, of the 20 studies (from 2006 to 2018) systematically reviewed by Richardson et al., (2018), only: (i) two studies received a strong quality rating according to the assessment criteria, (ii) five studies achieved a moderate quality rating, and (iii) one study demonstrated a positive effect of an intervention on participant outcomes. The latter was a randomized control trial study that demonstrated wearing unstable shoes over a 6-week period significantly decreased low-back pain among hospital workers - suggesting the shoes, which work by activating muscles that enhance postural control, may be an effective intervention strategy (Richardson et al., 2018).

In summary, for the past 15 years, the methods used to investigate the efficacy of PLDs to assist healthcare workers, prevents any conclusions from being made. This includes conclusions regarding the effectiveness of: (i) introducing PLDs on reducing musculoskeletal injuries among CGs, (ii) improving patient handling techniques via training, and (iii) multi-factor interventions that include a training component.

As evidenced in the scientific literature, and in my professional career as an ergonomics practitioner, a commonly adopted approach to reduce the musculoskeletal injury risk associated with manual handling tasks is the implementation of employee training programs. Similarly, and as shown by intervention strategies that are aimed at promoting the use of PLDs, a grassroots component consistently involves training.

The rationale for training CGs on PLDs is to improve their level of knowledge and skill with the hopes that the training influences their behaviour in a positive way; that is, they will consistently make the decision to use PLDs as part of daily caregiving practice. Although this approach appears to be straight-forward, systematic literature reviews have repeatedly demonstrated the inadequacy of training programs for injury prevention, particularly when adopted as the primary or sole intervention (Dawson et al., 2007; Hignett, 2003; Martimo et al., 2008; Verbeek et al., 2011). An example is a study demonstrating that training nurses significantly improved knowledge (as evidenced by knowledge scores) and behaviour (as evidenced by body mechanics for specific patient-handling tasks) on low-back pain prevention; however, there was no significant effect on musculoskeletal injuries (Karahan and Bayraktar, 2013). Further, a study by Risor et al., (2017), showed that a multi-factor patient handling intervention strategy, that included a training component, improved nurses' attitudes towards patient handling devices and their use. Although the overall finding of this study is positive, the results do not necessarily demonstrate that training was independently effective, as it was bundled with other factors during implementation. Further, there is an overwhelming consensus from moderate quality publications that "inadequate" and/or "insufficient" training of healthcare workers on patient handling devices is one of the most significant barriers to the successful adoption of these devices (Bell, 1987; Jensen, 1987; Takala and Kukkonen, 1987; Garg et al., 1992; McGuire et al., 1996; Owen et al., 2000; Evanoff et al, 2003; Li et al., 2004; Engkvist, 2007; Koppelaar et al., 2009; Schoenfisch et al., 2011; Koppelaar et al., 2013).

Given the significant role that training has played in previous intervention strategies that were aimed at promoting PLD use (i.e., single-factor and multi-factor intervention strategies), and that training has been largely ineffective in protecting CGs from musculoskeletal injury by promoting PLD use, a more in-depth understanding of the potential barriers within training (i.e., barrier subcategories) is warranted.

4.2 Barrier Subcategories Within Training

Various approaches were taken to delve further into the potential barrier subcategories within training for the purpose of designing this study. The first involved reflecting on my own professional experiences as an ergonomist with training design,

development, and delivery to workers in a variety of work environments, including healthcare. The second approach involved a review of recent publications that involve training in healthcare and the effects on PLD use. Last, a personal interview was held with training and education expert Ms. Brenda Perkins Meingast who is the University Health Network (UHN) Director of Practice Based Education. The culmination of these approaches allowed for the identification of three main barrier subcategories within PLD training. These include: (i) barriers due to training content, (ii) barriers due to training methods, and (iii) barriers from management. A discussion of each of these barrier subcategories follows.

4.2.1 Barriers Due to Training Content

As specified by the Ontario Ministry of Labour (MOL), the minimum content requirement for PLD use training is to ensure that CGs know: (i) where to find PLDs, (ii) how to use PLDs, and (iii) how to report a malfunction in PLD-related equipment. While all three of these components are important elements of the learning process, as emphasized by Meingast, the training content component on how to use PLDs must be strong.

Based on the conceptual framework in Study 1 (shown in Figure 6 below for convenience), it is clear that gaps in training content introduce an immediate barrier in the learning process. Ineffective training content also interferes with the successful transfer of knowledge to CGs which, in turn, can influence the intentions and behaviour of CGs. The importance of effective training content in this early phase of the training process is stressed by Karahan and Bayraktar (2013) who found that the training of direct healthcare providers must increase knowledge to lead to a positive change in behaviour.

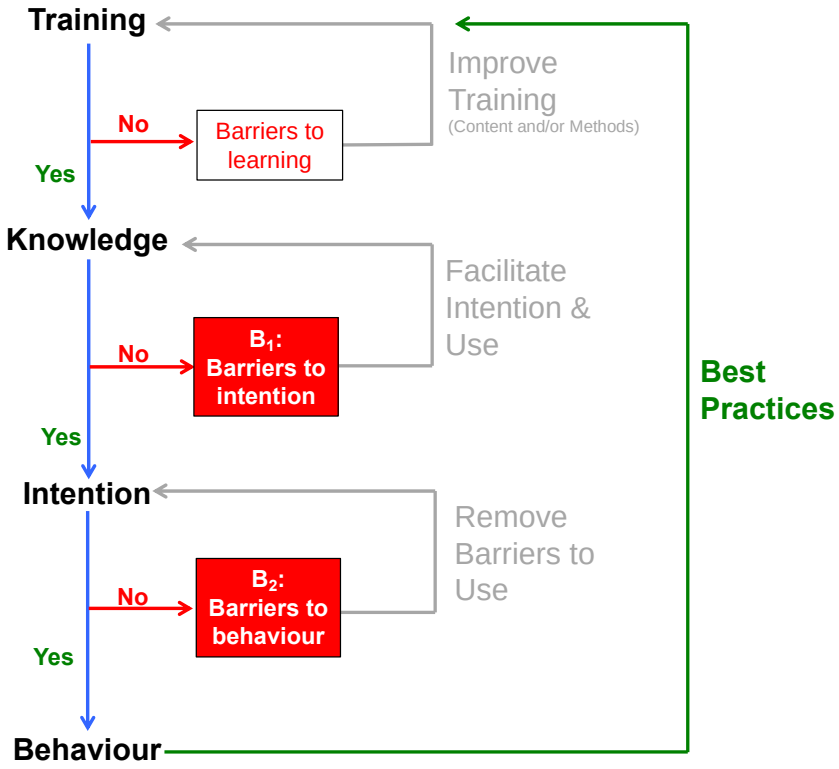

Figure 6. The conceptual framework from Study 1 shows that ineffective training content (see red 'No') leads to an immediate barrier to learning and that effective training content (see green 'Yes') is the foundation for CGs' knowledge which is an critical part of the learning process.

Subject matter that is not relevant to the demands of the work environment is considered a training content barrier that could negatively affect the use of PLDs. This is particularly relevant in hospital environments where daily care is often complex and the conditions of patients can change rapidly over time. The literature supports the need for the content of training sessions to be well-suited for adoption in clinical settings (Hignett, 2003; Koppelaar, et al., 2009; Charney et al., 2010; DeRuiter and Liaschenko, 2011, and Kay et al., 2015). As Vendittelli et al., (2016) found, there is a need for occupational health professionals to work together with hospital administrators and nurse educators to equip CGs with essential competence, knowledge, and skills to execute patient handling activities safely. In hospital environments, this participatory approach would ideally involve nurse educators, unit managers, and CGs in the design and development of training materials on PLD use.

As described in the Theory of Planned Behaviour model, behavioural beliefs help to guide human action by relating to a person's belief about the consequence of a particular behaviour (e.g., what will happen if I use/don't use the PLD?). This then produces a favourable (i.e., positively valued; e.g., using the PLD will reduce my injury risk) or unfavourable (i.e., negatively valued; e.g., using the PLD takes too much time) attitude toward the behaviour. When applied to training content, effective content can result in CGs leaving training with a positive attitude toward using PLDs, whereas ineffective content can result in CGs leaving training with an attitude that is negative. Evidence for the effects of the TPB construct of attitude has shown that the attitudes of CGs towards lift use significantly influenced the use of PLDs (Lee and Lee, 2017) and that individuals commit to healthy behaviours based on their perceived benefits (i.e., positive attitude) (Noble and Sweeney, 2018).

According to Meingast, the most effective way to reach CGs and promote positive attitudes towards using PLDs is through storytelling about real hospital life situations, including anecdotes of negative consequences because of CGs' decisions to not use PLDs. She describes storytelling as a method to intrinsically motivate CGs by informing them of how much preventable harm can occur by using the lift; for example, *"we need you here, you're important to us, we want to keep you safe and this is one way of doing it {encouraging PLD use}"* (B. Perkins Meingast, personal communication, November 12, 2021). Other examples of storytelling content include statements such as *"let me tell you a story about when a {caregiver} didn't use the PLD……..."* and *"we had a {caregiver} that did not use it {PLD}, the patient became agitated {during the manual transfer} and now they're on permanent disability"* (B. Perkins Meingast, personal communication, November 12, 2021). Storytelling, she says, trumps the technical aspects of training knowledge every time; for example, *"telling them it's important for their back is OK and they may listen to it, they may not – but when you provide real life accounts, that is when you reach them"* (B. Perkins Meingast, personal communication, November 12, 2021). Storytelling can also influence what CGs sometimes believe is a lack of perceived need for using PLDs and it can be used by senior CGs to set the tone for newer colleagues' behavioural beliefs by presenting a workplace culture that values using them. This is supported by Lee and Lee (2017) who found that safety climate has

been demonstrated to be the most influential factor linked to safe patient handling behaviours among CGs.

CGs are taught in university that the patient comes first and, as a result, they will often do what they believe is best for their patient, sometimes at the expense of their own well-being. The latter includes a CG's decision to not use PLDs to protect their patient. Therefore, it appears that if CG training content highlighted the benefits of lift use for both patients and CGs, it may be more likely that they will use the devices to keep their patients safe. For example, the literature has shown enhancements to patient safety with the use of lifting devices, including reduced incidence of pressure injures (Gucer et al., 2013; Kennedy and Kopp, 2015; and Walden et al., 2013) and falls (Kennedy and Kopp, 2015). And so, not including the close interconnection between the CGs' interest in their patient's safety, with their own personal safety, is considered a training content barrier that could negatively affect the use of PLDs.

Finally, Meingast stresses the importance of including training content that improves the CGs' knowledge of how to engage the patient in the PLD transfer experience from start to finish. For example, involving the patient's help to physically get into the device and talking with the patient before each step in the transfer so that the patient knows what is coming next and is physically and mentally prepared. This is especially important as patient profiles are becoming increasingly complex (e.g., higher incidence of dementia patients) and/or for patients that are in pain (i.e., agitated). Engagement, she suggests, involves partnering with the patient so that the transfer is not *"happening to them; {the caregiver} is doing it with them"* and talking to the patient to make sure that they understand what is happening to them and that they feel psychologically safe (B. Perkins Meingast, personal communication, November 12, 2021). The exclusion of training content that stresses the importance of patient participation in the transfer is considered a training content barrier that could negatively affect the use of PLDs.

4.2.2 Barriers Due to Training Methods

Similar to behavioural beliefs that dictate one's attitude towards a behaviour, according to the TPB, control beliefs refer to a person's perception of the ease or difficulty of performing a given behaviour (e.g., can I do it?). The control beliefs are an individual's beliefs about the presence of factors that may facilitate or hinder

performance of the behaviour which then determines a person's perceived behavioural control (i.e., self-efficacy). For example, a CG's fear of dropping a patient during a PLD transfer (i.e., a control belief that hinders performance of the behaviour) determines the degree to which the CG believes in their capacity to operate the PLD successfully (i.e., their perceived behavioural control or self-efficacy). When applied to training methods, the opportunity for hands-on practice using PLDs will provide the CG with a stronger sense of self-efficacy compared to PLD training that only occurs in the classroom and/or through e-learning.

Training methods that include an opportunity for practical hands-on experience using a PLD is well supported in the literature. For example, contextual training has been found to be more effective in promoting compliance with safe patient handling practices than classroom training (Resnick and Sanchez, 2009). Specific to PLD use, Hodder et al., (2010) demonstrated that theoretical and practical training in transfer techniques, using a PLD can improve posture and other injury-associated risk factors. According to Meingast, people learn by doing - *"knowledge is one thing, skill is another; {the caregiver} can hear about it {PLDs}, read about it, see it, touch it, but until you play with it and experience the using of it, it doesn't complete the learning cycle"* (B. Perkins Meingast, personal communication, November 12, 2021). An important element to incorporate in practical methods of training is the ability to problem-solve (de Ruiter and Liaschenko, 2011) by creating scenarios that are typical but also precarious. For example, what do you do if the patient becomes agitated during the transfer? What do you do if one of the straps comes lose or breaks mid-transfer? By practicing everything from a smooth PLD transfer to an emergency situation, *"you are creating productive struggle in the caregiver's thinking; you are creating resilience, you are creating trouble-shooting ability"* (B. Perkins Meingast, personal communication, November 12, 2021). A very appropriate analogy provided by Meingast, that sums up the significance of play-based learning, is as follows:

> *"A pilot knows how to turn a plane on… they know how to do their checklist… they know how to take off… they know how to go through turbulence… they know how to land…and they practice that…they do that and it becomes familiar… they have capacity; they can have a conversation while they're doing it now because it has become quite normal and routine; but what doesn't happen is when a bird flies into the engine and they have to make a water landing on a river…so that's what*

> *they practice – to build resilience – not telling them how to do it, but rather figure it out in a safe environment…… what better way to train?"* (B. Perkins Meingast, personal communication, November 12, 2021).

A caregiver with astute trouble-shooting abilities will have a strong sense of self-efficacy which, in turn, can help to promote positive experiences and perceptions about PLDs which Lee and Lee (2017) found can be vital to ensuring that lift equipment is used. Consequently, the exclusion of play-based learning, as part of a CG's training, may be a barrier in training methods and could negatively affect the use of PLDs.

The Wilson Center is an academic partnership between the University of Toronto and The Michener Institute of Education of UHN and is engaged in theoretical and applied research dedicated to advancing the understanding and practice of education in the health profession. A key message coming out of research at the Wilson Center is the importance of the pacing of training content. An example provided by Meingast is the importance of delivering training content in a way that allows CGs the opportunity to *"learn a little bit….go play….learn a bit more….answer questions about previous experiences…{then} go play some more"*. Training methods that are long and lecture-based will be tuned out in the time-sensitive hospital environment (B. Perkins Meingast, personal communication, November 12, 2021).

Initially, for Study 2, the inclusion of a competency component to test CG knowledge and skills, as part of PLD training, was considered to be an important training method and the absence of this approach would be considered a barrier subcategory that could negatively affect the use of PLDs. However, according to Meingast, PLD training that includes testing CGs on their knowledge and practical skills is a low priority. Rather, she explained that the focus of a CG's competency in healthcare is on their clinical assessment skills, their understanding on how to administer hazardous and high-risk drugs, and their recognition of patient status. She stressed that training methods should focus on creating partnering for accountability such that CGs are responsible for their actions when it comes to PLD use. For example, if a CG has not used a lift in a while, they would be expected to seek assistance and/or guidance from a peer on the unit.

4.2.3 Barriers from Management

Similar to behavioural and control beliefs that have been mentioned previously, normative beliefs relate to the person's perception of the social pressures regarding whether they should, or should not, perform the behaviour (e.g., should I do it?) and are shaped by the judgement (approval/disapproval) of the behaviour by those that influence them (e.g., unit manager). According to the TPB, normative beliefs, in combination with a person's motivation to comply, determines the subjective norm. An example from the literature is the Koppelaar et al., (2010) study who found that nurses' motivation was a strong determinant of the use of lifting devices which was linked to a supportive management climate and management support.

It is important that CGs are supported by their managers as they build their skills away from the unit in the practice-based component of training which, ideally, includes more than a single hands-on session. Similarly, when CGs are off being trained, it is critical that managers ensure that staffing levels on the unit are adequate so that CGs don't feel guilty for being off the unit for skills-based training and staff working on the unit do not resent the absence of their peers because of training purposes. Also, since staffing levels is a common factor influencing CGs' decisions to use lift equipment (Noble and Sweeney, 2018), it is essential that managers staff an adequate amount of CGs to promote using PLDs when CGs are off the unit in training. In summary, the exclusion of management support and adequate staffing levels is considered a barrier that could negatively affect PLD use.

The literature frequently identifies the lack of training or ineffective training as being among the most significant barriers affecting the successful adoption of PLDs. However, our knowledge of why training has been ineffective in promoting PLD use is limited to vague descriptors in the literature such as "inadequate training" or "insufficient training". Therefore, more research is needed into the barrier subcategories within training, to better understand the key elements (i.e., facilitators versus barriers) that are necessary for a PLD training program to be successful.

4.3 Study Purpose and Hypotheses

The purpose of Study 2 is to:

i. Identify barrier subcategories within training and learn more about the three that have been proposed (i.e., barriers due to training content, barriers due to training methods, and barriers from management).
ii. Evaluate the impact of the barrier subcategories identified on the perceived overall effectiveness of a training program designed to promote PLD use.

This study will evaluate the hypothesis that training is one of the most significant barriers impacting the use of PLDs by CGs.

4.4 Methods

4.4.1 Participants

This study will take place in a large hospital setting that provides clinical care to patients in need of being transferred with a ceiling mounted and/or portable PLD. A hospital unit with the following criteria will be considered for selection: (i) readily available ceiling mounted and portable PLDs, (ii) a significant amount of patient handling is required due to the patient's level of care and patients not able to assist much during lifts/transfers, (iii) CGs administer individual-based care (as opposed to team-based care) so that CGs' individual beliefs can be captured, and (iv) the frequency of CGs experiencing work-related musculoskeletal injuries is high relative to other units. Potential settings for consideration for Study 2 include a: Medical and Radiation Oncology Unit, Spinal/Neurosurgery Unit, Surgical Unit, Multi Organ Transplant Unit, and Medical Surgical Intensive Care Unit.

A convenience sample of three groups (total of 45 participants) will be recruited to take part in the study which, collectively, includes hospital staff who: Group 1: design, develop, and deliver PLD training programs, Group 2: manage attendees of PLD training programs, and Group 3: attend PLD training programs. More specifically, participants in Group 1 will represent 15 practice-based education experts, who are hospital staff that design, develop, and deliver PLD training programs. For example: Directors of Practice-based Education who oversee PLD training program design and development, Managers of Professional Practice who directly oversee the staff that deliver PLD training programs, and Advanced Practice Nurse Educators (APNEs) who deliver PLD training

programs. Participants in Group 2 will represent 15 unit managers who are responsible for scheduling staff training and managing staffing levels when CGs are away from the unit attending PLD training. Participants in Group 3 will represent 15 CGs who have attended a PLD training program within the last year. The following is the eligibility criteria for Group 3: (i) qualifications of Registered Nurse (RN), Registered Practical Nurse (RPN), Occupational Therapist (OT), or Physiotherapist (PT), (ii) full-time employees with a minimum of 6 months working on a unit, (iii) familiarity with PLDs currently in place on the units, (iv) transferring patients via PLDs is an essential duty of the job, (v) past participant of the hospital's existing PLD training program.

All aspects of the research will be reviewed and approved by the research ethics board of the university and hospital (if applicable). All participants will be recruited on a volunteer basis and will sign a consent form prior to participating. To maintain anonymity, participant identification numbers will be assigned and will be used to identify responses. As appreciation for their involvement, participants will receive a Tim Horton's gift card valued at $10.

4.4.2 Instrumentation and Data Acquisition

A handheld digital voice recorder, that will ensure a high-quality recording, will be used to record participants' responses during focus group interviews and semi-structured interviews. The recorder will have the capability to transfer the recorded interviews from the digital voice recorder to a computer. Hard copies of the focus group questions will be available for reference by the researcher when facilitating the sessions. A hard copy of the questionnaire will be provided to participants in Groups 1, 2, and 3 along with a pen for recording answers. The researcher will always have a note-taking book and pen for recording information as needed. The content of the responses from the audio-recordings from the focus group interviews will be transcribed verbatim to a computer. These data will be stored on a password protected computer. Only the researcher, or their supervisor, will have access to the data which will include audio files and transcripts. Further, to maintain participant confidentiality, all data will be anonymized. During data analysis, any files that are shared will be done via a secure file sharing service storage drive available to McMaster University students. Access to the storage drive is controlled by the researcher. Guests must request access to the

storage drive and be approved by the researcher. At any time, the researcher can delete a guest from accessing the storage drive. A Virtual Private Network (VPN) feature will allow the researcher to access the storage drive network while off campus using their personal laptop. Connecting to the server for access to the storage drive requires the researcher's McMaster identification name and password which is known only to the researcher.

4.4.3 Experimental Procedures and Protocol

The researcher will provide a 1-page study information sheet and ask the ward clerk (or other appropriate hospital staff member) to email the study information sheet to all potential participants in Groups 1, 2, and 3. A supply of the information sheet will also be provided in the staff lounges on the unit. The study information sheet will contain the researcher's contact information and will request interested potential participants to contact the researcher by email or phone if they want more information about the study. The researcher will respond to interested potential participants from each group by email or phone and will provide a copy of the consent and answer any questions that they may have about the study. Any potential participants from each group, that are interested in participating in the study, will be asked to sign a consent form and their contact information will be recorded in the participant log. The signing of the consent form will be witnessed, and the participant will receive a copy of the signed consent.

Further to the email to Group 1, the researcher will attend staff meetings to briefly introduce the study and answer any questions. During this time, any practice-based education experts that are interested in participating in the study will be asked to sign a consent form and their contact information will be recorded in the participant log. The signing of the consent form will be witnessed, and the participant will receive a copy of the signed consent. Buy-in from the unit manager (Group 2) will be essential to the overall success of the study and their support for the study will influence CGs' (Group 3) willingness to participate. Therefore, further to the email to Group 2, the researcher will meet with each unit manager individually to ensure that they are on board with their unit, and potentially their staff, being involved in the study. Following an explanation of the study to the unit manager and their approval of the research taking place on their unit, the researcher will answer any questions they may have. During this time, any unit

manager that is interested in participating in the study will be asked to sign a consent form and their contact information will be recorded in the participant log. The signing of the consent form will be witnessed, and the participant will receive a copy of the signed consent. Further to the email to Group 3 (CGs), the researcher will attend daily huddles and/or staff meetings to briefly introduce the study and answer any questions. During this time, any CGs that are interested in participating in the study will be asked to sign a consent form and their contact information will be recorded in the participant log. The signing of the consent form will be witnessed, and the participant will receive a copy of the signed consent.

Focus groups help to gather the personal and group feelings, perceptions, and opinions of people. Hence, conducting focus group interviews with practice-based education experts (Group 1), unit managers (Group 2), and CGs (Group 3), will allow for a broad range of qualitative information about personal values and beliefs regarding potential barrier subcategories within PLD training programs. Three focus group interviews will be conducted to elicit the views of participants in Group 1, 2, and 3. Separate focus group interviews will be held with participants from each group to promote discussion. For example, a CG (Group 3) may not feel comfortable sharing what they believe is a training barrier when the staff that design and develop the training (Group 1) is in the room. An open and natural discussion format will be encouraged to allow for a wide variety of perspectives during the estimated duration of ~45 minutes. For Group 2 and 3, the researcher will be flexible as to the timing and frequency of the focus groups since unit managers and CGs may not be able to attend a session during their shift due to staffing levels, patient status, etc. For example, facilitating the interviews before, during, or after a shift and/or facilitating more than one session per group (e.g., two sessions of 6 CGs per session for Group 3) will need to be considered. However, the ideal timing and frequency of the sessions will be determined by the unit manager or CG in charge on the unit.

The researcher will consult with the APNE for the unit for their advice regarding logistics (e.g., session timing, room allocation, etc.) to help ensure that the sessions run smoothly. The audio-recorded sessions will take place in a room to be determined by the unit manager or CG in charge of the unit. Refreshments will be offered to

participants. No data will be collected until written consent is secured, and a copy of the signed consent form is provided to participants.

The same introduction will be delivered at the start of each focus group. The introduction talking points to participants will include the following:

- researcher introduces themselves
- focus group participants introduce themselves by their first name only and share their job title and how long they have been working at the hospital
- participants will be asked if they have any questions before getting started
- the researcher will engage participants with the following statements/questions:
    - *Thank you for participating in this focus group.*
    - *I'm sure this is a busy time for everyone.*
    - *What is your favourite thing to do in your down time? For me, it is {RESEARCHER STATES FAVOURITE ACTIVITY OR HOBBY}.*
    - *Today we'll be chatting about PLD training for caregivers; what are your early thoughts on that?*

Participants will be asked the following exploration questions:

- *What does a successful PLD training program look like to you?*
- *Describe what you believe would be the key elements of a successful PLD training program.*
- *If you could change one thing about the content of the hospital's existing PLD training program, what would it be?*
- *If you could change one thing about how the hospital's existing PLD training program is delivered, what would it be?*
- *What do you believe are the contributions that management can make towards a PLD training program that is considered successful?*

Follow-up questions will be asked after a primary exploratory question has been answered to dig deeper, collect more information about an interesting assertion, clarify anything that is unclear, or invite other participants to comment on a point that has been made. Examples will include:

- *What do you mean when you say "X"?*
- *Can you give us a few examples?*
- *What did you do when that happened?*
- *What do you think it is about "X" that makes you feel that way?*
- *Can you say anything else about that?*
- *Can you build on the point [Name] just made?*
- *Who has had a similar experience to [Name]?*

A hard copy list of the barrier subcategories that were identified for barriers due to training content, barriers due to training methods, and barriers due to management will be available for reference during the focus groups to the researcher only. Participants will be asked the following exit questions:

- *Are there any other issues that come to mind when you think about PLD training programs and what makes them effective or ineffective?*
- *Is there anything we didn't touch on that you feel is important?*

Approximately 8-10 weeks after the focus group data is collected and analyzed, individual semi-structured interviews will be held with 15 participants from each of the three groups. Like the protocol for the focus group interviews, the researcher will consult with the unit's APNE for their advice regarding logistics (e.g., in-hospital interview timing, room allocation, etc.) to help ensure that the interviews run smoothly. It will be up to the discretion of the participant as to whether they would prefer the interview to be held virtually (e.g., phone, MS Teams, Zoom) or in-person. The ~45-minute interview, which will be audio-recorded, will involve administrating a questionnaire to evaluate the impact of the barrier subcategories on the perceived overall effectiveness of a training program designed to promote PLD use. Participants will be asked to mark their response to statements describing desired qualities of an effective PLD training program based on the themes of barrier subcategories formulated from the focus group interviews. A 5-point Likert scale will be used with a range of responses from strongly disagree to strongly agree. An initial questionnaire will be designed and then it will be refined through a pilot study on a small subgroup (n=10) of participants from Group 1, 2 & 3. Based on input from the pilot group, the final questionnaire will be drafted and used in the study. The first section of the questionnaire will ask about demographic information (gender, birth year, qualifications, years' experience, musculoskeletal health history (Group 3 only), weekly work hours, frequency of PLD use per shift (Group 3 only), etc. The second section of the questionnaire will contain a question set that will be based on the themes emerging from the findings of the focus group interviews. The researcher and the participant will each have a copy of the questionnaire. The researcher will explain each question the same way to every participant to mitigate the

issue of question interpretation. The participants' questionnaire will be returned to the researcher once completed. The completed questionnaires will be stored in a secure file cabinet. No data will be collected until written consent is secured, and a copy of the signed consent form is provided to participants. An example of a 5-point Likert scale questionnaire to evaluate the impact of barrier subcategories on the perceived overall effectiveness of a training program designed to promote PLD use is shown below in Figure 7.

Desired qualities of an effective patient lift training program

1 Strongly Disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly Agree

Category	Statement	Score
Training Content	Should have strong content that increases knowledge	
	Should be relevant to clinical environments	
	Should include real-life accounts / storytelling	
	Should promote that using patient lifts benefits caregivers and patients	
	Should promote the importance of engaging the patient in the lift/transfer	
Training Methods / Delivery	Should include opportunities for hands-on practice using patient lifts	
	Should include practice of typical and precarious patient lift scenarios	
	Should be paced so there is time to learn, practice, ask questions, practice some more	
	Should instill responsibility for one's actions	
Management	Should have support from management	
	Should instill a supportive management climate	
	Should maintain adequate staffing levels on the unit during training	
Other results from focus groups	Other subcategory barriers identified from focus groups	

Figure 7. Example statements of desired qualities of an effective PLD training program based on barrier subcategories formulated from focus group interviews.

4.4.4 Data Analysis

The content of the responses from the focus groups will be analyzed independently by two researchers to increase the validity of the analysis. As such, the researcher will deductively categorize and analyze the content of the responses into themes and will list the themes from most to least frequently mentioned. Independent from the researcher, a graduate student, that is experienced in qualitative methods, will be hired

to assist with data analysis. The researcher and graduate student will then meet to review and assess accuracy and agreement on the coding of the themes.

Text data from the semi-structured interviews with participants will be deductively analyzed for common themes related to potential barrier subcategories regarding PLD training programs and suggestions to improve the effectiveness of PLD training programs in the future. Like the focus groups, the same graduate student that assisted with the data analysis of the focus group data will conduct a second analysis of data from the semi-structured interviews with staff participants (i.e., coding themes independent of the researcher, assessing accuracy of coded themes, etc.).

CHAPTER 5: STUDY 3

PATIENT LIFTING DEVICE USE BY CAREGIVERS IN A HOSPITAL SETTING:

IS VICARIOUS LEARNING THROUGH OBSERVATION AS EFFECTIVE AS HANDS-ON LEARNING?

5.1 Introduction

Training programs, on the proper use of mechanical patient lifting devices, require that new CG hires be off-site for hands-on learning. Ironically, during such training, this may contribute to the under-utilization of PLDs by the remaining staff due to the resulting staff shortages.

5.2 Ontario Ministry of Labour Requirements

The prevalence of musculoskeletal disorders among health care workers prompted the Ontario Ministry of Labour (MOL) in 2013 to design regulatory requirements pertaining to patient handling activities for the health care sector. As of July 2019, it was estimated that half of the MSDs among health care workers were due to patient handling activities (Ontario Ministry of Labour, Training and Skills Development, 2022). Patient handling refers to activities such as lifting, transferring, and repositioning a patient or resident and includes working with mechanical PLDs. Specific to the education and training requirement for patient handling activities, and in accordance with the Occupational Health and Safety Act (Clause 25(2)(a)) and the Health Care and Residential Facilities Regulation (Subsection 9(4) of O. Reg, 67/93), the MOL recommends two key components for PLD training programs:

1. A classroom training session for workers on the written measures and procedures.
2. A practical hands-on training component in which workers can practice the measures and procedures and receive feedback on whether they are being completed correctly.

Last, the MOL mandates that training is required for all workers who carry out patient handling tasks, including supervisors, who need to ensure that workers are adhering to measures and procedures (Ontario Ministry of Labour, Training and Skills Development, 2019).

5.3 Overview of a PLD Training Program

Large teaching hospitals, like the University Health Network (UHN), design comprehensive training programs on the proper use of PLDs. Newly hired CGs (e.g., nurses, occupational/physical therapists) are oriented to the proper use of PLDs through a four-part series over a paced ~8-week period.

Part 1 of the series includes an education component where CGs self-direct their learning by completing two e-learning modules that are available through the hospital intranet. The first e-learning module involves educating new CGs on why PLDs are in place and includes information about hospital policies and procedures regarding PLDs. For example, CGs are instructed on where to find PLDs on the unit, how they generally operate, and how to report an equipment malfunction. The new CG is also educated on the health benefits of using PLDs; namely, the mitigation of musculoskeletal disorders by avoiding manual patient handling. The second e-learning module educates the new CG on the importance of engaging the patient during the PLD transfer. An example of patient engagement would be for the CG to verbally describe each step of the PLD transfer to the patient so that they are part of the experience. After the e-learning modules are completed, the new CG has a basic knowledge of PLDs.

Parts 2, 3, and 4 of the PLD training program involve skills development - learning how to operate PLDs safely and effectively and with a suitable level of confidence. In Part 2, cohorts of new CGs are brought off-site to a learning facility, associated with the hospital, for hands-on learning. Led by APNEs, in a mock hospital room with ceiling mounted and portable PLDs in place, new CGs participate in simulations, using each other as pretend patients, to practice operating the PLD in a variety of learning scenarios. The APNE encourages the new CGs to ask questions as they play with the devices. Ideally, the simulations cover typical PLD transfers and, more importantly, precarious scenarios (e.g., agitated patient, broken strap); however, that is up to the discretion of the APNE who is facilitating the learning.

Overall, the goal of hands-on learning is developing skills with PLDs by playing with them and, through a variety of learning scenarios that result in productive struggle, creating resilience and trouble-shooting abilities in the new CG hires. The term ‘productive struggle’ is meant to imply that, by experiencing difficulties/challenges while playing with PLDs and working through those experiences with peers, that the CG is productive in their overall PLD learning process.

With Part 1 (education) and Part 2 (off-site hands-on skills development) completed, the new CGs return to the unit. Part 3 of the PLD training program involves working shifts alongside a Preceptor, who is an experienced CG who gives practical experience

and training on site and helps to identify and fulfill the learning needs of new hospital hires. In this part of PLD training, the hands-on skills learned in Parts 1 and 2 are applied to using PLDs with actual patients on the unit. The Preceptor demonstrates, coaches, corrects, and answers questions as the newly hired CGs develop their hands-on skills. Although there are no formal competency evaluations associated with PLD training programs, the number of shifts with the Preceptor depends on: (i) how confident the new CG is at operating PLDs safely and effectively, and (ii) the Preceptor's assessment of the new CGs' skill level, with patient safety being the top priority.

The final component (Part 4) of the PLD training program involves the CGs returning to the off-site facility where the APNE leads continued practice sessions that are based on the collective learnings from Parts 1, 2 and 3. With additional opportunities for role playing and hands-on practice with PLDs, the new CGs have a final opportunity to hone their skills. Like Part 2, the APNE encourages productive struggle, which creates resiliency and the ability to trouble-shoot in typical and precarious PLD transfer scenarios. When the hands-on session is completed, the APNE facilitates an informal debriefing session with CGs where the objectives of the learning session are reviewed, and CG questions are answered. At the end of Part 4, the PLD training program learning cycle for new CG hires is complete.

5.4 Importance of Hands-On PLD Training

Patient safety is the cornerstone of high-quality health care. Hence, the ultimate goal is to minimize harmful effects on patient outcomes. A comprehensive PLD training program, that includes a robust hands-on skills development portion for new CG hires, is critical to ensuring that PLD transfers are uneventful, thereby creating a safe and positive experience for the patient. Every time a CG uses a PLD, the patient should feel physically comfortable in the straps and psychologically secure in the capabilities of the CG who is operating the device. The significance of the latter was confirmed in a study of patient perceptions of satisfaction on the use of ceiling lifts. The study showed that patient's perceptions of the expertise and experience of the staff using the PLD was an important factor in the patient's overall comfort rating of a transfer (Alamgir et al., 2009). When PLDs are used over manual methods, patients can benefit in terms of fewer

pressure ulcers, incidents of urinary incontinence, and patient falls (Alamgir et al., 2009).

According to the Theory of Planned Behaviour, control beliefs refer to a person's perception of the ease or difficulty of performing a given behaviour (e.g., can I do it?) (Ajzen, 1991). The control beliefs are an individual's beliefs about the presence of factors that may facilitate or hinder performance of the behaviour, which then determines a person's perceived behavioural control (i.e., self-efficacy) (Ajzen, 1991). A comprehensive PLD training program, that includes a broad range of hands-on learning opportunities (i.e., off-site role play, Preceptor shifts, typical and precarious scenario simulations), can provide CGs with a strong sense of self-efficacy. As a result, instead of the control belief hindering performance of the behaviour (e.g., fear of dropping the patient during a PLD transfer), the CG is more likely to believe in their capacity to use the device safely and effectively (i.e., their self-efficacy). In turn, a well-trained CG, with a strong sense of self-efficacy, is more likely to use PLDs even when challenged in the often time-focused hospital work environment. Knowing that one's skills are strong gives the CG the confidence to operate the PLD effectively, both from a time efficiency and patient engagement perspective. As the literature makes abundantly clear, musculoskeletal injury risk is significantly higher when patients are transferred manually versus using mechanical assistance (Smedley, 1995; Hignett, 1996; Knibbe and Friele, 1996; Hoogendoorn et al., 1999; Ando et al., 2000; Warming et al., 2009; Karahan et al., 2009) and, more specifically, there is an increased prevalence of neck, low-back and shoulder injuries with manual methods (Lagerstrom et al., 1998; Myers et al., 2002; Waters et al., 2007; Edlich et al., 2005; Engkvist, 2004; Leighton and Reilly, 1995; Nelson et al., 2007; Waters, 2007; Buckle, 1987; Smith et al., 2005; Trinkoff et al., 2006; Engkvist et al., 2000; Smedley et al., 2003; Trinkoff et al., 2003; Byrns et al., 2004, Burdorf et al., 2013). Since the future musculoskeletal health of new CG hires is dependent on the consistent use of PLDs, it is critical that the PLD training program emphasizes hands-on learning such that it produces CGs who are competent and confident in the use of PLDs.

5.5 Off-Site PLD Training, Staff Shortages, and COVID-19

PLD training programs in large hospitals are typically robust and, as outlined above, a hands-on learning component is a mandatory requirement in Ontario. While hands-on learning is critical to developing PLD skills, the drawback of off-site hands-on learning is the increased likelihood of under-staffing on hospital units. While staff shortages during CG orientation could be considered short-term, they occur every time new CGs are hired and, most importantly, they add to the already existing chronic shortage of CG staff in Ontario, Canada, and globally. Regarding the latter, statistics for countries such as Canada, Australia, and the United Kingdom predict a shortage of 2.5 million nurses by the year 2030 (Scheffler, 2019). The on-going nursing shortage speaks to larger issues such as: (i) an insufficient number of nursing students completing their education, (ii) the ageing workforce, (iii) turnover due to stress and long work hours, and (iv) nurses leaving the profession altogether (Sasso, 2019). For example, in 2015 in Ontario, it was predicted that 14,000 of the 81,000 (~17%) of nurses would be lost to retirement in just one year. Further, in 2015 in Canada, almost a third of nurses were over age 50, and only 10 percent were under age 30 (INSCOL Blog, 2015). To make matters worse, the existing CG shortage has been exacerbated by the COVID-19 pandemic. An example is the findings from a “Work and Wellbeing” online survey (n = 2,102 respondents) that was conducted by the Registered Nurses’ Association of Ontario (RNAO, 2021) one year into the pandemic (i.e., January to February 2021). An alarming finding was that Ontario Registered Nurses intend to leave their profession in the year 2021 at a rate that is four times higher than any other year (RNAO, 2021). Most concerning was the finding that 13.3 percent of young nurses (aged 31-35) were “very likely” to leave the profession after the COVID-19 pandemic (RNAO, 2021) citing a lack of support from government, hospitals, and their older colleagues (INSCOL Blog, 2015). As concluded in the RNAO survey, Ontario is facing the prospect of a much-diminished nursing workforce post-pandemic (RNAO, 2021).

5.5.1 Negative Implications of Staff Shortages

A major contributor to the under-utilization of PLDs in busy clinical environments is a lack of adequate staffing levels on the unit (Nelson, 2006; Koppelaar et al., 2009, Schoenfisch et al., 2011). When clinical units are short-staffed, the common perception

amongst CGs is that there is a ‘lack of time’ to carry out their duties in the usual manner, including the use of PLDs. CGs are acutely aware of the longer transfer time with PLDs compared to manual methods (Bell, 1987; Jensen, 1987; Garg et al., 1992; Engkvist et al., 1992; Evanoff et al., 2003; Keir & MacDonnel, 2004; Collins et al., 2004; Li et al., 2004; Nelson and Baptiste, 2006; Engkvist, 2007; Koppelaar et al., 2009; Schoenfisch et al., 2011; Koppelaar et al., 2013; Park et al., 2014; Lee & Lee, 2017) which is why, when units are short-staffed, it can be very tempting to revert to faster, but higher-risk, patient handling methods. The degree to which transfer times are affected by work methods was demonstrated in a study by Keir and MacDonnel (2004) that showed transfer times for novice CGs using manual methods to be five times faster than using a PLD. In addition to the perception of lack of time to use a PLD, staff shortages can result in there being an insufficient number of trained peers available to help with PLDs that require more than one CG (Koppelaar et al., 2009) (e.g., bariatric patient, dementia patient). Stressful work environments characterized by long work hours, along with physically and mentally demanding work, are often cited as reasons why nurses leave the profession (Carnevale, 2015; CFNU, 2012; Douglas, 2011; RNAO, 2017; Shin, 2018).

Not only do staff shortages compromise patient care, it also impacts nurses’ well-being leading to adverse outcomes such as: (i) burnout, (ii) increased stress, (iii) workplace violence, (iv) intention to leave, (v) absenteeism, (vi) job dissatisfaction, and (vii) leaving the position, or the profession altogether (Douglas, 2011; RNAO, 2017; Shin, 2018). Nurse burnout is described as the physical and emotional state of chronic overwork and the lack of job fulfillment and support (Chan, 2013). Burnout manifests as exhaustion, cynicism. and low sense of personal success (CFNU, 2012). Job dissatisfaction refers to the lack of positive feelings or response to one’s work conditions (CFNU, 2012). Nursing burnout and job dissatisfaction have been correlated with over-burdened patient workloads, little or no input into decision-making regarding patient care, or flexibility in scheduling and work shifts (CFNU, 2012). However, these outcomes are rooted in excessive workloads and insufficient staffing (CFNU, 2012). The vicious cycle repeats as CGs leave the profession at a rate that is higher than new CGs coming in, which adds further to the overall shortage. As for CGs physical health, as

discussed above in Section 5.5, insufficient staffing leads to an increased MSD risk among CGs as they may cut corners to make up for a lack of time and/or an insufficient number of trained peers to help with more complicated PLD transfers.

5.6 Vicarious Learning Through Observation

5.6.1 Simulation as a Teaching Methodology

Simulation has been used as a teaching method to train adults dating back as far as the 18th century in the military and 1930's in aviation (Bradley, 2006; Scherer et al., 2003). Simulation is used in these fields because training or testing in the real world would be too dangerous and/or costly (Rutherford-Hemming, 2012). Similarly, simulation is often used in nursing education as a teaching methodology because training new hires with real patients would be unsafe.

5.6.2 Introduction to Vicarious Learning and Social Learning Theory

There is a need for time-efficient but effective alternatives to hands-on training on PLDs for new CG hires. For instance, the need for alternative learning methods that successfully develop PLD skills, while maintaining adequate staffing levels (which, in turn, promote PLD use by CGs). Vicarious learning through observation shows promise for this purpose. The concept of learning by observing is the basis of the Social Learning Theory (Bandura, 1977), and assumes that much of human learning is vicarious. That is, we learn by observing someone else's behaviour and its consequences. Just as we learn individual behaviours, we learn new behaviour patterns when we see them performed by other people or models. Bandura contends that humans learn by observing others, but pointed out that role modelling is not simply mimicking a response but a learned behaviour psychologically embedded into the brain (Rutherford-Hemming, 2012). Bandura also contends that people use the modeled behaviours they've learned and apply them to situations as needed, going beyond what has been seen and heard in the modeled behaviours (Rutherford-Hemming, 2012). In addition, Bandura emphasizes that, although observation starts the learning process, expertise is developed through practice with external and internal (self-regulatory) feedback (Rutherford-Hemming, 2012).

Three kinds of models were identified by Bandura: (1) live, (2) verbal, and (3) symbolic. A live model demonstrates a behaviour in person (e.g., Figure 8a). A verbal

instructional model does not require performance of the behaviour but, instead, uses explanations and/or descriptions of the behaviour (e.g., soccer coach tells his young players to kick the ball with the side of the foot, not with the toe). A symbolic model can be fictional characters or real people who demonstrate behaviours in books, movies, television shows, video games, or internet sources (e.g., Figure 8b).

Figure 8a & 8b. (a) Yoga students learn by observation as their yoga instructor demonstrates the correct stance and movement for her students (live model). (b) Models don't have to be present for learning to occur: through symbolic modelling, this child can learn a behaviour by watching someone demonstrate it on television (lumenlearning. (n.d.). *Social Cognitive Learning Theory.* Educational Psychology. Retrieved February 11, 2022, from https://courses.lumenlearning.com/edpsy/chapter/social-cognitive-learning-theory/)

5.6.3 Steps in the SLT Modelling Process

Bandura (1977) described specific steps in the process of modelling that must be followed if learning is to be successful, including attention, retention, reproduction, and motivation (Figure 9). These components of the SLT process are described by MacLeod (2016):

- **Attention:**
    - The extent to which we are exposed/notice the behaviour
    - For a behaviour to be imitated, it must grab our attention
    - We observe many behaviours daily, and many of these are not noteworthy

  - Attention is therefore extremely important in whether a behaviour influences others imitating it
- **Retention:**
  - How well the behaviour is remembered
  - The behaviour may be noticed, but it is not always remembered which obviously prevents imitation
  - It is important, therefore, that a memory of the behaviour is formed to be performed later by the observer
  - Much of social learning is not immediate, so this process is especially vital in the above cases
  - Even if the behaviour is reproduced shortly after seeing it, there needs to be a memory to refer to
- **Reproduction:**
  - This is the ability to perform the behaviour that the model has just demonstrated
  - We see much behaviour daily that we would like to be able to imitate but that is not always possible
  - We are limited by our physical ability, and for that reason, even if we wish to reproduce the behaviour, we cannot
- **Motivation:**
  - The will to perform the behaviour
  - The rewards and punishment that follow a behaviour will be considered by the observer
  - If the perceived rewards outweigh the perceived costs (if there are any), then the behaviour will be more likely to be imitated by the observer
  - If the vicarious reinforcement is not seen to be important enough to the observer, then they will not imitate the behaviour

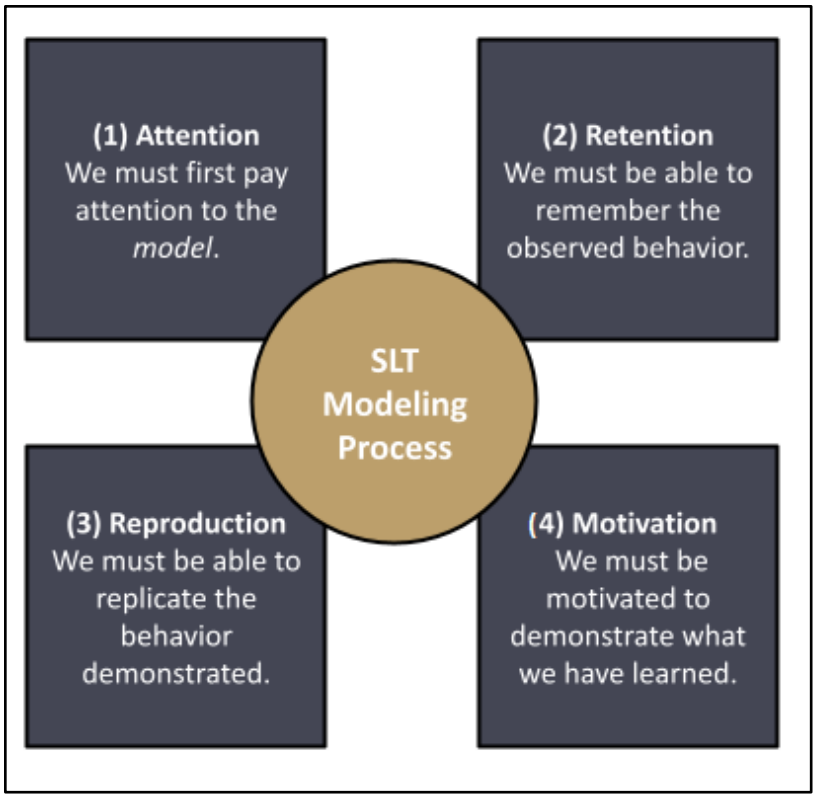

Figure 9. Specific steps in the SLT modelling process that must be followed if learning is to be successful (Sutton, 2022).

5.6.4 Vicarious Learning Through Observation in the Literature

Vicarious learning has been shown in the literature to be equally, if not more, effective compared to traditional hands-on learning methods. For example, the results from a study of 200 undergraduate medical students showed that students learned at least as much, if not more, about doctor-patient communication by observing their peers interact with sample patients, as they did from interacting with sample patients themselves. Further, when the vicarious learning group was supported by an observation script (i.e., directed observer role), the knowledge scores were even higher than the hands-on group (Stegmann et al., 2012). In addition to an observation script, a person in a directed observer role may receive a specific instructional briefing about the simulation being observed, or they may have tools that inform them about learning objectives, behaviours, or activities to consider, points for peer feedback, or a checklist to measure against (O'Regan et al., 2016). In the directed observer role, the aim of the tools is to help the vicarious learner pay active attention to the behaviour, which is

considered one of the four essential components for learning success with vicarious learning through observation (Figure 9). Conversely, the non-directed observer watches the behaviour without specific guidance or objectives.

In the first systematic review of its kind, O'Regan et al., (2016) examined the factors that promote learning for the directed observer role compared to hands-on participation for scenario-based simulations. An overall finding from the nine papers that qualified, was an association of observer tools with both satisfaction and equal, if not better, learning outcomes in observer roles than in hands-on roles (O'Regan et al., 2016). The authors note that the use of the tools in the directed observer role shifts observers from simply watching to actively observing, and by doing so, experience the satisfaction and learning normally associated with hands-on experience (O'Regan et al., 2016). Similar findings, of vicarious learning being equally as effective as hands-on learning, were observed in studies that looked at student knowledge scores (Kaplan et al., 2012; Jeffries and Rizzolo, 2006), critical thinking characteristics (Ertmer et al., 2010), satisfaction with the learning experience (Jeffries and Rizzolo, 2006), and self-confidence (Jeffries and Rizzolo, 2006).

In addition to modelling physical skills that can be learned vicariously through observation, studies have shown that interpersonal skills, such as those required for collaboration, can also be learned vicariously (Rummel and Spada, 2005) which could have significant implications for new CG hires interacting with peers and their patients. Finally, vicarious learning has been shown to promote positive behaviour through positive role modelling. For instance, a positive (moderate) correlation was found between the number of positive social models observed via a training video and subsequent wearing of ear protection by new hires during a simulated work task (Olson et al., 2009). The impact of this finding is significant since Olson et al., (2009) suggest that social modelling is a potentially powerful determinant of prevention behaviours within workgroups, especially for newly hired workers. Examples of prevention behaviours include wearing hearing protection in loud work environments, wearing Kevlar gloves when using sharp knives, or following good work practices when manually handling heavy objects.

We hypothesize that, if more peers on the unit are using PLDs, and other prevention behaviours, it will be more likely that newly hired CGs would model that behaviour and use them as well. An example demonstrating the potentially powerful effects of positive social modelling was observed in nursing students who, trying to “fit in” with group norms, copied good hand hygiene practices from their positive peer models (Barrett and Randle, 2008).

5.6.5 Benefits of Vicarious Learning Through Observation vs. Hands-On Learning

In typical times, each year, large hospitals train several cohorts of CGs on PLDs that include an off-site hands-on component. Due to the chronic CG shortage in Canada, which results in considerable turnover, the aggregate training time invested by APNEs in PLD training is significant. In a pandemic, which can mean the turnover of CGs that would amount to a small hospital, PLD training requirements become enormous. In addition to on-boarding new CG hires faster, which is a huge advantage for fast-paced clinical settings, vicarious learning shows promise as an effective alternative to hands-on training.

One of the biggest advantages of vicarious learning through observation is the significant reduction in time that CGs spend off the unit which helps maintain adequate staffing levels. In turn, this results in perceptions of a more manageable workload which can reduce feelings of stress, being overwhelmed, and burnout which can further lead to increased job satisfaction and improved morale - two factors linked closely with job retention. For example, improvements in mental health outcomes could deter a young CG from leaving the profession altogether and/or a mature CG from retiring earlier than planned. From an ergonomics perspective, perceptions of more time and adequate staffing can promote PLD use and deter CGs from resorting to faster manual methods to maneuver patients. Also, with more time, CGs are more likely to seek assistance from a peer for two-person PLD transfers. Given that the CG profession is in the top 10 occupations at highest risk for musculoskeletal disorders (PSHSA, 2010), adequate time for PLD decision-making is crucial.

From a workplace culture perspective, vicarious learning through observation can help promote a positive work environment that exudes encouragement, pride, a positive

attitude, and positive PLD behaviour. This is done in vicarious learning by using positive role models in the training content/scripts. With hands-on training, the APNE is not scripted and so the new CG hires will be exposed to the APNE's modelling which could be neutral or less positive than the positive models used in vicarious learning.

The critical nature of adequate staffing levels in healthcare necessitates an investigation into effective alternatives to hands-on training. Given that healthcare education often involves simulation to ensure patient safety, vicarious learning through observation may provide a viable such alternative.

5.6.6 Study Purpose and Hypotheses

The purpose of Study 3 is to:

i. Investigate whether vicarious learning through observation is as effective as hands-on learning as part of PLD training programs designed for newly hired caregivers.
ii. Evaluate learning outcomes in the observer role for directed versus non-directed observation compared to hands-on learning.

This study will evaluate the following hypotheses:

i. Hypothesis 1: Vicarious learning through observation is as effective as hands-on training for the utilization of PLDs by new caregiving hires.
ii. Hypothesis 2: Directed observation will result in learning outcomes in observer roles that are equal to learning outcomes in hands-on training.

5.7 Methods

5.7.1 Participants

This study will take place in a large hospital setting that provides clinical care to patients in need of being transferred with a ceiling mounted and portable PLDs. A hospital unit with the following criteria will be considered for selection: (i) readily available ceiling mounted and portable PLDs, (ii) a significant amount of patient handling is required due to the patient's level of care and patients not able to assist much during lifts/transfers, (iii) CGs administer individual-based care (as opposed to team-based care) so that CGs' individual beliefs can be captured, and (iv) the frequency

of CGs experiencing work-related musculoskeletal injuries is high relative to other units. Potential settings for consideration for Study 3 include a: Medical and Radiation Oncology Unit, Spinal/Neurosurgery Unit, Surgical Unit, Multi Organ Transplant Unit, and Medical Surgical Intensive Care Unit.

Three groups, each with 25 participants, will be recruited to take part in the study which includes CGs who will be scheduled for new hire orientation training on PLDs. A different PLD training program intervention will be assigned to each group. The qualifications of new CG hires will include Registered Nurse (RN), Registered Practical Nurse (RPN), Occupational Therapist (OT), or Physiotherapist (PT).

All aspects of the research will be reviewed and approved by the research ethics board of the university and hospital (if applicable). All participants will be recruited on a volunteer basis and will sign a consent form prior to participating. To maintain anonymity, participant identification numbers will be assigned and will be used to identify responses. As appreciation for their involvement, participants will receive a Tim Horton's gift card valued at $10.

5.7.2 Instrumentation and Data Acquisition

The observation tool from Bethards (2014) will be modified and used to promote the participant's attention to the PLD behaviour modelled by the APNE. A second worksheet, taken directly from Bethards (2014), will be used as an observation recording tool during vicarious learning through observation.

The hospital's electronic charting system will be used to track information about new CG PLD use for a 12-month period. This will likely require the hospital's information technology department to re-design the existing electronic charting form to include new required entry fields to capture: (i) CG experience (months), (ii) frequency of PLD use, (iii) overall experience rating for PLD transfers, and (iv) barriers encountered if PLD used/not used. When completing a patient's chart, the CG will be required to complete these fields. A data collection tool will be developed by the researcher to ensure that, during direct observation of new CG PLD use, all desired data are recorded.

A hard copy of the questionnaire will be provided to participants in Groups 1, 2, and 3 along with a pen for recording answers. Similarly, a hard copy of the questionnaire will be provided to the unit Preceptors along with a pen for recording answers. The

researcher will always have a note-taking book and pen for recording information as needed.

All data collected will be stored on a password protected computer. These data include results from electronic charting, direct observation, and questionnaires to CGs and unit Preceptors. Hard copies of the direct observation worksheets and questionnaires will be stored in the researcher's office in a locked file cabinet. Only the researcher, or their supervisor, will have access to the data. Further, to maintain participant confidentiality, all data will be anonymized. During data analysis, any files that are shared will be done via a secure file sharing service storage drive available to McMaster University students. Access to the storage drive is controlled by the researcher. Guests must request access to the storage drive and be approved by the researcher. At any time, the researcher can delete a guest from accessing the storage drive. A Virtual Private Network (VPN) feature will allow the researcher to access the storage drive network while off campus using their personal laptop. Connecting to the server for access to the storage drive requires the researcher's McMaster identification name and password which is known only to the researcher.

5.7.3 Experimental Procedures and Protocol

The researcher will meet with the unit manager(s) to explain the study and answer any questions. Once the unit manager agrees for the study to take place on their units, the researcher will share general information about the study at daily huddle or other type of staff meeting on the unit(s). The researcher will meet with a representative from the hospital's human resources department to introduce the study and request their assistance with distribution of the study sample. Following the human resources department's agreement to help with the study, as part of the hiring process, a human resources representative will use randomized blocks to assign 25 consenting CGs to each of the three PLD training groups. The human resources representative will inform the head of the Advanced Practice Nurse Educator (APNE) department of the new CG's name and their assigned group number (Group 1, 2, or 3). The head of APNE will be responsible for ensuring that, during orientation, new CGs receive the PLD training intervention according to their assigned group.

5.7.3.1 Description of training components

This section will describe the various training components that will be included or excluded, in some combination, for each of the three intervention groups.

E-learning

Participants will take part in two self-directed e-learning modules where they will be educated on why PLDs are used, the health benefits of using PLDs, and the importance of engaging patients during PLD transfers. The e-learning modules will be prepared by the practice-based education experts at the hospital. The e-learning modules will be available via the hospital intranet site.

Off-site hands-on skills development (Part 1 and 2)

Participants will take part in two off-site hands-on skills development sessions that will take place at two different times during the intervention (i.e., Part 1 and Part 2). Led by APNEs, in a mock hospital room with ceiling mounted and portable PLDs in place, participants will take part in simulations, using each other as pretend patients, to practice operating the PLD in a variety of learning scenarios. The APNE will encourage the participants to ask questions as they play with the device. Ideally, the simulations will cover typical PLD transfers and, more importantly, precarious scenarios (e.g., agitated patient, broken strap); however, that will be up to the discretion of the APNE who is facilitating the learning. Overall, the goal of hands-on learning will be to develop skills with PLDs by playing with them and, through a variety of learning scenarios that result in productive struggle, create resilience and trouble-shooting abilities in the participants. The term ‘productive struggle’ is meant to imply that, by experiencing difficulties/challenges while playing with PLDs, and working through those experiences with peers, participants will be more productive in their overall PLD learning process.

Vicarious learning through observation

The researcher will work alongside the head of APNE to ensure that this intervention runs smoothly as it is a new training method. Vicarious learning through observation will take place in a private meeting room on the unit or via a virtual meeting platform (e.g. Zoom or MS Teams). Together with an experienced APNE, participants will assemble in person or online to observe a 30-minute video on PLD use. The video will be designed by the Practice Based Education department and will be facilitated by an APNE who will

serve as a positive role model for the utilization of PLDs, meaning that their attitude, personal values, and beliefs towards PLDs will be upbeat and encouraging. Using mock patients, participants will observe APNE-simulated PLD transfers that will include typical and precarious scenarios. The APNE will include storytelling in various aspects of the training script so that teaching concepts will be expanded to as many learning scenarios as possible.

As participants observe the video, they will use observation tools (e.g., guide or worksheet) to help direct them during the vicarious learning. The purpose of the observation tools will be to design vicarious learning opportunities for attention processes, which is one of the four component processes of Bandura's vicarious learning through observation construct. For example, the modified observation worksheet in Bethards (2014) will be used to promote the participant's attention to the PLD behaviour modelled by the APNE. The worksheet will emphasize concepts, not specific tasks being observed, to help participants see (i.e., pay attention to) the big picture of the modelling behaviours and encourage critical thinking (Bethards, 2014).

A second worksheet, taken directly from Bethards (2014), will be used as an observation recording tool. The worksheet has column headers that emphasize effective implementation and provide an opportunity for observers to indicate questions for future discussion (i.e., debriefing sessions).

Shifts accompanied by a Preceptor

Participants will work shifts on the unit accompanied by a Preceptor. A Preceptor is an experienced CG that shares practical experiences and provides training on site, and helps to identify and fulfill the learning needs of new hospital hires. The Preceptor will demonstrate, coach, correct, and answer questions as the participant develops their hands-on skills with actual patients. Although there are no formal competency evaluations associated with PLD training programs, the number of shifts with the Preceptor will depend on: (i) how confident the participant is at operating PLDs safely and effectively, and (ii) the Preceptor's assessment of the participant's skill level, with patient safety being the top priority. Similar to the observation tools that will help to promote attention processes during vicarious learning, when participants switch to the hands-on role of using PLDs under the Preceptor's supervision, it will promote motor

reproduction processes for the desired PLD use behaviours (Bethards, 2014). To maximize the promotion of motor reproduction processes, it will be ideal if the Preceptor shifts are scheduled as close as possible to the vicarious learning through observation session.

Debriefing session

Immediately after implementation of the hands-on skills development method of PLD training and the vicarious learning through observation method of PLD training, participants will take part in a debriefing session which will be led by the APNE. During the debriefing session, participants will be encouraged by the APNE to verbally share their learning experiences with the group including examples of effective PLD use, suggestions/questions for the group, etc. Similar to promoting the attention processes during vicarious learning via observation tools and motor reproduction processes via Preceptor shifts, to promote retention processes, the APNE will encourage participants to symbolically rehearse the modelled behaviours and verify their thought processes during the debriefing session by taking an active role (Bethards, 2014). To promote motivation processes, the value and importance of learning through observation will be emphasized by the APNE, in addition to the expectation of the participants to lead discussion during the debriefing sessions (Bethards, 2014).

Unique training components for each group

Collectively, the three interventions will contain some combination of the following training elements:

- e-learning
- off-site hands-on skills development (Part 1 & 2)
- vicarious learning through observation (with/without observation tools)
- shifts accompanied by a Preceptor
- debriefing sessions

The participants in each group (n=25) will participate in:

- e-learning
- shifts accompanied by a Preceptor
- debriefing sessions

In addition, the three groups will participate in different additional training elements as follows:

Group 1: Participants will be provided with two off-site hands-on skills development sessions that will take place at two different times during the intervention (Part 1 and Part 2).

Group 2: Participants will be provided with vicarious learning through observation with the use of observation tools to facilitate their learning.

Group 3: Participants, like Group 2, with be provided with vicarious learning through observation but, unlike Group 2, will not be provided with observation tools.

A summary of the training elements by Group is outlined below in Table 4.

Table 4: Training elements associated with each of the three intervention groups.

Training Element	Group 1 Hands-On	Group 2 Vicarious - Directed	Group 3 Vicarious - Non-Directed
e-Learning			
Off-Site Hands-On Skills Development - Part 1			
Vicarious Learning Through Observation			
- use of Observation Tools			
Shifts Accompanied by a Preceptor			
Off-Site Hands-On Skills Development - Part 2			
Debriefing Session			

5.7.3.2 Data collection

Electronic charting

Following permission from the unit manager, at 3-, 6-, and 12-months post intervention, the researcher will review electronic charting as recorded by CGs in Group 1, 2, and 3. Only data for charts that will be completed by a newly hired CG will be collected. For example, at three months post intervention, only charts with CG experience of three months will be reviewed, and similarly for 6- and 12-month benchmarks. Regularly, the researcher will visit the unit nursing station and will ask new CGs if they have any questions about completing the PLD-related questions on the

patient e-chart. At these visits, the researcher will also meet with the unit manager and Preceptor for the unit to discuss how the study is going from their perspective and answer any questions and/or address any concerns. The researcher will collect raw data from electronic charting for the following five questions:

- *Q1: "How many months experience do you have working on this unit*?"
    - INPUT: months experience
    - This question will verify, at 3-, 6-, and 12- months post-intervention, that CGs qualify for the same number of months experience on the unit

- *Q2: "Did you use a PLD to transfer this patient?"*
    - INPUT: Yes or No
    - This question will provide data on frequency of PLD use

- *Q3: "If you responded yes to Q2, rate your overall experience using the PLD on a scale of 1 (very poor) to 5 (very good)"*
    - INPUT: 1, 2, 3, 4, 5, or N/A
    - This question may help to explain why some new CGs did not change their behaviour despite the PLD training intervention received

- *Q4: "If you used a PLD, did you experience any barriers that interfered with the transfer?"*
    - INPUT: barriers experienced, or no barriers
    - This question will provide data on barriers experienced when PLDs are used

- *Q5: "If you did not use a PLD, but intended to, what barriers did you experience?"*
    - INPUT: barriers experienced, or no barriers
    - This question will provide data on barriers experienced when PLDs are not used

<u>Direct observation</u>

Prior to this phase of data collection, the researcher will work with the unit manager to ensure that the details of the study are communicated to all staff and patients on the unit, regardless of whether they are participating in the study. At the same time that the researcher visits the units to collect data from the PLD-related electronic charting questions (i.e., at 3-, 6-, and 12-months post intervention), over the course of several day and night shifts, the researcher will directly observe CGs from Group 1, 2, and 3 as they work with actual patients. In a manner that is unobtrusive to CGs and their patients, observations will be made by the researcher to learn:

- How often PLDs are used?
- Overall experience rating for PLD transfers
    - Technical skills
    - Verbal skills (e.g., patient engagement)
    - Transfer time

- Challenges, workarounds, and strategies used by the CGs during a PLD transfer
- Aspects of the environment that are relevant to CGs deciding to use PLDs
- Informal reports of barriers during PLD transfer by:
  - CG
  - Patient
  - Family member
- Barriers reported and/or observed as to why a PLD was not used

In addition, the researcher will make observations about the physical layout of patient lifts in rooms, the type of care delivered to patients on the unit, the condition of patients, the design of the patient lifts, etc. The researcher will follow a prepared data collection tool to help guide the observations and the data gathered will be stored in a secure file cabinet. No data will be collected until written consent is secured, and a copy of the signed consent form is provided to participants.

Caregiver questionnaire

Following direct observation of CGs at 3-, 6-, and 12-months, with the help of the unit manager, the researcher will schedule a meeting room on the unit for CGs to drop in during their shift to complete a questionnaire. The researcher will be required to make several visits to the units. Since CGs will be completing the questionnaire during work hours, and likely during a break, refreshments will be made available by the researcher.

The researcher will be present to administer the questionnaire, provide writing utensils, and answer any questions that CGs may have.

Identical to the TPB-based questionnaire in Study 1, a theory-based questionnaire will be administered to measure the TPB constructs of attitude, subjective norms, perceived behavioural controls and intent. The first section of the questionnaire will ask about demographic information (gender, birth year, qualifications, years' experience, weekly work hours, etc.). The second section of the questionnaire will contain a discomfort survey (Figure 10) and the Perceived Stress Survey (PSS) (Cohen, 1983) (Figure 11). For the discomfort survey, CGs will be asked to locate body areas where they may be experiencing discomfort and indicate the frequency of this discomfort for the last month. Also, they will be asked to score their pain levels on a scale of 0 (no pain) to 10 (severe pain). The PSS will measure CGs' overall perceived stress in the

last month. The third section of the questionnaire will contain ~40 questions that will be based on the themes emerging from the findings of the focus group interview in Study 1. The CG questionnaire will be returned to the researcher once completed. The completed questionnaires will be stored in the researcher's secure file cabinet. No data will be collected until written consent is secured, and a copy of the signed consent form is provided to participants. Like Study 1, the TPB questionnaire will be designed and developed as per Francis et al., (2004) based on the following sections of the manual:

- Steps in the Construction of a TPB Questionnaire (Section 3)
- Measuring Behavioural Intentions (Section 4)
- Measuring Attitudes (Section 5)
- Measuring Subjective Norms (Section 6)
- Measuring Perceived Behavioural Control (Section 7)
- Steps in Managing a TPB Survey (Section 8)
- Example Questionnaire (Section 12.2)

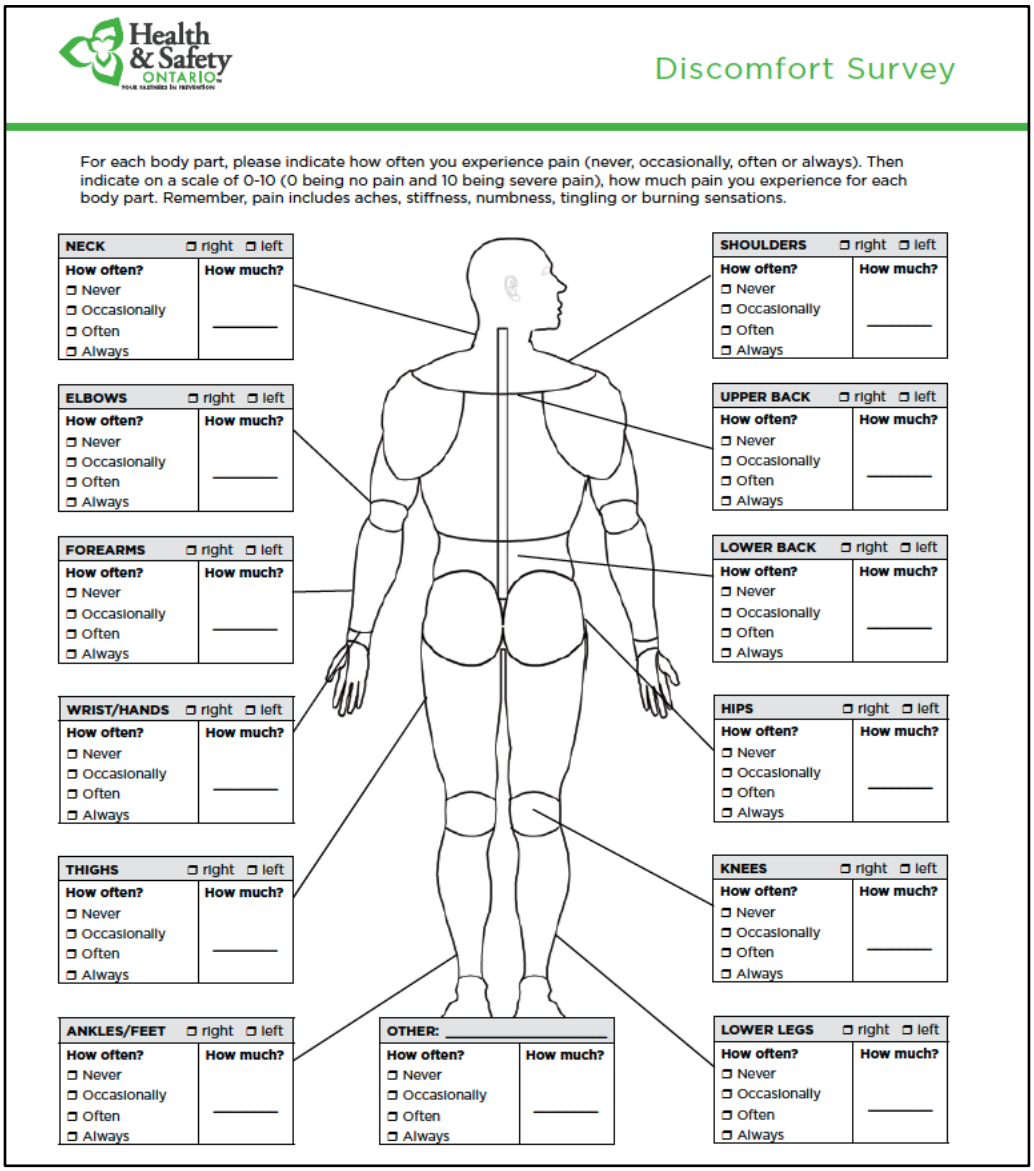

Figure 10. Subjective ratings for musculoskeletal discomfort by body area in the last month (Workplace Safety and Prevention Services, 2011).

PERCEIVED STRESS SCALE

The questions in this scale ask you about your feelings and thoughts during the last month. **In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.**

Name _____ Date _____

Age _____ Gender (*Circle*): **M F** Other _____

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

1. In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2. In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3. In the last month, how often have you felt nervous and "stressed"?	0	1	2	3	4
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
5. In the last month, how often have you felt that things were going your way?	0	1	2	3	4
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
7. In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
8. In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
9. In the last month, how often have you been angered because of things that were outside of your control?	0	1	2	3	4
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

Figure 11. Questions for CGs to rate their perceived personal stress during the last month (Cohen, 1983).

Unit Preceptor questionnaire

Individual semi-structured interviews will be held with unit Preceptors. The ~30-minute interview will involve administrating a questionnaire to evaluate Preceptors' perceived outcomes for traditional (Group 1) and alternative (Group 2 and 3) PLD training programs. Participants will be asked to mark their response to statements describing various outcomes from PLD training programs based on the three interventions implemented. A 5-point Likert scale will be used with a range of responses from strongly disagree to strongly agree. An initial questionnaire will be designed and

then it will be refined through a pilot study on a small subgroup (n=6) of participants that supervised CGs from Group 1, 2, and 3. Based on input from the pilot group, the final questionnaire will be drafted and used in the study.

The first section of the questionnaire will ask about demographic information (gender, birth year, qualifications, years' experience). The second section of the questionnaire will contain a question set that will be based on various outcomes from PLD training programs and Preceptors will be asked to score their agreement level with these outcomes for the three interventions. The researcher and the Preceptor will each have a copy of the questionnaire. The researcher will explain each question the same way to every participant to mitigate the issue of question interpretation. The participants' questionnaire will be returned to the researcher once completed. The completed questionnaires will be stored in a secure file cabinet. No data will be collected until written consent is secured, and a copy of the signed consent form is provided to participants. An example of a 5-point Likert scale questionnaire to evaluate Preceptors' perceived outcomes for traditional versus alternative PLD training programs is shown below in Figure 12.

Preceptors' perceived outcomes for traditional vs alternative PLD training programs

1 Strongly Disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly Agree

Outcomes	Statement	Group 1 Hands-on Score	Group 2 VLTO-D Score	Group 3 VLTO-ND Score
PLD use	Promotes utilization of PLD devices as part of daily practice			
Staffing Levels	Helps to maintain adequate staffing levels on the unit			
Onboarding	Results in faster on-boarding of new hires on unit			
Self efficacy	Promotes a strong sense of self-efficacy			
Attitude	Promotes a positve attitude towards PLD use			
Peer values	Promotes strong values for PLD use with peers			
Morale	Promotes good morale on unit			
Job satisfaction	Promotes contentment in job			
Management support	Promotes a sense of support from management peers			
Stress	Promotes healthy stress levels			
Retention	Helps to hold CGs in their roles			
MSD risk	Helps to minimize MSD risk from patient handling			
Patient engagement	Encourages verbal engagement with patients during PLD transfer			
Trouble-shooting	Promotes strong troubleshooting skills			
Patient safety	Promotes patient safety			
Transfer time	Promotes a positive perception of PLD transfer time			
Turnover	Encourages CGs to stay on the job			
Role modelling	Promotes positive role models			
Training time	Reduces aggregate training time			
Preceptor shifts	Reduces the number of preceptor shifts			

Figure 12. Sample questionnaire to obtain rating scores for Preceptors' perceived outcomes for hands-on versus alternative PLD training programs. Note: "VLTO-D" denotes vicarious learning through observation - directed observer role and "VLTO-ND" denotes vicarious learning through observation - non-directed observer role.

5.7.4 Data Analysis

All data will be analyzed at 3-, 6-, and 12-months post-intervention and comparisons will be made from the results at the three time periods. All raw data will be entered into Excel spreadsheets for: (i) electronic charting results, (ii) MSD discomfort survey results, (iii) Perceived Stress Scale results, and (iv) Preceptor survey results.

5.7.4.1 Electronic charting

The response for months experience will be used to confirm that the CG completing the e-chart is a new hire. In addition to calculating the frequency of PLD use from 'yes/no' responses, data from the rating question for overall PLD experience will be analyzed to determine the average rating. Also, low overall experience ratings will be compared with CG reports of barriers experienced during PLD transfers to determine if there is a relationship between these findings. Text data from the electronic charting will

be deductively analyzed for common themes related to potential barriers regarding PLD use - both for when the PLD is actually used and when the CG intends to use it, but does not.

5.7.4.2 Direct observation

The data collected from the direct observations will be transferred from the data collection tool into Microsoft Excel (2016). The frequency of PLD use will be calculated based on the number of times the researcher observed CGs using PLDs as part of daily practice. The average rating score will be calculated for the researcher's perceived overall rating for PLD transfers and will be categorized by technical skills, verbal skills, and transfer time. Text data from the direct observations will be deductively analyzed for common themes related to potential barriers regarding PLD use, challenges/workarounds carried out by the CG, work environment factors, etc.

5.7.4.3 Caregiver questionnaire

Raw data from the demography responses will be analyzed for common responses and how often responses occurred. The results from the MSD discomfort survey will be analyzed for pain scores by body areas (13). Also, the frequency of discomfort reported as 'never', 'occasional', 'often', and 'always' will be calculated. Last, the overall results of the MSD discomfort survey will be summarized.

To determine the Perceived Stress Scale score, the researcher will first reverse the scores for questions 4, 5, 7 and 8. For example, on these four questions, the scores will be changed as follows: 0=4, 1=3, 2=2, 3=1, 4=0. Then, the scores for each question will be added to obtain the total score. The results will be compared to the guideline by Cohen (1983) where total scores ranging from 0-13 would be considered low perceived stress, 14-26 moderate perceived stress, and 27-40 high perceived stress. The total scores for the three groups will be compared.

For questions based on the Theory of Planned Behaviour, data analysis will be identical to that previously described for the predictor variables of (1) behavioural intention, (2) attitude, (3) subjective norm, and (4) perceived behavioural control, in Study 1 (Section 3.3.4 - Data Analysis). This section includes the analyses processes for the following:

- summaries of the steps involved in data analysis for the direct measurement and indirect measurement of each predictor variable
- measurement of behavioural intention
- direct and indirect measurement of attitude
- procedure for designing the subjective norm items for measurement
- indirect measurement of subjective norm
- procedure for designing the perceived behavioural control items for measurement
- indirect measurement of perceived behavioural control

5.7.4.4 Preceptor questionnaire

The data collected from the Preceptor questionnaire will be tabulated in Microsoft Excel (2016) and analyzed using SPSS (Version 25.0.0.0). As described in detail below, results for individual Likert scale statements will be analyzed using non-parametric statistical tests and results for overall Likert scale statements will be analyzed using parametric statistical tests.

CHAPTER 6: GENERAL DISCUSSION

6.1 Summary of the Research Program

In summary, this research program aims to: (i) identify the barriers to PLD use by CGs, (ii) further evaluate the specific role of training methods as a barrier to PLD use, and (iii) explore the feasibility of an alternative learning method for PLD training programs. Specifically, the proposed series of studies asks: (i) Why are PLDs under-utilized by CGs in hospital environments? (ii) What barrier subcategories within PLD training programs contribute to low PLD use?, and (iii) Is vicarious learning through observation an effective alternative to hands-on PLD learning?

Study 1 applies the Theory of Planned Behaviour to better understand the barriers between CGs' knowledge (training/education) and intent to use PLDs, and CGs' intent to use PLDs and actual PLD use (i.e., behaviour) (Figure 1). The TPB model will identify the contribution of the predictor variables attitude, subjective norm, and perceived behavioural control towards the prediction of CGs' intention to use PLDs (i.e., future behaviour). It is hypothesized that CGs avoid using PLDs despite their knowledge that manually handling patients increases their risk of back injury. Additionally, it is anticipated that some CGs who intend to use PLDs, in actual daily practice, do not use them. Last, it is expected that the patient is a potential barrier to PLD use by CGs. These theories are expected due to barriers that exist within PLD training programs and daily CG practice. Examples include barriers due to: (i) lack of perceived need for PLDs, (ii) lack of time to use PLDs, (iii) low staffing levels, (iv) unique patient characteristics, and (v) organizational and cultural aspects of work (Evanoff et al., 2003; Koppelaar et al., 2009; Schoenfisch et al., 2011). It is predicted that Study 1 will demonstrate that training is an important barrier to the under-utilization of PLDs by CGs. This provides a theoretical basis for Study 2 where the specific role of training as a barrier to PLD use will be evaluated.

Study 2 aims to further evaluate the: (i) specific role of training methods as a barrier to PLD use, and (ii) impact of barrier subcategories within training on the perceived overall effectiveness of a PLD training program. The barrier subcategories will be identified by conducting focus groups with hospital staff who: (i) design, develop and deliver PLD training programs (i.e., practice-based educators, APNEs), (ii) supervise CGs (i.e., unit managers), and (iii) receive PLD training (i.e., CGs). Further, unit

Preceptors will evaluate the impact of the barrier subcategories identified on the perceived overall effectiveness of a PLD training program. This study will evaluate the hypothesis that training methods is one of the most significant barriers impacting the use of PLDs by CGs.

Additionally, it is anticipated there are several barrier subcategories within PLD training programs that further contribute to training as a barrier to PLD use. Last, it is expected that a significant barrier subcategory to PLD use is the temporary staff shortages that occur when CGs leave the unit to participate in (provincially mandated) hands-on practical training. These theories are based on several barrier subcategories that exist within PLD training programs (e.g., barriers due to training content, barriers due to training delivery, and barriers due to management) (B. Perkins Meingast, personal communication, November 12, 2021). Further, within the barrier subcategory of training delivery, the removal of CGs from units to attend off-site hands-on practical PLD training contributes to the under-utilization of PLDs due to the resultant staff shortages. Inadequate staffing levels on units is a major contributor to the under-utilization of PLDs in busy clinical environments (Nelson, 2006; Koppelaar et al., 2009, Schoenfisch et al., 2011) which further compounds MSD injury risk. It is hypothesized that Study 2 will demonstrate the need for an effective alternative to off-site hands-on learning that does not remove CGs from the unit. This would provide the theoretical basis for Study 3 which explores the effectiveness of the novel intervention - vicarious learning through observation - as an alternative approach to hands-on learning.

The aim of Study 3 is to explore the feasibility of implementing vicarious learning through observation as an effective alternative to off-site hands-on learning for new CG hires. This study will evaluate the hypotheses that vicarious learning through observation is as effective as hands-on learning for the utilization of PLDs by new CG hires. Additionally, it is anticipated that directed observation (i.e., use of observer tools) will result in learning outcomes that are equal to outcomes in hands-on learning. These theories are based on research findings that demonstrate: (i) vicarious learning through observation to be equally, if not more, effective compared to traditional hands-on learning methods (O'Regan et al., 2016, Kaplan et al., 2012, Jeffries and Rizzolo,

2006), and (ii) the ability of observation tools to facilitate learning when learning vicariously through observation (O'Regan et al., 2016).

Participants in the control group will receive the traditional off-site hands-on PLD training, while participants in the two intervention groups will receive vicarious learning through observation, either with observer tools in one group or without observer tools in the other group. The effectiveness of the three groups will be evaluated by unit Preceptors.

6.2 Impact of the Research Program

This research program has the potential to make both a theoretical and practical impact. This research will extend the theoretical foundation of our understanding of the observed under-utilization of PLDs by CGs by: (i) identifying barriers and their subcategories to PLD use, and (ii) examining the effectiveness of an alternative approach to PLD training that promotes the maintenance of adequate unit staffing levels. This theoretical foundation will provide evidence for the design of more effective PLD intervention strategies that will result in a more widespread adoption of PLDs by CGs, thereby mitigating musculoskeletal injury risk. More specifically, Study 1 is expected to extend the literature by identifying barriers between (1) CGs' knowledge (training/education) and intent to use PLDs, and (2) CGs' intent to use PLDs and actual use of PLDs (i.e., behaviour). Also, Study 1 will improve understanding of the patient role in CGs' PLD decision-making. Study 2 will extend the literature by identifying barrier subcategories within PLD training programs that contribute to the under-utilization of PLDs by CGs. A better understanding of the barrier subcategories, and their overall impact on PLD training program effectiveness (as evaluated by unit Preceptors), will equip hospital administrators with the necessary knowledge to design PLD training programs that result in high PLD use. Study 3 is expected to support the literature regarding vicarious learning through observation, providing a study in which an effective alternative to hands-on PLD learning can be considered.

The practical implications of this research program are expected to have great importance. An overarching effect is the opportunity to contribute to the goal of reducing musculoskeletal injuries in the CG profession by addressing the identified barriers and their subcategories to PLD use. Reducing musculoskeletal injury risk can contribute to

reduced lost time (which promotes adequate staffing levels) and improved job satisfaction and morale (which promotes reduced turnover and perceived stress).

The research program provides an opportunity to introduce an alternative approach to hands-on PLD learning that could contribute to improving staffing levels on units, and in turn, promote PLD use. A better understanding of the barriers (Study 1) and their subcategories (Study 2) to PLD use will contribute towards the design and implementation of more effective PLD training programs and multi-factor PLD intervention strategies. Similarly, an increased awareness of patient-related barriers to PLD use can help CGs approach patients in a manner that results in the PLD being used, and a positive experience for the CG and patient. Finally, CGs' adoption of new healthier PLD use behaviours has the potential to shift unit culture to one that is more positive and accepting towards the implementation of PLDs as part of daily caregiving practice.

6.3 Limitations of the Research Program

This research program was designed for implementation at a large hospital that encourages and supports collaborative academic practice-based research. Thus, it is possible that this research program may not be directly transferable to hospitals that are small/medium sized and/or hospitals that do not support research and innovation.

There are several factors inherent to research hospitals that facilitate implementation of this research program and are likely to contribute to its success. First, in research hospitals, the researcher has access to a staff mentor (i.e., Principal Investigator) who is able to connect them with the right hospital administrators to ensure the research program is fully supported at all levels of management (a critical first step). Second, hospital staff are very much used to research being conducted at the hospital. As such, key personnel (e.g., unit managers, Preceptors, CGs) are keen to participate in research studies, particularly when, for example, the unit manager perceives a direct benefit to front line staff. Third, the barriers and their subcategories identified in one large research hospital may not be applicable to other similar-sized hospitals that also employ ceiling mounted and portable PLDs. The latter may depend on several factors like, for example, the type of care that is administered by CGs using PLDs, the layout of

ceiling mounted PLDs in relation to bed orientation, hospital organizational factors, and, the culture on the unit(s) being studied.

6.4 Future Directions

This section will discuss future directions for the study of PLD use barriers in the CG profession. The first section will present future directions specific to the current proposed research program, followed by high-level future directions based on the current state of this area of research.

6.4.1 Future Directions Specific to this Research Program

A future direction for this research program would be the continuation of e-chart tracking of PLD use (Study 3) for all CGs and not just new hires. Tracking PLD use through e-charting, like other passive surveillance methods (e.g., injury rates, lost time), provides an abundance of useful information that can contribute towards a more in-depth understanding of PLD-associated barriers to use. Additionally, if vicarious learning through observation proves to be an effective alternative to hands-on PLD learning (Study 3), future studies should consider evaluating its effectiveness when applied to other PLD training initiatives, such as refresher training - which is provided to CGs annually and/or after a significant absence from the hospital (e.g., maternity leave, short/long-term disability, etc.). The barriers identified in Study 1, and their subcategories identified in Study 2, should be used to design best practices to promote PLD use (i.e., facilitators) (Figure 1). These best practices could be incorporated into: (i) future PLD training program e-learning content, (ii) positive messaging in scripts used by models during vicarious learning through observation, and (iii) verbal messaging during Preceptor shifts with CGs. A future direction should consider designing an additional study that would apply an extended TPB model to predict CGs' intention to use PLDs. For example, similar to the successful study of nurses' intention by Cote (2012), this future study could extend the TPB model to include moral norm and past behaviour as new predictor variables to predict CGs' intentions to use PLDs. The findings of the future study (extended TPB modelling) could be compared to Study 1 (TPB model, no extensions).

Overall, this area of research has substantial potential and should be explored further.

6.4.2 Future Directions - High-Level

This section will discuss future directions for the study of PLD use barriers by CGs based on the: (i) gaps in the PLD literature, (ii) severity of the CG shortage, and (iii) the importance of looking beyond training.

6.4.2.1 More robust high-quality research papers

The on-going absence of high-quality papers, that allow for the identification of the factor(s) responsible for improvements in outcomes (e.g., MSDs), is considered a major gap in the literature. More specifically, for the past 15 years, the methods used to investigate the efficacy of PLD interventions prevent any conclusions from being made regarding the effectiveness of: (i) introducing PLDs on reducing musculoskeletal injuries, and (ii) multi-factor intervention strategies on reducing musculoskeletal injuries and promoting PLD use. Future directions for this research include the need for more robust, high-quality research that allow conclusions to be drawn regarding barriers that interfere with PLD use and factors that help promote (i.e., facilitators) PLD utilization, especially for multi-factor interventions as the factors are bundled and more difficult to discern.

6.4.2.2 Cumulative effect of chronic CG shortage and COVID-19 on future PLD use

In my opinion, the under-utilization of PLDs will become even more prevalent in the next two to five years which will have negative implications on CGs' physical and mental health. This prediction is based on the chronic CG shortage in Canada which has been exacerbated to new levels by the COVID-19 pandemic. Since a major contributor to the under-utilization of PLDs is a lack of adequate staffing levels on the unit (Nelson, 2006; Koppelaar et al., 2009, Schoenfisch et al., 2011), there is cause for significant concern for future PLD use. Specifically, staff turnover is at an all-time high, to the point where the Ontario government has designed a retention strategy to persuade CGs to stay in their jobs, including a one-time lump sum payment of $5,000. Radio advertisements, produced by the Registered Nurses' Association of Ontario, attempt to inspire Ontarians to join the caregiving profession. Large hospitals have turned over so many CGs that it could amount to a small hospital - thousands of new CGs, many of them contract workers, who do not receive any formal hands-on PLD training. Instead, they learn

practical PLD skills on the fly from their unit peers or Preceptor. Together, the critical nature of the CG staffing shortage, that is being rectified by mass hiring of contract CGs with no formal PLD training, raises significant concern for the future of PLD use by CGs. As such, it will be important for the healthcare research community to prioritize studies in this area.

6.4.2.3 Beyond training

Future efforts by hospital administrators to positively impact the chronic under-utilization of PLDs will require more than just CG training. As described by Meingast (2022), in some patient rooms, the bed-to-ceiling PLD orientation has changed (e.g., due to new beds, more/fewer patients per room, new equipment) and, as a result, CGs don't use PLDs because the ceiling mounted tracking system does not reach the patient. Unfortunately, even the best training program will not address this barrier to PLD use. Similar to the systems approach used to examine human factors and ergonomics concerns, obtaining a thorough understanding of the root causes of low PLD use is critical to ensuring that the problem is clearly identified and described. By addressing as many PLD-associated barriers as possible, that cannot be affected by training, and then implementing an effective PLD training program, PLD use is more likely to change from being an after-thought to an essential part of daily caregiving practice.

6.5 Trials and Tribulations

6.5.1 Research Ethics

The decision to study CGs in a hospital setting introduced several challenges. However, nothing on my graduate studies journey required such a profound demonstration of resiliency as obtaining research ethics board (REB) approval from the 4th ranked hospital in the world (i.e., UHN's Toronto General Hospital). I learned quickly that there is a very thorough set of procedures for the study of human participants in medical institutions; in particular, when the participants are patients.

All research involving humans performed at UHN hospitals require Institutional Authorization prior to the conduct of the research and before applying for REB approval.

This process involves submitting the study protocol into the Coordinated Approval Process for Clinical Research (CAPCR), a web-based application system through which researchers obtain the approvals required for conducting research involving humans at UHN. After an ~8-week review, my study received Institutional Authorization. The next UHN requirement was a Data Transfer Agreement since my research was field-based and data would be shared between UHN and McMaster University. This formal contract required signatures from the head of hospital and university research departments to my supervisor and Principal Investigator. I was able to submit my research proposal to the UHN REB in late April, 2019. Late in the review process (August 2019), I was assigned a new REB coordinator who requested several revisions and approved my application for review by the Chair of the UHN REB. Finally, in December 2019, after nine months, I obtained UHN REB approval for my study.

With research ethics approval in place at UHN, the process of obtaining McMaster research ethics was very quick and straight-forward. Including minor revisions, McMaster REB approved my research study in five weeks. In total, it took 10 months to obtain dual ethics approval for my study.

Although my original and COVID-19 amended studies would not be conducted, in the spirit of REB thoroughness, and in addition to UHN REB approval, I received McMaster REB approval for my amendment for virtual research on April 3rd, 2022. In total, I obtained research ethics approval four times!

6.5.2 Lessons Learned

As a mature student, my part-time graduate studies journey was incredibly long (12 years!) and many lessons were learned along the way. Below, I will outline six tips based on the lessons I've learned from this journey. If I knew then what I know now, I would have adhered more closely to Tip 1, 2, and 3. Tips 4, 5, and 6 served me very well and I stand behind them strongly.

Tip #1: *Recognize that it is very difficult to complete your thesis part-time*

Working on your thesis part-time results in starts and stops that can add up to a lot of wasted time. For example, every time you re-immerse yourself, you spend at least an hour getting back on track because you're no longer in the flow. A thesis should be

worked on every day so that writing points remain clear and focused and the whole process is less fragmented than part-time thesis work.

Tip #2: *Prepare for research outside of the university*

If your research is affiliated with an institution outside of your university (e.g., field study), be prepared for a longer REB approval process (especially for medical institutions, even if your study is straight-forward) and prepare your expected timeline accordingly. Also, ask your contact/supervisor at the institution for a work area at the institution for a minimum of 3 days per week. This will save time by avoiding remote logins, endless emails that could have been a quick conversation, visits to busy hospital staff that prefer in-person conversations to emails, etc. Also, being physically present is a great way to build relationships with key hospital personnel (e.g., unit managers) who are the gate keepers to hospital research involving CGs.

Tip #3: *Keep the protocol scope in perspective with the degree*

In hindsight, and my Supervisory Committee did caution me about this for a master's research study, focusing on CGs (and avoiding patients/family members) from the start would have been sufficient and would have saved a significant amount of time, especially since the REB approval process for the study of patient participants is so stringent (e.g., multiple revisions of the patient consent form).

Tip #4: *Document everything*

Keep a hard copy or virtual study notebook and document of everything from the start to finish of your thesis. For example, document every email sent, every ethics application submitted and include dates and a short note of explanation. You never know when you may need to make a case for yourself (e.g., delays outside your control, out of time status, request for special circumstance, etc.).

Tip #5: *Get your hands on "A Guide to Writing a Scientific Manuscript or Thesis"* (Potvin, J.R., 2016)

This is a very helpful writing guide that, if followed closely, could save you a round or two of edits with your supervisor.

Tip #6: *Be prepared for bumps in the road*

This tip is most applicable to part-time and/or mature graduate students since your journey will be longer and you will have many more competing life demands than your

studies (e.g., full-time job, family). Expect there to be setbacks (hopefully only minor) and be prepared to be resilient (e.g., make your computer screen saver a Bengal tiger jumping through a flaming hoop - trust me, it helps!). Finally, should there be more bumps in the road than you care to deal with, remember that *“Our greatest glory is not in never falling, but in rising every time we fall” - Confucius.*

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APPENDIX A

Summary Tables (Francis et al., 2004)

Table 5: Summary of procedures for the direct measurement of predictor variables (Francis et al., (2004).

Direct Measurement	Method	Procedure	Scoring
4. Behavioural Intention	4.2 Generalized Intention	*Box 4.2* 1. I expect to refer patients with lower back pain for an x-ray Strongly disagree 1 2 3 4 5 6 7 Strongly agree 2. I want to refer patients with lower back pain for an x-ray Strongly disagree 1 2 3 4 5 6 7 Strongly agree 3. I intend to refer patients with lower back pain for an x-ray Strongly disagree 1 2 3 4 5 6 7 Strongly agree	Mean of 3 scores
5. Attitude	5.1 Direct Measurement	*Box 5.1*[7] *Example: A patient presents with lower back pain. The target behaviour is referring the patient for x-ray.* Referring a patient with acute lower back pain for x-ray is (*stem*; *negative endpoints*) harmful 1 2 3 4 5 6 7 beneficial good 1 2 3 4 5 6 7 bad pleasant (for me) 1 2 3 4 5 6 7 unpleasant (for me) worthless 1 2 3 4 5 6 7 useful	Recode so high numbers are positive Scores should be highly correlated Calculate the mean
6. Subjective Norm	6.1 Direct Measurment	*Box 6.1* *Example: A patient presents with lower back pain. The target behaviour is referring the patient for x-ray.* 1. Most people who are important to me think that (*negative endpoint*) I should 1 2 3 4 5 6 7 I should not refer patients who have lower back pain for x-ray. 2. It is expected of me that I refer patients who have lower back pain for x-ray. Strongly disagree 1 2 3 4 5 6 7 Strongly agree 3. I feel under social pressure to refer patients who have lower back pain for x-ray. Strongly disagree 1 2 3 4 5 6 7 Strongly agree 4. People who are important to me want me to refer patients who have lower back pain for x-ray. Strongly disagree 1 2 3 4 5 6 7 Strongly agree	Recode so high numbers are positive Scores should be highly correlated Calculate the mean
7. Perceived Behavioural Control	7.1 Direct Measurement	*Box 7.1* Self-efficacy 1. I am confident that I could refer my patients for x-ray if I wanted to (*negative endpoint*) Strongly disagree 1 2 3 4 5 6 7 Strongly agree 2. For me to refer my patients for x-ray is easy 1 2 3 4 5 6 7 difficult Controllability 4. The decision to refer for x-ray is beyond my control. Strongly disagree 1 2 3 4 5 6 7 Strongly agree 5. Whether I refer for x-ray or not is entirely up to me. Strongly disagree 1 2 3 4 5 6 7 Strongly agree	Recode so high numbers are positive Scores should be highly correlated Calculate the mean

Table 6: Summary of procedures for the indirect measurement of attitude (Francis et al., 2004).

<table>
<tr><th>Indirect Measurement</th><th>Method</th><th>Procedure</th><th>Analyzing / Scoring</th></tr>
<tr><td rowspan="4">5. Attitude</td><td rowspan="4">5.2 Indirect Measurement</td><td>A. Elicit behavioural beliefs via focus group:
Box 5.2 Example: Your patient has Type 2 diabetes. The target behaviour is taking the patient's blood pressure. Please take a few minutes to list your thoughts about the following questions:
What do you believe are the advantages of measuring the patient's blood pressure?
What do you believe are the disadvantages of measuring the patient's blood pressure?
Is there anything else you associate with measuring the patient's blood pressure?</td><td>List themes (behavioural beliefs) from most to least frequently mentioned</td></tr>
<tr><td>B. Convert most common behavioural beliefs into statements. The statements should reflect the beliefs which might affect the behaviour of the target population.
Box 5.3.1 Question format, behavioural beliefs | Box 5.3.2 Response format, behavioural beliefs[9]
a If I measure blood pressure (BP), I will feel that I am doing something positive for the patient. — Unlikely 1 2 3 4 5 6 7 Likely
b It causes a lot of worry and concern for the patient if they are found to have high BP. — Unlikely 1 2 3 4 5 6 7 Likely
c If I measure BP, I will detect any problems at an early stage. — Unlikely 1 2 3 4 5 6 7 Likely
d If I measure BP, I've got to see some patients more often. — Unlikely 1 2 3 4 5 6 7 Likely</td><td>Include 75% of all beliefs stated. Pilot test items on sample for clarity.</td></tr>
<tr><td>C. Convert each belief statement into the form of an incomplete sentence which, when completed, will result in a positive or negative evaluation of the belief statement.
Box 5.4.1 Question format, outcome evaluations | Box 5.4.2 Response format, outcome evaluations[11]
e Doing something positive for the patient is: — Extremely undesirable -3 -2 -1 0 +1 +2 +3 Extremely desirable
f Causing a lot of worry and concern for the patient is: — Extremely undesirable -3 -2 -1 0 +1 +2 +3 Extremely desirable
g Detecting problems for these patients at an early stage is: — Extremely undesirable -3 -2 -1 0 +1 +2 +3 Extremely desirable
h Having to see some patients more often is: — Extremely undesirable -3 -2 -1 0 +1 +2 +3 Extremely desirable</td><td>Pilot test items on sample for clarity. Modify wording if necessary.</td></tr>
<tr><td>Scoring:
Box 5.5 Example, scoring procedure
a If I measure blood pressure (BP), I will feel that I am doing something positive for the patient. — Unlikely 1 2 3 4 5 6 7 Likely
B It causes a lot of worry and concern for the patient if they are found to have high BP — Unlikely 1 2 3 4 5 6 7 Likely
C If I measure BP, I will detect any problems at an early stage. — Unlikely 1 2 3 4 5 6 7 Likely
D If I measure BP, I've got to see some patients more often. — Unlikely 1 2 3 4 5 6 7 Likely
e Doing something positive for the patient is: — Extremely undesirable -3 -2 -1 0 +1 +2 +3 Extremely desirable
F Causing a lot of worry and concern for the patient is: — Extremely undesirable -3 -2 -1 0 +1 +2 +3 Extremely desirable
G Detecting problems for these patients at an early stage is: — Extremely undesirable -3 -2 -1 0 +1 +2 +3 Extremely desirable
H Having to see some patients more often is: — Extremely undesirable -3 -2 -1 0 +1 +2 +3 Extremely desirable
Imagine that a participant has responded by circling the numbers indicated in bolded italics above.
The total attitude score is calculated as
A = (5 x +3) + (2 x -2) + (6 x +3) + (2 x -1)
= (+15) +(-4) + (+18) +(-2)
= +27
Because there are 4 items, the possible range of total scores is (7 x ±3) x 4 = -84 to +84[13]
THEREFORE, THE ATTITUDE SCORE OF THE PARTICIPANT REFLECTS A WEAK TO MODERATE POSITIVE ATTITUDE (i.e. IN FAVOUR OF MEASURING BLOOD PRESSURE)</td><td>Sum the weighting of outcome evaluation scores to behavioural belief scores</td></tr>
</table>

Table 7: Summary of procedures for the indirect measurement of subjective norm (Francis et al., 2004).

<table>
<tr><th>Indirect Measurement</th><th>Method</th><th>Procedure</th><th>Analyzing / Scoring</th></tr>
<tr><td rowspan="4">6. Subjective Norm</td><td rowspan="4">6.2 Indirect Measurement</td><td>A. Elicit commonly held beliefs via focus group:
Box 6.2 Example: Your patient has Type 2 diabetes. The target behaviour is measuring the patient's blood pressure (BP). Please take a few minutes to list your thoughts about the following questions:
Are there any individuals or groups who would approve of your measuring the patient's BP?
Are there any individuals or groups who would disapprove of your measuring the patient's BP?
Is there anything else you associate with measuring the patient's blood pressure?</td><td>List themes (normative beliefs) from most to least frequently mentioned.</td></tr>
<tr><td>B. Convert most frequently listed reference goups or individuals into "stems" of normative belief items. Items may reflect what important people think a person should do (injunctive norms) or what important people actually do (descriptive norms).
Box 6.3 Imagine that the elicitation study has identified three sources of social pressure: patients with Type 2 diabetes; diabetologists; and other GPs.
Injunctive items (what important people think a person should do)
1. Patients with Type 2 diabetes think I should not -3 -2 -1 0 +1 +2 +3 should measure their blood pressure.
(stem)
2. Diabetologists would disapprove -3 -2 -1 0 +1 +2 +3 approve of my measuring patients' blood pressure.
Descriptive items (what important people actually do)
3. Other GPs do not -3 -2 -1 0 +1 +2 +3 do measure the blood pressure of their patients with diabetes.</td><td>Include 75% of the groups or individuals listed to give adequate coverage of the sources of social pressure</td></tr>
<tr><td>C. Convert each of the sources of social pressure into the form of a statement about the importance of the various sources of social pressure. Responses indicate the strength of motivation to comply with each reference group or individual.
Box 6.4
1. Patients' approval of my practice is important to me
Not at all 1 2 3 4 5 6 7 Very much
2. What diabetologists think I should do matters to me
Not at all 1 2 3 4 5 6 7 Very much
3. Doing what other GPs do is important to me
Not at all 1 2 3 4 5 6 7 Very much</td><td>Pilot test items on sample for clarity. Modify wording if necessary.</td></tr>
<tr><td>Scoring:
Box 6.5 Example, scoring procedure
a Patients with Type 2 diabetes think I … measure their blood pressure. — Should not -3 -2 -1 0 +1 +2 +3 Should
b Diabetologists would ……. of my measuring the BP of these patients. — Disapprove -3 -2 -1 0 +1 +2 +3 Approve
c Other GPs ….. measure the BP of these patients. — Do not -3 -2 -1 0 +1 +2 +3 Do
d Patients' approval of my practice is important to me. — Not at all 1 2 3 4 5 6 7 Very much
e What diabetologists think I should do matters to me. — Not at all 1 2 3 4 5 6 7 Very much
f Doing what other GPs do is important to me. — Not at all 1 2 3 4 5 6 7 Very much
Imagine that a participant has responded by circling the numbers indicated in bold above.
The total normative belief score is calculated as
N = (+1 x 4) + (+3 x 1) + (+2 x 2)
= (+4) + (+3) + (+4)
= +11
The possible range of total scores is -63 to +63. THEREFORE,
THE NORMATIVE BELIEF SCORE OF THE PARTICIPANT REFLECTS FAIRLY WEAK POSITIVE SOCIAL PRESSURE (i.e. TO MEASURE PATIENTS' BLOOD PRESSURE).</td><td>Sum the weighting of motivation to comply scores to normative belief scores</td></tr>
</table>

Table 8: Summary of procedures for the indirect measurement of perceived behavioural control (Francis et al., 2004).

<table>
<tr><th>Indirect Measurement</th><th>Method</th><th>Procedure</th><th>Analyzing / Scoring</th></tr>
<tr><td rowspan="4">7. Perceived Behavioural Control</td><td rowspan="4">7.2 Indirect Measurement</td><td>A. Elicit commonly held beliefs via focus group:
Box 7.2 Example: Your patient has Type 2 diabetes. The target behaviour is taking a patient's blood pressure. Please take a few minutes to list your thoughts about the following questions:
What factors or circumstances enable you to measure the blood pressure of a patient with diabetes?
What factors or circumstances make it difficult or impossible for you to measure the blood pressure of a patient with diabetes?
Are there any other issues that come to mind when you think about measuring the blood pressure of a patient with diabetes?</td><td>List themes (control beliefs) from most to least frequently mentioned.</td></tr>
<tr><td>B. Convert most frequently listed beliefs into a set of statements to reflect the beliefs which might make it difficult to perform (or not perform) the target behaviour.
Box 7.3 Imagine that the elicitation study has identified a control factor to do with patients being inappropriately dressed for BP measurement; another to do with feeling rushed when measuring BP in the consultation; another about uncomfortable cuffs on BP machines.
1. Patients with diabetes come to the consultation inappropriately dressed to have their BP measured.
Unlikely 1 2 3 4 5 6 7 Likely
2. When I am measuring BP in the consultation I feel rushed.
Unlikely 1 2 3 4 5 6 7 Likely
3. The cuffs on the BP machines are uncomfortable for patients.
Unlikely 1 2 3 4 5 6 7 Likely</td><td>Include 75% of all beliefs listed to give adequate coverage of the belief 'population'.</td></tr>
<tr><td>C. Convert each of the control belief statements into the form of an incomplete statement about whether this makes it more or less likely that the person will do the target behaviour, or whether it makes the behaviour easier or more difficult to do.
Box 7.4
1. When patients with diabetes come to the consultation inappropriately dressed to have their BP measured, I am
less likely -3 -2 -1 0 +1 +2 +3 more likely
to measure their BP.
2. Feeling rushed in the consultation makes it
much more difficult -3 -2 -1 0 +1 +2 +3 much easier
to measure patients' BP.
3. When the cuffs on the BP machine are uncomfortable for patients, I am
less likely -3 -2 -1 0 +1 +2 +3 more likely
to measure patients' BP.</td><td>Pilot test items on sample for clarity. Modify wording if necessary.</td></tr>
<tr><td>Scoring:
Box 7.5 Example, scoring procedure
a Patients with diabetes come to the consultation inappropriately dressed to have their BP measured. — Unlikely 1 2 3 4 5 6 7 Likely
b When I am measuring BP in the consultation I feel rushed. — Unlikely 1 2 3 4 5 6 7 Likely
c The cuffs on the BP machines are uncomfortable for patients. — Unlikely 1 2 3 4 5 6 7 Likely
d When patients with diabetes come to the consultation inappropriately dressed to have their BP measured, I am ..... to measure BP. — Less likely -3 -2 -1 0 +1 +2 +3 More likely
e Feeling rushed in the consultation makes it ..... to measure patient's BP. — More difficult -3 -2 -1 0 +1 +2 +3 Easier
f When the cuffs on the BP machines are uncomfortable for patients, I am ..... to measure BP. — Less likely -3 -2 -1 0 +1 +2 +3 More likely
Imagine that the participant has responded by circling the numbers indicated in bolded italics above.
The total perceived behavioural control score is calculated as
PBC = (5 x -3) + (3 x -2) + (2 x -3)
= (-15) + (- 6) + (- 6)
= - 27
The possible range of total scores is -63 to +63. THEREFORE,
THE PBC SCORE OF THE PARTICIPANT REFLECTS A MODERATE LEVEL OF NEGATIVE CONTROL, i.e. MEASURING PATIENTS' BLOOD PRESSURE IS FAIRLY DIFFICULT.</td><td>Sum the weighting of control belief power scores to control belief scores</td></tr>
</table>

APPENDIX B

WorkSafeBC Grant Application

Specific Priorities/Systematic Reviews

2022 Grant Application Form

Applicant Name: Dr. Jim Lyons

Project Title:
Breaking Down Barriers: Addressing the Under-utilization of Patient Lifting Devices by Caregivers.

Submission Deadline

- Please refer to the Request for Proposals document, available on the Specific Priorities/Systematic Reviews webpage.
- Late or incomplete applications will not be accepted. The only materials that will be accepted after the deadline are ethics and biosafety certificates.

Notes

Review and follow the "Specific Priorities/Systematic Reviews Guide to the Grant Application Form."

All standard terms and funding conditions, set out in Schedules A-E, shall apply to projects funded through Research Services.

All documents are available on the Specific Priorities/Systematic Reviews webpage.

If you have any questions or would like assistance, please contact Research Services:

Email: resquery@worksafebc.com

WorkSafeBC would like to thank all applicants for your interest in the research program.

APPLICATION PACKAGE CHECKLIST

Required Items

☐	Completed Grant Application Form	Sections 1-20
☐	Project Team Information (if applicable)	Section 5
☐	Project Signatories	Section 7
☐	Equipment Items over $1,000 – attach supplier quotes (if applicable)	Section 13C
☐	Project Supporters – attach letters (if applicable)	Section 15

☐	WorkSafeBC Signatories (if applicable)	Section 17B
☐	External Reviewers	Section 20
☐	Signed Applicant Consent Form for Use and Disclosure of Personal Information – one for each team member is required	

Required from Successful Candidates Only

☐	Biohazard and/or Ethics Approval Certificates	Section 3

SUBMISSION INSTRUCTIONS

Please follow these instructions when you are ready to submit your completed application package:

- Complete your application electronically and save in Word document format (i.e., do not send PDFs).
- Electronic signatures (scanned copies of handwritten signatures) are accepted.
- Use the following format to name your file: **Lastname_SPSR2022** (e.g., Smith_SPSR2022).
- Submit the completed application to resquery@worksafebc.com, or via OneDrive. If the latter, please email us for a link to upload your file.
- Limit the file size to 5 MB – larger file sizes will not be accepted.

Research Services will acknowledge receipt by email within two working days.

1. PRINCIPAL APPLICANT		
Name	Jim Lyons	Dr. ☒ Mr. ☐ Ms. ☐ Other ☐
Title	Professor	
Host Organization	University Health Network (UHN) - Princess Margaret Hospital (PMH)	
Address	1280 Main Street West, Hamilton, ON, L8S 4K1 - Ivor Wynne Centre, Room 205	
Telephone	(905) 525-9140 ext. 27899	
Email	lyonsjl@mcmaster.ca	

2. PROJECT TITLE/RESEARCH QUESTION	
Project Title	Breaking Down Barriers: Addressing the Under-utilization of Patient Lifting Devices by Caregivers
Central question being addressed	What are the barriers to patient lifting device use by caregivers and how can they be overcome?
Keywords	Patient lifting device use, musculoskeletal injury, caregivers, nurses, barriers, patient lift, hospital

3. CERTIFICATES REQUIRED All required certificates must be received prior to the release of any approved funding.	
Are the following certificates required?	
Biohazard/Biosafety Approval	Yes ☐ No ☒ If yes, is it included in submission ☐ or will it follow ☐
Ethics Approval	Yes ☒ No ☐ If yes, is it included in submission ☐ or will it follow ☒
Are certificates required from other institutions (e.g., in the case of Co-applicants)?	Yes ☒ No ☐ If yes, is it included in submission ☐ or will it follow ☒

4. BUDGET SUMMARY Please verify the numbers add up correctly and correspond to Section 13A.	
a) Salaries and Benefits	$ 120,000
b) Supplies and Expenses	$ 2,450
c) Permanent Equipment	N/A
d) Travel, Accommodation and Meals	$ 3,840
e) Knowledge Translation and Exchange	$ 3,250
TOTAL	**$ 129,540**

5. PROJECT TEAM INFORMATION (Co-applicants and Additional Authors)		
Name	Kathy Kawaja	Dr. ☐ Mr. ☐ Ms. ☒ Other ☐
Title	Canadian Certified Professional Ergonomist (CCPE) and Vice-President - Human Factors North Inc.	
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6. FINANCIAL OFFICER INFORMATION A project team member is not allowed to be the Financial Officer.	
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7. PROJECT SIGNATORIES (electronic signatures are accepted) We, the undersigned, have read this proposal and certify that the statements contained in this application are true, complete and accurate to the best of our knowledge.	
Principal Applicant	
Name	Dr. Jim Lyons
Title	Professor
Date	April 7, 2022
Signature	
Head of Department (if applicable)	
Name	N/A

Title	
Date	
Signature	
Executive Authority of Host Organization at which the research will be conducted	
Name	Helen Kelly
Title	Clinical Research Manager
Date	April 7, 2022
Signature	

8. HIGH-LEVEL SUMMARY (two pages maximum)

The summary should capture all relevant details in plain non-technical language.

Objective

Explain the problem to be solved and how your research will address it.

Assessing the history of the literature concerning the primary prevention of musculoskeletal disorders (MSDs) in health care provides a testament to its complexity. For over a half century, researchers from around the world have been investigating the challenges associated with patient handling in hospitals and long-term care facilities. Much progress has been made in terms of gaining a better understanding of the benefits of mechanical lifting devices and barriers to their effective implementation. However, the fact that patient lifting device (PLD) use is not yet a universally accepted practice by caregivers (CGs) is a signal to the scientific community, ergonomics practitioners, and health care institutions of the need for on-going study.

In general, this research program aims to: (i) identify the barriers to PLD use by CGs (see conceptual framework in Appendix A, Figure 1), (ii) further evaluate the specific role of training methods as a barrier to PLD use, and (iii) explore the feasibility of an alternative learning method for PLD training programs.

Relevance

Why is the research important and what gaps in knowledge will the research fill?

While some PLD interventions have demonstrated varying degrees of success, many others have failed to change CGs' behaviour to adopt PLDs as an integral part of care practices. As a result, many CGs continue to engage in high-risk behaviour by manually handling patients, despite workplace education and training initiatives aimed at increasing awareness that mechanical PLDs are effective in reducing musculoskeletal injury risk by reducing spinal loads.

Workplace intervention studies are abundant in the literature; however, the interventions studied demonstrated only moderate effectiveness with respect to reducing musculoskeletal injuries associated with patient handling. As a result, further research efforts have focused on identifying various factors, referred to in the literature as barriers and facilitators that may influence the appropriate implementation and utilization of lifting device interventions. Examples of barriers, or factors that hamper the successful implementation of PLD interventions, include but are not limited to: (i) lack of perceived need for PLDs, (ii) insufficient training in PLD use, (iii) lack of time, (iv) lack of management and social support, (v) patient characteristics, and (vi) insufficient availability of devices.

Despite research efforts that identified various barriers that may influence the appropriate implementation of lifting device interventions, the impact of these barriers on the effectiveness of the interventions has not yet been evaluated, as they have been bundled in multi-factor intervention strategies. As a result, our understanding of the barriers, that impede the successful implementation of PLDs, is currently limited and could be enhanced by this research.

Study 1 will demonstrate that training is an important barrier to the under-utilization of PLDs by CGs (as shown in the literature and an expected result of Study 1). Therefore, Study 2 is important as it will further evaluate: (i) the specific role of training as a barrier to PLD use, and (ii) the impact of barrier subcategories within training on the perceived overall effectiveness of a PLD training program. An expected result of Study 2 (as shown from the literature and personal interview with hospital administration) is the resultant staff shortages that occur when CGs leave the unit to participate in (provincially mandated) hands-on PLD training. Inadequate staffing levels on units is a major contributor to the under-utilization of PLDs in busy clinical environments (Nelson et al., 2006; Koppelaar et al., 2009, Schoenfisch et al., 2011) which further compounds musculoskeletal injury risk. Study 2 will demonstrate the need for an effective alternative to off-site hands-on learning that does not remove CGs from the unit. This provides a theoretical basis for Study 3 which explores the effectiveness of the novel intervention - vicarious learning through observation - as an alternative approach to hands-on learning. Finally, Study 3 will also explore the feasibility of implementing vicarious learning through observation as an effective alternative to off-site hands-on learning for new CG hires.

Methodology

What methods do you plan to use and why are they appropriate? Briefly explain how you plan to conduct your research, who the participants will be, sample size, when and where the study will be done, etc.

In Study 1, a convenience sample of three groups of hospital staff (total of 40 participants) will be recruited. Group 1a will be 15 CGs who will participate in focus group interviews where they will be asked about perceived barriers to PLD use. The results from the focus groups will be themed and used to design a Theory of Planned Behaviour-based questionnaire as per the manual by Francis et al., (2004). Group 1b will be 15 CGs who will participate in semi-structured interviews with the researcher. Participants will complete the TPB-based questionnaire which will be used to predict CGs' intention to use PLDs (i.e., their behaviour) to better understand why PLDs are under-utilized in healthcare. Finally, Group 1c will be 10 patients and, if present, family members, who will participate in semi-structured interviews with the researcher to discuss potential patient-related barriers to PLD use. The study will take place on units 16P and 17 A/B at Princess Margaret Hospital.

In Study 2, a convenience sample of three groups of hospital staff (total of 45 participants) will be recruited to take part in the study. Group 2a will be 15 practice-based education experts who are hospital staff that design, develop, and deliver PLD training programs. Group 2b will be 15 unit managers who are responsible for scheduling staff training and managing staffing levels when CGs are away from the unit attending PLD training. Group 2c will be 15 CGs who have attended a PLD training program within the last year. Following the focus groups, individual semi-structured interviews will be held with all participants from each of the three groups which will involve administrating a questionnaire to evaluate the impact of the barrier subcategories on the perceived overall effectiveness of a training program designed to promote PLD use.

In Study 3, three groups, each with 25 participants, will be recruited to take part in the study which includes CGs who will be scheduled for new hire orientation training on PLDs. A different PLD training program intervention will be assigned to each group for the skills development portion of the PLD training program. Group 3a participants will be provided with two off-site hands-on skills development sessions that will take place at two different times during the intervention. Group 3b participants will be provided with vicarious learning through observation with the use of observation tools to facilitate their learning. Group 3c participants, like Group 3b, will be provided with vicarious learning through observation but, unlike Group 3b, will not be provided with observation tools.

Outcomes/Potential Impact
Clearly describe how you will define successful achievement of each objective identified above. Explain the outcomes or potential impact that will indicate project success.

Study 1: A better understanding of the barriers to PLD use will contribute towards the design and implementation of more effective PLD training programs and multi-factor PLD intervention strategies which have the potential to mitigate MSD risk.

Study 2: A better understanding of the barrier subcategories within PLD training programs will contribute towards the design and implementation of more effective PLD training programs which have the potential to mitigate MSD risk. In addition, results from the impact of 'staff shortages' on PLD training program effectiveness will provide a theoretical basis for Study 3 and can improve the design and facilitation of PLD training programs.

Study 3: Provides an opportunity to introduce an alternative approach to hands-on PLD learning that can contribute towards improving staffing levels on units, and in turn, promote PLD use.

9. DETAILED RESEARCH PROPOSAL (20 pages maximum)

The research proposal must be no longer than 20 pages of double-spaced text. References and any appendices do not affect the page count.

Rationale and Significance (one page maximum)
Explain the rationale and significance of the proposed research. Highlight the importance of your project by including relevant workplace injury or illness statistics.

Years of biomechanics research has shown that manual patient handling contributes greatly to the high musculoskeletal injury rate in caregivers, especially to the neck, low-back and shoulder areas. For instance, the CG profession is in the top 10 occupations at highest risk for musculoskeletal disorders (PSHSA, 2010) along-side workers in construction, mining, and manufacturing (Nelson et al., 2003; BLS., 2007). As well, CGs lose time from work at a rate 1.5 times that of the average Canadian worker (PSHSA, 2010). An engineering ergonomics solution to the high physical demands of manual methods of patient handling has been the widespread implementation of patient lifting devices, which, have been shown to reduce mechanical loads significantly and, thereby, reduce MSD risk considerably.

However, what seemed like a straight-forward prevention strategy has fallen short, as evident by soft tissue injuries that continue to plague the CG profession due, in part, to low PLD use behaviours. For example, a study in the Netherlands reported only 27% of hospital CGs had sustained behaviours of using PLD equipment (Koppelaar et al., 2013) and, more recently, in a review of 4,674 patient handling injury cases, lifting equipment was only used 18% of the time (Gomaa et al., 2014).

There are many factors that affect the adoption of PLDs as part of daily caregiving practice. These factors can be broken down into issues that impede (barriers) and promote (facilitators) PLD use. Recurrent barriers cited in the literature include: (i) a lack of perceived need for PLDs, (ii) insufficient/inadequate training in PLD use, (iii) a lack of time to use PLDs, (iv) low staffing levels, (v) unique patient characteristics, and (vi) organizational and cultural aspects of work (Evanoff et al., 2003; Koppelaar et al., 2009; Schoenfisch et al., 2011). While the literature does not specify, the barrier of 'insufficient/inadequate training' likely implies that CGs do not have adequate knowledge and/or ability to adopt PLDs as part of daily practice.

As shown in the literature, training is likely to be an important barrier to the under-utilization of PLDs by CGs. In addition, there are likely several barrier subcategories, within PLD training programs, that further contribute to training as a barrier to PLD use. One such subcategory barrier is the resultant staff shortages that occur when CGs leave the unit to participate in (provincially mandated) hands-on practical training. While hands-on practice is important, a lack of adequate staffing levels on the unit is a

major contributor to the under-utilization of PLDs in busy clinical environments (Nelson et al., 2006; Koppelaar et al., 2009, Schoenfisch et al., 2011) which further compounds MSD injury risk.

Vicarious learning, through observation, may provide a novel intervention to allow for effective PLD training that does not contribute to CG staffing shortages. The concept of learning by observing is the basis of the Social Learning Theory (Bandura, 1977), and assumes that much of human learning is vicarious. That is, we learn by observing someone else's behaviour and its consequences. Bandura contends that, just as we learn individual behaviours, we learn new behaviour patterns when we see them performed by other people or models. A simple everyday example of vicarious learning through observation is watching a YouTube "how-to" video that elaborately demonstrates how to perform a series of tasks, thus enhancing the observer's skills.

Critical Review of Existing Knowledge

Provide a review of the existing knowledge/current research on your topic.

STUDY 1:

With biomechanical evidence as support, a major MSD prevention focus was instituted by hospitals and long-term care facilities around the world through the implementation of PLD initiatives. In Canada, from 2003 to 2006, the province of Ontario released $103 million (CDN) to purchase and install over 12,000 new mechanical lifts in more than 650 health care institutions (PSHSA, 2010). Other participating countries, with similar initiatives, included Australia, the United States and the United Kingdom.

The resounding message, from years of research and a variety of attempts to reduce the risk of manual handling injury for CGs, is that the intervention of PLDs has not been as successful at mitigating musculoskeletal injuries as would be expected. While some studies have demonstrated a decrease in the number of injuries as a result of interventions that include PLDs (Evanoff et al., 2003; Li et al., 2004; Collins et al., 2004; Engkvist, 2007), others have reported less successful outcomes (Hartvigsen et al., 2005; Kneafsey, 2000). In the case of PLD interventions that have not been successful, Burdorf et al., (2013) suggests that timing and the integrated implementation of lifting device use into the actual work situation may be one of the biggest challenges facing the healthcare industry. Low rates of use of newly installed equipment have been reported (Garg and Owen, 1992; Evanoff et al., 2003) and studies show that PLD use is not part of regular practices among many CGs (Gomaa et al., 2014; Lee et al.; 2013, Lee et al., 2015). Examples include a study in the Netherlands that reported only 27% of hospital CGs had sustained behaviours of using PLD equipment (Koppelaar et al., 2013) and, more recently, in a review of 4,674 patient handling injury cases, lifting equipment was not used 82% of the time (Gomaa et al., 2014).

Implementation of ergonomics interventions requires significant effort that involves the consideration of individual, occupational, and organizational factors that are believed to affect an adoption process (Park et al., 2014). There have been numerous studies investigating factors that affect the adoption of mechanical lifting devices in healthcare settings. A pre-post intervention study by Evanoff et al., (2003), at four hospitals and five long-term care facilities, identified barriers to the use of mechanical PLDs. From their study, which involved interviews with 190 health care workers, the three most common barriers included: i) lack of perceived need for PLDs, ii) insufficient training in PLD use, and iii) lack of time. In a systematic review by Koppelaar et al., (2009), the key factors of 'motivation' and 'convenience and easy accessibility' emerged as barriers to the implementation of patient handling interventions. More specifically, for the category 'convenience and easy accessibility' the authors were alluding to issues of time required to transfer patients, staff situations, and availability of lifting devices (Koppelaar et al., 2009). Schoenfisch et al., (2011) collected qualitative feedback related to the adoption of PLDs in two hospitals over a five-year period. With the caveat that *"adoption is a dynamic process that can be complex to assess"*, they noted several factors affecting PLD adoption such as time, knowledge/ability, staffing, patient characteristics, and organizational and cultural aspects of work. Less traditional barriers to PLD use discussed in the literature include 'lack of buy-in' from CGs when PLDs are implemented (Garg and Owen, 1992; Li et al., 2004; Engkvist, 2007), patient-related factors (Koppelaar et al., (2009), and PLD use interfering with the 'culture of caregiving' meaning that the interests of the CG (i.e., personal safety) are ahead of the patient (Myers et al., 2012).

In addition to many identified barriers to PLD use, a major gap in the literature is the on-going absence of high-quality papers that allow for the identification of the factor(s) responsible for improvements in outcomes (e.g., musculoskeletal injuries). For the past 15 years, the methods used to investigate the efficacy of PLDs to assist CGs prevents any conclusions from being made. This includes conclusions regarding the effectiveness of: (i) introducing PLDs on reducing musculoskeletal injuries among CGs, (ii) improving patient handling techniques via training, and (iii) multi-factor interventions that include a training component.

In conclusion, there is a significant need for on-going study to better understand the barriers to PLD use by CGs and, by doing so, design facilitators as best practice to mitigate MSD risk in the profession.

STUDY 2:

Given the significant role that training has played in previous intervention strategies that were aimed at promoting PLD use (i.e., single-factor and multi-factor intervention strategies), and that training has been largely ineffective in protecting CGs from musculoskeletal injury by promoting PLD use, a more in-depth understanding of the potential barriers within training (i.e., barrier subcategories) is warranted.

Barriers Due to Training Content

The literature supports the need for the content of training sessions to be well-suited for adoption in clinical settings (Hignett, 2003; Koppelaar, et al., 2009; Charney et al., 2010; deRuiter and Liaschenko, 2011, and Kay et al., 2015). Subject matter that is not relevant to the demands of the work environment is considered a training content barrier that could negatively affect the use of PLDs. This is particularly relevant in hospital environments where daily care is often complex and the conditions of patients can change rapidly over time. Additionally, effective training content can result in CGs leaving training with a positive attitude which can influence PLD use behaviour (Lee and Lee, 2017). According to Meingast (2022), the most effective way to reach CGs and promote positive attitudes towards using PLDs is through storytelling about real hospital life situations, including anecdotes of negative consequences as a result of CGs' decisions to not use PLDs. She describes storytelling as a method to intrinsically motivate CGs by informing them of how much preventable harm can occur by using the lift (B. Perkins Meingast, personal communication, November 12, 2021).

Barriers Due to Training Methods

Training methods that include an opportunity for practical hands-on experience using a PLD is well supported in the literature. For example, contextual training has been found to be more effective in promoting compliance with safe patient handling practices than classroom training (Resnick and Sanchez, 2009). Specific to PLD use, Hodder et al., (2010) demonstrated that theoretical and practical training in transfer techniques, using a PLD, can improve posture and other injury-associated risk factors. An important element to incorporate in practical methods of training is the ability to problem-solve (de Ruiter and Liaschenko, 2011) by creating scenarios that are typical but also precarious. By practicing everything from a smooth PLD transfer to an emergency situation, *"you are creating productive struggle in the caregiver's thinking; you are creating resilience, you are creating trouble-shooting ability"* (B. Perkins Meingast, personal communication, November 12, 2021). A CG with astute trouble-shooting abilities will have a strong sense of self-efficacy which, in turn, can help to promote positive experiences and perceptions about PLDs which Lee and Lee (2017) found can be vital to ensuring that lift equipment is used. Consequently, the exclusion of play-based learning, as part of a CG's training, may be a barrier in training methods and could negatively affect the use of PLDs.

Barriers from Management

Koppelaar et al., (2010) found that nurses' motivation was a strong determinant of the use of lifting devices which was linked to a supportive management climate and management support. Similarly, when CGs are off being trained, it is critical that managers ensure that staffing levels on the unit are adequate so that CGs don't feel guilty for being off the unit for skills-based training and staff working on the unit do not resent the absence of their peers because of training purposes. Also, since staffing level is a common factor influencing CGs' decisions to use lift equipment (Noble and Sweeney, 2018), it is essential that managers staff an adequate amount of CGs to promote using PLDs when CGs are off the

unit in training. In summary, the exclusion of management support and adequate staffing levels is considered a barrier that could negatively affect PLD use.

The literature frequently identifies the lack of training or ineffective training as being among the most significant barriers affecting the successful adoption of PLDs. However, our knowledge of why training has been ineffective in promoting PLD use is limited to vague descriptors in the literature such as "inadequate training" or "insufficient training". Therefore, more research is needed into the barrier subcategories within training, to better understand the key elements (i.e., facilitators versus barriers) that are necessary for a PLD training program to be successful.

STUDY 3:

Negative Implications of Staff Shortages

Training programs, on the proper use of mechanical PLDs, require that new CG hires be off-site for hands-on learning. Ironically, during such training, this may contribute to the under-utilization of PLDs by the remaining staff due to the resulting staff shortages (Nelson, et al., 2006; Koppelaar et al., 2009, Schoenfisch et al., 2011) which adds to the already existing chronic CG shortage in Ontario, Canada, and globally. When clinical units are short-staffed, the common perception amongst CGs is that there is a 'lack of time' to carry out their duties in the usual manner, including the use of PLDs. Also, staff shortages can result in there being an insufficient number of trained peers available to help with PLDs that require more than one CG (Koppelaar et al., 2009) (e.g., bariatric patient, dementia patient). Finally, staff shortages impact nurses' well-being both physically (e.g., increased MSD risk due to PLD non-use) and mentally (e.g., burnout, leaving the profession) (Douglas, 2011; RNAO, 2017; Shin, 2018).

Vicarious Learning Through Observation

There is a need for time-efficient but effective alternatives to hands-on training on PLDs for new CG hires; for instance, the need for alternative learning methods that successfully develop PLD skills, while maintaining adequate staffing levels (which, in turn, promote PLD use by CGs). Vicarious learning through observation shows promise for this purpose as it has been shown in the literature to be equally, if not more, effective compared to traditional hands-on learning methods. Further, when the vicarious learning group is supported by an observation script (i.e., directed observer role), the knowledge scores were even higher than the hands-on group (Stegmann et al., 2012). In the directed observer role, the aim of the observation tools is to help the vicarious learner pay active attention to the behaviour, which is considered one of the four essential components for learning success with vicarious learning through observation (see Appendix C, Figure 3, Social Learning Theory process model).

In addition to modelling physical skills that can be learned vicariously through observation, studies have shown that interpersonal skills, such as those required for collaboration, can also be learned vicariously (Rummel and Spada, 2005) which could have significant implications for new CG hires interacting with peers and their patients. Finally, vicarious learning has been shown to promote positive behaviour through positive role modelling (Olson et al., 2009).

We hypothesize that, if more peers on the unit are using PLDs, and other prevention behaviours, it will be more likely that newly hired CGs would model that behaviour and use them as well. An example demonstrating the potentially powerful effects of positive social modelling was observed in nursing students who, trying to "fit in" with group norms, copied good hand hygiene practices from their positive peer models (Barrett and Randle, 2008).

Benefits of Vicarious Learning Through Observation vs. Hands-on Learning

One of the biggest advantages of vicarious learning through observation is the significant reduction in time that CGs spend off the unit which helps maintain adequate staffing levels. In turn, this results in perceptions of a more manageable workload which can reduce feelings of stress, being overwhelmed, and burnout which can further lead to increased job satisfaction and improved morale - two factors linked closely with job retention. From an ergonomics perspective, perceptions of more time and adequate staffing can promote PLD use and deter CGs from resorting to faster manual methods to maneuver patients. Also, with more time, CGs are more likely to seek assistance from a peer for two-person PLD transfers.

From a workplace culture perspective, vicarious learning through observation can help promote a positive work environment that exudes encouragement, pride, a positive attitude, and positive PLD

behaviour. This is done in vicarious learning by using positive role models in the training content/scripts. With traditional hands-on training, the Advanced Practice Nurse Educator (APNE) is not scripted and so the new CG hires will be exposed to the APNE's modelling which could be neutral or less positive than the positive models used in vicarious learning.

The critical nature of adequate staffing levels in healthcare necessitates an investigation into effective alternatives to hands-on training. Given that healthcare education often involves simulation to ensure patient safety, vicarious learning through observation may provide a viable such alternative.

Objectives, Research Design and Methodology

Describe the research objectives, design, methodology, procedures and planned analyses. Describe the types of data you will gather, your data sources, who the participants will be, the number of participants and/or work sites involved, etc.

Study 1: Research Objectives

The purpose of Study 1 is to identify the barriers between CGs' knowledge (training/education) and intent to use PLDs, and CGs' intent to use PLDs and actual use of PLDs (i.e., behaviour) (see Figure 1 in Appendix A). Three research hypotheses will be posed to help identify potential barriers to PLD use by caregivers. These include: (i) CGs avoid using PLDs despite their knowledge that manually handling patients increases their risk of back injury, (ii) some CGs who intend to use PLDs in actual daily practice do not use them, (iii) the patient is a potential barrier between CGs who intend to use PLDs, but in actual daily practice, they do not use them.

Study 1: Design, Methodology, & Procedures

Participants

This study will take place at Princess Margaret Hospital on Units 16P & 17 A/B where ceiling mounted and portable PLDs are available and patients are commonly in need of being transferred via mechanical lifting devices. Following research ethics approval, a convenience sample of three groups of hospital staff (total of 40 participants) will be recruited. Group 1a will be 15 CGs who will participate in focus group interviews where they will be asked about perceived barriers to PLD use. The results from the focus groups will be themed and used to design a Theory of Planned Behaviour-based questionnaire as per the manual by Francis et al., (2004). Group 1b will be 15 CGs who will participate in semi-structured interviews with the researcher. Participants will complete a TPB-based questionnaire which will be used to predict CGs' intention to use PLDs (i.e., their behaviour) to better understand why PLDs are under-utilized in healthcare. The eligibility criteria for CGs is that they have the qualifications of Registered Nurse (RN), Registered Practical Nurse (RPN), Occupational Therapist (OT), or Physiotherapist (PT) and are full-time employees with a minimum of six months experience working on a unit. In addition, CGs must be familiar with the PLDs currently in place on the units and transferring patients via PLDs will be an essential duty of their job. Group 1c will be 10 patients and, if present, family members, who will participate in semi-structured interviews with the researcher to discuss potential patient-related barriers to PLD use. Patients' family members will not be directly recruited as participants in the study. However, if they are present when the interview is taking place with the patient, the family member will be asked to sign a consent form prior to participating in discussions. Patients will be eligible to participate if they are in stable health and require a PLD when being transferred. Also, patients must be English-speaking and literate individuals. Family members present at the time of the interview will be invited to participate pending verbal approval from the patient. Family members must be English-speaking and literate individuals.

The study will take place on units 16P and 17 A/B at Princess Margaret Hospital. All participants will be recruited on a volunteer basis and will sign a consent form prior to participating. To maintain anonymity, participant identification numbers will be assigned and will be used to identify responses. As appreciation for their involvement, participants will receive a Tim Horton's gift card valued at $10.

Procedures

Following buy-in from the unit manager, the researcher will design a study information sheet (including contact information) that will be emailed to all CGs and posted in the staff lounges on the unit. Interested

CGs will be able to contact the researcher by email/phone. The researcher will attend daily huddles/staff meetings to recruit CGs. All CGs and patients will be notified that the study is taking place on the unit. A consent form will be provided to and signed by all interested CGs (Group 1a & 1b). Patients (Group 1c), will be recruited with the help of the CG in charge on the unit. The researcher will provide the patient/family member with the study information sheet, answer questions, and obtain a signed consent form.

A walkthrough of the units will be conducted by the researcher to learn how CGs interact with the PLDs, room layout, etc. Focus groups (~45 mins) will be held with participants in Group 1a to discuss perceived barriers to PLD use by CGs and will be audio recorded. The question set for the focus groups will be taken from the manual "Constructing Questionnaires Based on The Theory of Planned Behaviour: A manual for Health Services Researchers (Francis et al., 2004; Section 12.1) (see Appendix A for focus group questions). Refreshments will be provided at the focus group interviews.

Approximately 8 weeks after the focus group data have been collected, individual interviews of ~45 minutes (with audio recordings) will be held with Group 1b participants where a questionnaire will be administered. The first section of the questionnaire will ask about demographic information (gender, birth year, qualifications, years' experience, musculoskeletal health history, weekly work hours, frequency of PLD use per shift, etc.). The second section of the questionnaire will contain ~40 questions (as per Francis et al., 2004) that will be based on the themes emerging from the findings of the focus group interview. The researcher and CG participant will each have a copy of the questionnaire and will work through each question together. For the discomfort survey, CG participants will be asked to locate body areas where they may be experiencing discomfort and indicate the frequency and intensity of this discomfort. The CG participants' questionnaire will be returned to the researcher once completed. The completed questionnaires will be stored in a secure file cabinet. It will be up to the discretion of the CG participant as to whether they would like the interview to be held by phone or in-person.

Finally, individual interviews of ~20 minutes will be held with patients/family members (Group 1c) to gain a better understanding of the role that the patient, and possibly their family members, play in CGs using PLDs as part of care practices. The format of the interview will be open, allowing new ideas to be raised depending on the patient participant's responses. The 20-minute interview will be audio-recorded and will take place in the patient participant's private room or in a room on the unit that ensures privacy. Signage indicating that a meeting is in progress will help to control interruptions. The family member will not be directly recruited as a participant in the study. As mentioned above, if they are present when the interview is taking place with the patient, the family member will be asked to sign a consent form prior to participating in discussions. See Appendix A for patient/family member interview questions).

Study 1: Data Analysis

All data analysis will follow the procedures outlined in Francis et al., (2004). The content of the responses from the focus groups (Group 1a) will be analyzed independently by two researchers and themed according to the TPB model for beliefs. A similar approach will take place for the text data from the individual interviews with CGs (Group 1b). The responses to the TPB-based questionnaire will be analyzed for each of the TPB variables (4) and will include direct and indirect measurements as per the detailed instructions in Francis et al., (2004). SPSS software (Version 25.0.0.0) will be used to analyze the results for the predictor variables (i.e., intention, attitude, subjective norm, and perceived behavioural control) and multiple regression will be used for direct and indirect measurement of the predictor variables. A series of t-tests will be used to identify the TPB-related beliefs that discriminate between the predictor variables.

Study 2: Research Objectives

The purpose of Study 2 is to: (i) identify any additional barrier subcategories within training and learn more about the three that have been proposed (i.e., barriers due to training content, barriers due to training methods, and barriers from management), and (ii) evaluate the impact of the barrier subcategories identified on the perceived overall effectiveness of a training program designed to promote PLD use.

Study 2: Design, Methodology, Procedures

Participants

Study 2 will be similar to Study 1 for setting (i.e., large hospital with PLDs), CG qualifications, CG PLD experience, research ethics approval, and remuneration for participation. A convenience sample of three groups (total of 45 participants) will be recruited to take part in the study which, collectively, includes hospital staff who: Group 2a: design, develop, and deliver PLD training programs, Group 2b: manage attendees of PLD training programs, and Group 2c: attend PLD training programs. More specifically, participants in Group 2a will represent 15 practice-based education experts, who are hospital staff that design, develop, and deliver PLD training programs. Participants in Group 2b will represent 15 unit managers who are responsible for scheduling staff training and managing staffing levels when CGs are away from the unit attending PLD training. Participants in Group 2c will represent 15 CGs who have attended a PLD training program within the last year.

Procedures

Recruitment will be similar to Study 1 for buy-in from the unit manager, design and distribution of study information sheets to recruit participants for all groups, consent forms, attendance at staff meetings (all groups), one-on-one meetings (Group 2b), and daily huddles (Group 2c).

Each of the three groups will attend a ~45-minute focus group interview to discuss perceived barrier subcategories to PLD use within PLD training programs. See Appendix B for focus group questions. Refreshments will be provided. Approximately 10 weeks after the focus group data is collected, individual semi-structured interviews (in-person or phone) will be held with 15 participants from each of the three groups. The ~45-minute interview will involve administrating a questionnaire to evaluate the impact of the barrier subcategories on the perceived overall effectiveness of a training program designed to promote PLD use. Participants will be asked to mark their response to statements describing desired qualities of an effective PLD training program based on the barrier subcategories formulated from the focus group interviews. A 5-point Likert scale will be used with a range of responses from strongly disagree to strongly agree (see Appendix B, Figure 2). An initial questionnaire will be designed and then it will be refined through a pilot study on a small subgroup (n=10) of participants from Groups 2a, 2b & 2c. Based on input from the pilot group, the final questionnaire will be drafted and used in the study.

The first section of the questionnaire will ask about demographic information (gender, birth year, qualifications, years' experience, musculoskeletal health history (Group 2c only), weekly work hours, frequency of PLD use per shift (Group 2c only), etc. The second section of the questionnaire will contain a question set that will be based on the themes emerging from the findings of the focus group interviews. The researcher and the participant will each have a copy of the questionnaire. The researcher will explain each question the same way to every participant to mitigate the issue of question interpretation. The participants' questionnaire will be returned to the researcher once completed. The completed questionnaires will be stored in a secure file cabinet. No data will be collected until written consent is secured, and a copy of the signed consent form is provided to participants.

Study 2: Data Analysis

The content of the responses from the focus groups will be analyzed independently by two researchers to increase the validity of the analysis. As such, the researcher will deductively categorize and analyze the content of the responses into themes and will list the themes from most to least frequently mentioned. The data collected from the questionnaire will be tabulated in Microsoft Excel (2016) and analyzed using SPSS (Version 25.0.0.0). Qualitative data from the focus groups and individual interviews will be analyzed in terms of frequencies and percentages (e.g., frequency of themes emerging). After measuring reliability of the questionnaire using Cronbach's alpha, descriptive statistics will be used to analyze the results from the demographic data. Non-parametric tests for the ordinal data from individual Likert scale statements will include a calculation of the mode to determine the most common response to each statement. Spearman's correlation will be computed to measure the degree of association between two variables (e.g., support from management and storytelling). A comparison of differences between Group 2a, 2b & 2c will be computed by applying the Mann Whitney U test. Parametric tests for the interval data from overall Likert scale scores will include calculating the

mean and the standard deviation of the scores. A one-way ANOVA will be computed to compare the means from the three groups for each of the independent variables (i.e., training content, training methods, and management). The Pearson correlation coefficient will be computed to measure the degree of relationship between (i) training content and training method, (ii) training method and management, and (iii) training content and management.

Study 3: Objectives

The purpose of Study 3 is to: (i) investigate whether vicarious learning through observation is as effective as hands-on learning as part of PLD training programs designed for newly hired caregivers, and (ii) evaluate learning outcomes in the observer role for directed versus non-directed observation compared to hands-on learning. This study will evaluate the following hypotheses: (i) vicarious learning through observation is as effective as hands-on training for the utilization of PLDs by new caregiving hires, and (ii) directed observation will result in learning outcomes in observer roles that are equal to learning outcomes in hands-on training.

Study 3: Design, Methodology, Procedures

Participants

Study 3 will be similar to Study 1 and 2 for setting (i.e., large hospital with PLDs), CG qualifications, CG PLD experience, research ethics approval, and remuneration for participation. Three groups, each with 25 participants, will be recruited to take part in the study which includes CGs who will be scheduled for new hire orientation training on PLDs.

Procedures

Two instruments will be developed based on the observation tool and worksheet in Bethards (2014). The hospital's information technology department will be consulted to re-design the electronic patient charting to include required fields to track PLD use by new CGs. Recruitment will be similar to Study 1 and 2 for buy-in from the unit manager and sharing study information (staff meeting, daily huddle).

The hospital's human resources department will be asked to assist with distribution of the study sample as part of new CG hiring process. More specifically, using randomized blocks, 25 consenting CGs will be assigned to one of three PLD training groups. Collectively, the three interventions will contain some combination of the following training elements: (a) e-learning, (b) off-site hands-on skills development (Part 1 & 2), (c) vicarious learning through observation (with/without observation tools), (d) shifts accompanied by a Preceptor, (e) debriefing sessions. The participants in each group (n=75) will participate in: (i) e-learning, (ii) shifts accompanied by a Preceptor, and (iii) debriefing sessions. In addition, the three groups will participate in different additional training elements as follows:

Group 3a: Participants will be provided with two off-site hands-on skills development sessions that will take place at two different times during the intervention (Part 1 and Part 2).

Group 3b: Participants will be provided with vicarious learning through observation with the use of observation tools to facilitate their learning.

Group 3c: Participants, like Group 2, with be provided with vicarious learning through observation but, unlike Group 2, will not be provided with observation tools.

A summary of the training elements by Group is outlined below in Appendix C, Table 1.

The human resources representative will inform the head of the ANPE department of the new CGs name and their assigned group number (Group 3a, 3b, or 3c). The head of APNE will be responsible for ensuring that, during orientation, new CGs receive the PLD training intervention according to their assigned group.

Data collection at 3-, 6-, and 12-months post intervention will be carried out for: (i) electronic charting (see Appendix C for questions), (ii) direct observation of PLD use/barriers (see Appendix C, Direct observation checklist), (iii) TPB-based questionnaire (identical to Study 1, including MSD discomfort

survey; exclusive to Study 3 - Perceived Stress Survey), and (iv) unit Preceptor questionnaire for ranking of perceived outcomes for traditional (hands-on) vs. alternative (vicarious learning through observation) PLD training programs (see Appendix C, Figure 4).

Study 3: Data Analysis

All data will be analyzed at 3-, 6-, and 12-months post-intervention and comparisons will be made from the results at the three time periods. All raw data will be entered into Excel spreadsheets for: (i) electronic charting results, (ii) MSD discomfort survey results, (iii) Perceived Stress Scale results, and (iv) Preceptor survey results.

For electronic charting results, data from the rating question for overall PLD experience will be analyzed to determine the average rating score. Also, low overall experience ratings will be compared with CG reports of barriers experienced during PLD transfers to determine if there is a relationship between these findings. Text data from the electronic charting will be deductively analyzed for common themes related to potential barriers regarding PLD use - both for when the PLD is actually used and when the CG intends to use it, but does not.

For the MSD discomfort survey, the results will be analyzed for pain scores by body areas (13). Also, the frequency of discomfort reported as 'never', 'occasional', 'often', and 'always' will be calculated. For the Perceived Stress Survey, the researcher will first reverse the scores for questions 4, 5, 7 and 8. For example, on these four questions, the scores will be changed as follows: 0=4, 1=3, 2=2, 3=1, 4=0. Then, the scores for each question will be added to obtain the total score. The results will be compared to the guideline by Cohen (1983) where total scores ranging from 0-13 would be considered low perceived stress, 14-26 moderate perceived stress, and 27-40 high perceived stress. The mean Perceived Stress Scale scores will be compared by group including standard deviation.

For the TPB-based questionnaire, data analysis will be identical to Study 1. For the Preceptor questionnaire, data will be tabulated in Microsoft Excel (2016) and analyzed using SPSS (Version 25.0.0.0). Like Study 2, results for individual Likert scale statements will involve measuring reliability of the questionnaire using Cronbach's alpha, then descriptive statistics will be used to analyze the results from the demographic data. Non-parametric tests for the ordinal data from individual Likert scale statements will include a calculation of the mode to determine the most common response to each statement. Spearman's correlation will be computed to measure the degree of association between two variables (e.g., staffing levels and job satisfaction). A comparison of differences between Group 1, 2 & 3 will be computed by applying the Mann Whitney U test. Parametric tests for the interval data from overall Likert scale scores will include calculating the mean and the standard deviation of the scores. A one-way ANOVA will be computed to compare the means from the three groups for each of the independent variables (e.g., list of outcomes in Appendix C, Figure 4). The Pearson correlation coefficient will be computed to measure the degree of relationship between the outcomes listed in Appendix C, Figure 4.

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Provide a complete list of references.

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10. KNOWLEDGE TRANSLATION AND EXCHANGE (KTE)

Use this section to describe your KTE Plan.

Target Audience/End Users

Briefly describe the key audiences and potential users of this research. Include all stakeholders and/or knowledge users you plan to share your results with.

Dissemination of this proposed research program could include presenting the findings at an ergonomics/human factors conference (e.g., Association of Canadian Ergonomists (ACE), Human Factors and Ergonomics Society (HFES), International Ergonomics Association (IEA)) or caregiving conference (e.g., Home and Community Care Conference). Additional audiences could include UHN's Collaborative Academic Practice, Research and Innovation department.

Potential users of this research program could include hospital administrators that: (i) design and deliver PLD training programs (e.g., Director, Practice-Based Education, Advanced Practice Nurse Educator) and/or (ii) design policies and procedures.

KTE Goals

Please describe your KTE goals for the project. Examples include: to share knowledge, create awareness, influence changes in behaviour, generate changes in policy or practice, etc.

The KTE goals for this research program include increasing awareness on the barriers to PLD use by CGs to hospital staff at all levels (e.g., hospital administrators to unit managers to CGs) and, by doing so, influence changes in PLD use behaviour and improve workplace culture. Depending on the results of Study 3, a goal would be to address the considerable staffing shortage problem by implementing vicarious learning through observation as a new practice to traditional PLD skills development learning.

Stakeholder Engagement

Describe how KTE activities will be included in the design and conduct of your research. How might stakeholders (participants, target audience, occupational health and safety community, etc.) be engaged at each stage throughout the project?

From the early stages, this research program will be designed/refined in conjunction with the UHN Collaborative Academic Practice, Research and Innovation department.

Information Sharing Strategies
Clearly describe how you plan to share key learnings after the project has been completed. Discuss how the results will be disseminated and the potential for generalizability to other areas.

Bi-weekly meetings will be held with key personnel of UHN's Collaborative Academic Practice, Research and Innovation department to provide study updates and discuss research questions as the three studies are being conducted. At the end of each study, a presentation of the findings will be delivered to key stakeholders of the Collaborative Academic Practice, Research and Innovation department.

A brief description of the study findings will be posted on UHN's intranet site with a link to a more detailed description of the study results. All employees at UHN have access to the site.

11. RESEARCH WORKPLAN

Use the table below to provide a timeline of key activities and milestones. Include a description, dates and person responsible for each item. You may add additional rows as required.

Team Member	Key Activity / Milestone	Start Date	End Date
All	Start-up meeting with Collaborative Academic Practice department	May 2022	May 2022
Kelly/Kawaja	Obtain Institutional Authorization and research ethics for Study 2 & 3	May 2022	August 2022
Kelly/Kawaja	Recruitment and data collection - Study 1	September 2022	Mid-November 2022
Kawaja/Potvin	Data analysis - Study 1	Mid-November 2022	February 2023
Kawaja/Potvin	Report writing - Study 1	February 2023	March 2023
All	Presentation - Study 1 to Collaborative Academic Practice department	April 2023	April 2023
Kelly/Kawaja	Recruitment and data collection - Study 2	April 2023	August 2023
Kawaja/Potvin	Data analysis - Study 2	August 2023	October 2023
Kawaja/Potvin	Report writing - Study 2	October 2023	November 2023
All	Presentation - Study 2 to Collaborative Academic Practice department	November 2023	November 2023
Kelly/Kawaja	Recruitment and data collection - Study 3 (at 3, 6, and 12 months post-intervention)	December 2023	February 2024
Kawaja/Potvin	Data analysis - Study 3	February 2024	April 2024
Kawaja/Potvin	Report writing - Study 3	April 2024	June 2024
All	Presentation - Study 3 to Collaborative Academic Practice department	June 2024	June 2024

12. POTENTIAL BARRIERS

Are there any challenges you foresee to completing this project in the proposed time period? If so, please describe them and your plan to mitigate them.

A potential barrier could be obtaining hospital research ethics approval; however, the time frame provided should be sufficient. If not, the researcher will maintain regular communication with the UHN REB and follow-up on submissions in a timely manner.

If waves of the existing COVID-19 pandemic continue, it will be challenging to recruit participants and collect data. If this is the case, all means possible to conduct the research virtually will be implemented.

13A. BUDGET REQUEST

Review "Schedule B: Research Grant Funding" and "Guidelines for Allowable Travel Expenses" on our website to complete this section. You may add more rows as required.

Salaries and Benefits (including consultants)	
Salary - Kawaja - 2 years	$120,000
Subtotal	$120,000
Supplies and Expenses	
Tim Horton's gift cards - 150 participants @ $10	$1500
Printing - consent forms, questionnaires, recruitment posters, etc.	$500
Refreshments for focus group interviews - ~15 focus groups @ $50	$450
Subtotal	$2450
Permanent Equipment (items over $1,000 each) Requests must be justified in Section 13C.	
N/A	
Subtotal	N/A
Travel, Accommodation and Meals Please include expenses relating to project research in this section.	
GO train to UHN - Kawaja (8 trips per month @ $20/return trip x 24 months)	$3840
Subtotal	$3840
Knowledge Translation and Exchange Please include all KTE expenses in this section, including travel for KTE activities.	
2 Conferences - Kawaja (2 days per conference) Registration: 2 conferences @ $450 each Travel: Airfare - Toronto-Vancouver-Toronto - $800; Toronto - GO train return fare - $20 Meals: $85 per diem x 4 days Accommodation: $180 x 4 nights Miscellaneous: public transit, etc. $50	$2830
Presentations to Collaborative Academic Practice- travel costs: 3 presentations x 4 researchers @ ~$35/trip	$420
Subtotal	$3250
TOTAL OF ALL CATEGORIES	**$129,540**

13B. BUDGET EXPLANATION

Provide a detailed description and justification of the budget items requested above.

Salaries and Benefits: This includes a salary for Kawaja who will be doing the majority of the research for a two-year period.

Supplies and Expenses: Tim Horton's gift cards are remuneration for the 150 participants in total for the three studies. Printing and focus group refreshments as outlined above.

Travel, Accommodation and Meals: This expense is for Kawaja to travel to UHN over the two-year period. See Table 13A for details.

Knowledge Translation and Exchange: This expense assumes presentations by Kawaja at two Canadian conferences (Vancouver & Toronto). See Table 13A for details for travel costs, meals and accommodations, conference registration fee, and miscellaneous expenses.

For presentations to the Collaborative Academic Practice department, see Table 13A for travel expenses for four research team members. Kelly, the 5th research team member already works at UHN.

13C. PERMANENT EQUIPMENT ITEMS OVER $1,000

Provide a detailed description and justification for permanent equipment items over $1,000.

Description of equipment (including manufacturer, model number, and accessories requested).

N/A

Estimated cost of equipment and accessories (attach supplier quotes).

N/A

What equipment is currently being used for this purpose?

N/A

Why is the new equipment required? (e.g., to replace existing equipment, to make new types of measurements, to furnish a new laboratory, etc.)

N/A

Provide a list of all other requests for research equipment (include all current or planned requests related to this project for equipment from other sources and granting agencies).

N/A

14. AVAILABLE RESOURCES/OTHER CONTRIBUTIONS

List resources available to the research team (laboratory facilities, necessary equipment, software, etc.). If you will be receiving in-kind contributions (financial or other resources), please describe the contribution and indicate the value.

UHN's four hospitals will be available to the research team. Study 1 has been secured at Princess Margaret Hospital. Study 2 and 3 will be conducted at a UHN hospital.

15. PROJECT SUPPORTERS/WORKPLACE PARTNERS

Clearly list your project supporters and workplace partners and explain how they will be involved in your project. What will each partner contribute? Why is it important that they participate? Include their letters of support in the Appendices (**five maximum**).

N/A

16. WORKING WITH WORKSAFEBC DATA (if applicable)

If you need access to data not freely available through our website or statistical reports, please describe the data that you require. If you wish to use WorkSafeBC data, you may need to make a request through FIPP or Population Data BC. All data are subject to the protection and disclosure provisions of the *Freedom of Information and Protection of Privacy Act*.

N/A

17A. DESCRIPTION OF WORKSAFEBC PARTICIPATION (if applicable)

This section is only applicable if WorkSafeBC will have an active role in the project (e.g., by providing facilities, WorkSafeBC data, or through another form of direct participation).

N/A

17B. WORKSAFEBC SIGNATORIES (if applicable – electronic signatures are accepted)

We, the undersigned, have reviewed this application and acknowledge the participation of WorkSafeBC in the proposed research project as described in the above item.

Applicable WorkSafeBC Official (Director)

Name	N/A
Position	
Date	
Signature	

Applicable WorkSafeBC Official (Vice-President)

Name	N/A
Position	
Date	
Signature	

18. PROJECT TEAM QUALIFICATIONS

Provide a one paragraph summary describing the experience and roles of the Principal Applicant and project team members. Illustrate how collectively you have the experience, capability and skills to achieve your stated objectives and outcomes.

Principal Applicant: **Dr. Jim Lyons**

Dr. Jim Lyons is a Professor in the Department of Kinesiology at McMaster University where he teaches undergraduate and graduate courses in human factors and cognitive ergonomics, motor control and learning, and motor behaviour. Dr. Lyons is a seasoned researcher and has conducted numerous studies in laboratory and field study environments. During this research program, Dr. Lyons will assume the role as co-supervisor and mentor to Ms. Kawaja, as he has done throughout her graduate studies at McMaster. Dr. Lyons will consult on all aspects of the research program including design and protocol, data collection data analysis, report writing, and presentations to key stakeholders.

Co-applicant/Additional Author (if applicable): **Dr. Jim Potvin**

Dr. Jim Potvin is Professor Emeritus at McMaster University and the founder and owner of Potvin Biomechanics Inc. He has been a professor at the University of Guelph, Windsor, and McMaster and has taught over 65 university courses. He currently teaches in the COEH Online Ergonomics Program. Dr. Potvin researches primarily in the areas of biomechanics and physical ergonomics and, like Dr. Lyons, is a seasoned researcher with over 90 scientific articles and $3.8 million in research funds. During this research program, Dr. Potvin will assume the role as co-supervisor and mentor to Ms. Kawaja, as he has done throughout her graduate studies at McMaster. Dr. Potvin will consult on all aspects of the research program including design and protocol, data collection data analysis, report writing, and presentations to key stakeholders.

Co-applicant/Additional Author (if applicable): **Dr. Peter Keir**

Dr. Peter Keir is a Professor in the Department of Kinesiology at McMaster University where he teaches undergraduate and graduate courses in biomechanics and ergonomics. Dr. Keir is a seasoned researcher and has conducted numerous studies in laboratory and field study environments. During this research program, Dr. Keir will assume the role as mentor to Ms. Kawaja, as he has done throughout her graduate studies at McMaster. Dr. Keir will consult on all aspects of the research program including design and protocol, data collection data analysis, report writing, and presentations to key stakeholders.

Co-applicant/Additional Author (if applicable): **Kathy Kawaja**

Ms. Kawaja is the Vice President of Human Factors North Inc., a Toronto-based human factors and ergonomics consulting firm. She holds a B.Sc. (1988) in Kinesiology (University of Waterloo) and is a MSc. candidate (McMaster University). Ms. Kawaja is a Canadian Certified Professional Ergonomist (CCPE) with over 29 years' experience consulting in the physical aspects of applied ergonomics. She routinely analyzes the physical requirements associated with work conditions and determines musculoskeletal injury risk based on human capabilities. She has conducted several hundred assessments in a variety of industries from manufacturing to greenhouses to emergency medical services. In addition to risk assessments, Ms. Kawaja provides expertise in design projects, ergonomics programming and strategy, virtual ergonomics, and legal cases involving musculoskeletal injury. During this research program, Ms. Kawaja will be the primary researcher on site at UHN and will be heavily involved in all aspects of the studies (e.g., research ethics, recruitment, data collection/analysis, report writing, and presentations to stakeholders).

Co-applicant/Additional Author (if applicable): **Helen Kelly**

Ms. Kelly is a Research Manager at UHN in the Collaborative Academic Practice, Research and Innovation department. One of Ms. Kelly's roles is to mentor individuals within the practice-based research arena. With a strong research background in the pharmaceutical industry, Ms. Kelly has been at UHN since 2005 where her research role at UHN has been the backbone of CAP's practice-based innovation and research portfolio. She has supported many UHN clinicians who were beginning their learning journey about understanding and conducting practice-based research, students completing Masters degrees, and has mentored many colleagues engaged in the Collaborative Academic Practice Fellowship program. During this research program, Ms. Kelly will play an instrumental role in mentoring Ms. Kawaja during all aspects of the research, most importantly, establishing connections with key stakeholders at the hospitals to obtain buy-in for the research to take place.

19. RESUME HIGHLIGHTS

Provide resume highlights for the Principal Applicant and each Co-applicant. You may use the template provided on the following page or you may use your own format. Limit your resume to a **maximum of five pages per applicant.** Please note that previous publications or specific education/training are not requirements for eligibility.

Include the following information:

- Full name and title
- Institution or organization
- Education and training
- Research, relevant experience and publications
- Other funding applied for or received (include active grants and/or applications pending)

TEMPLATE – RESUME HIGHLIGHTS		
Surname:	Given Name and Initial:	Title: ☐ Dr. ☐ Mr. ☐ Ms. Other:
Institution/Organization:		
EDUCATIONAL/TRAINING BACKGROUND		

Institution and location	Degree/Diploma/ Certificate/Qualification	Year conferred	Field of study
RESEARCH AND RELEVANT EXPERIENCE			
FUNDING APPLIED FOR AND RECEIVED			

20. EXTERNAL REVIEWERS

Please identify two or three impartial reviewers who have the expertise to critically evaluate your application. Do not include anyone with whom you have published or had a professional association in the last three years, or with whom you have an existing personal or business relationship. We may or may not use these reviewers.

Name	Dr. Sue Bookey-Bassett
Organization	Ryerson University
Department	Daphne Cockwell School of Nursing
Address	288 Church St. Toronto, ON M5B 1Z5
Telephone	(416) 979-5300
Email	sbookeybassett@ryerson.ca
Area of Expertise	Nursing
Name	Dr. Katheryn Nichol
Organization	VHA Home HealthCare
Department	President and CEO
Address	30 Soudan Avenue, Suite 600, Toronto, ON M4S 1V6
Telephone	(416) 489-2500
Email	Kathryn.nichol@vha.ca
Area of Expertise	Healthcare, nursing, change management

Please list people who should NOT be used as external reviewers.	
Name	N/A
Reason for exclusion	

Applicant Consent Form for Use andDisclosure of Personal Information Provided to WorkSafeBC

All information submitted by applicants to the competition is used to review applications, to administerand monitor awards, to compile statistics, and to promote and support health and safety research

for British Columbia workers and workplaces. Consistent with these purposes, applicants should alsoexpect that this information may be used in the following ways:

For review purposes

Applications are disclosed to peer reviewers and experts who may be recruited from the research community both inside and outside of Canada to determine the proposals' merit. Applications are also disclosed to internal and external advisory committees to determine relevance of the research.

Members of the advisory committees may be located inside or outside of Canada. WorkSafeBC informs all reviewers of their obligations to maintain confidentiality and to observe WorkSafeBC's conflict ofinterest policy regarding the information entrusted to them.

The peer reviewers' comments on an application are provided to the advisory committees as well as tothe applicant.

For review and funding decisions, application information may also be made available to:

a. Funding partners and/or potential funding partners
b. WorkSafeBC staff who are not in conflict of interest and who may or may not be directlyinvolved in the peer review and award administration process
c. WorkSafeBC's Board of Directors

For public information purposes

WorkSafeBC routinely publishes and disseminates certain details about successful applicants, includingthe name of the applicant, the institution, the research location, the project title, and a summary of the research proposed. For holders of research training awards, the supervisor's name, institution, department, and faculty will also be published. This information is normally posted to the WorkSafeBCwebsite.

For administration and planning purposes

WorkSafeBC may use information submitted by applicants to WorkSafeBC for program planning, evaluation, review, and audits, and/or for generating statistics for these activities.

I, the undersigned, do hereby give CONSENT to the use and disclosure of the information in my application for the purposes as herein described.

Project title: Breaking Down Barriers: Addressing the Under-utilization of Patient Lifting Devices by Caregivers		
Name Dr. Jim Lyons	Signature 	Date April 7, 2022

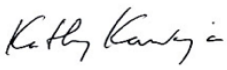
I, the undersigned, do hereby give CONSENT to the use and disclosure of the information in my application for the purposes as herein described.

Project title: Breaking Down Barriers: Addressing the Under-utilization of Patient Lifting Devices by Caregivers		
Name Dr. Jim Potvin	Signature 	Date April 7, 2022

I, the undersigned, do hereby give CONSENT to the use and disclosure of the information in my application for the purposes as herein described.

Project title: Breaking Down Barriers: Addressing the Under-utilization of Patient Lifting Devices by Caregivers		
Name Dr. Peter Keir	Signature	Date

I, the undersigned, do hereby give CONSENT to the use and disclosure of the information in my application for the purposes as herein described.

Project title: Breaking Down Barriers: Addressing the Under-utilization of Patient Lifting Devices by Caregivers		
Name Kathy Kawaja	Signature 	Date April 7, 2022

I, the undersigned, do hereby give CONSENT to the use and disclosure of the information in my application for the purposes as herein described.

Project title: Breaking Down Barriers: Addressing the Under-utilization of Patient Lifting Devices by Caregivers		
Name Helen Kelly	Signature 	Date April 7, 2022

APPENDIX A: STUDY 1

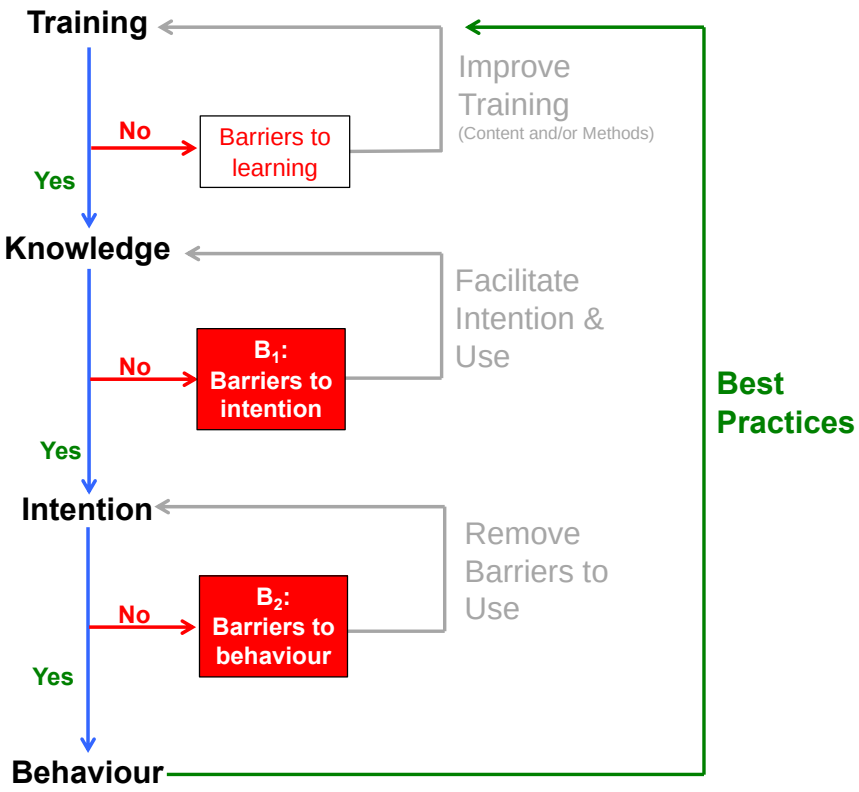


Figure 1. A conceptual framework for the study of CGs' adoption of PLDs as part of their care practices. As shown in black text, the assumption is that CGs must: (1) be trained in the benefits and proper use of PLDs before they are knowledgeable, (2) be knowledgeable of the benefits of PLDs before having intent to use them, and, (3) have intent to use PLDs before adopting the actual behaviour of doing so. CGs' decision-making that follows the '**Yes**' choices, from Training to Behaviour, is considered best practices, and this information will be used to better understand the current gaps between CGs' knowledge and actual practice (behaviour) towards the adoption of PLDs. CGs' decision-making that follows the '**No**' choices will facilitate a study of the barriers to intention (B_1) and the barriers to behaviour (B_2) that may hamper the adoption of PLDs. *Note: 'barriers to learning', and the three interventions in grey text on the right side of the figure, will not be evaluated in the study; however, they contribute to an overall understanding of the framework.*

Focus Group Questions for Group 1a (as per Francis et al., 2004)

The focus group questions will include the following:

- What do you believe are the advantages of using PLDs to transfer patients every shift?
- What do you believe are the disadvantages of using PLDs to transfer patients every shift?
- Is there anything else you associate with your own views about using PLDs to transfer patients every shift?
- Are there any individual or groups who would approve of your using PLDs to transfer patients every shift?
- Are there any individual or groups who would disapprove of your using PLDs to transfer patients every shift?
- Is there anything else you associate with other people's views about using PLDs to transfer patients every shift?
- What factors or circumstances would enable you to use PLDs to transfer patients every shift?
- What factors or circumstances would make it difficult or impossible for you to use PLDs to transfer patients every shift?
- Are there any other issues that come to mind when you think about using PLDs devices to transfer patients every shift?

Individual Interview Questions for Patients - Group 1c (as per Francis et al., 2004)

Examples of potential questions will include the following:

- What is your gender?
- In what year were you born?
- What is your primary language?
- Describe your experience(s) being transferred in a PLD. Did you feel comfortable? Did you feel safe?
- Did the health care worker explain what was going to happen before your transfer in the PLD started?
- Were you able to assist in any way during your transfer in the PLD?
- What is your preference for transfer: manual handling by a health care worker or by way of a PLD?
- Have you ever asked your health care worker not to transfer you by way of the PLD? If so, why?
- {Questions directed to family member participant, if present and consented to participate}: Describe the experience of your family member being transferred by way of the PLD. Have you ever asked a health care worker not to use the PLD to transfer your family member?

APPENDIX B: STUDY 2

Focus Group Outline & Questions - Group 2a, 2b, & 2c

The introduction talking points to participants will include the following:

- researcher introduces themselves
- focus group participants introduce themselves by their first name only and share their job title and how long they have been working at the hospital
- participants will be asked if they have any questions before getting started
- the researcher will engage participants with the following statements/questions:
  - *Thank you for participating in this focus group.*
  - *I'm sure this is a busy time for everyone.*
  - *What is your favourite thing to do in your down time? For me, it is {RESEARCHER STATES FAVOURITE ACTIVITY OR HOBBY}.*
  - *Today we'll be chatting about PLD training for caregivers; what are your early thoughts on that?*

Participants will be asked the following exploration questions:

- *What does a successful PLD training program look like to you?*
- *Describe what you believe would be the key elements of a successful PLD training program.*
- *If you could change one thing about the content of the hospital's existing PLD training program, what would it be?*
- *If you could change one thing about how the hospital's existing PLD training program is delivered, what would it be?*
- *What do you believe are the contributions that management can make towards a PLD training program that is considered successful?*

Follow-up questions will be asked after a primary exploratory question has been answered to dig deeper, collect more information about an interesting assertion, clarify anything that is unclear, or invite other participants to comment on a point that has been made. Examples will include:

- *What do you mean when you say "X"?*
- *Can you give us a few examples?*
- *What did you do when that happened?*
- *What do you think it is about "X" that makes you feel that way?*
- *Can you say anything else about that?*
- *Can you build on the point [Name] just made?*
- *Who has had a similar experience to [Name]?*

A hard copy list of the barrier subcategories that were identified for barriers due to training content, barriers due to training methods, and barriers due to management will

be available for reference during the focus groups to the researcher only. Participants will be asked the following exit questions:

- *Are there any other issues that come to mind when you think about PLD training programs and what makes them effective or ineffective?*
- *Is there anything we didn't touch on that you feel is important?*

Desired qualities of an effective patient lift training program

1 Strongly Disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly Agree

Category	Statement	Score
Training Content	Should have strong content that increases knowledge	
	Should be relevant to clinical environments	
	Should include real-life accounts / storytelling	
	Should promote that using patient lifts benefits caregivers and patients	
	Should promote the importance of engaging the patient in the lift/transfer	
Training Methods / Delivery	Should include opportunities for hands-on practice using patient lifts	
	Should include practice of typical and precarious patient lift scenarios	
	Should be paced so there is time to learn, practice, ask questions, practice some more	
	Should instill responsibility for one's actions	
Management	Should have support from management	
	Should instill a supportive management climate	
	Should maintain adequate staffing levels on the unit during training	
Other results from focus groups	Other subcategory barriers identified from focus groups	

Figure 2. Example statements of desired qualities of an effective PLD training program based on barrier subcategories formulated from focus group interviews.

APPENDIX C: STUDY 3

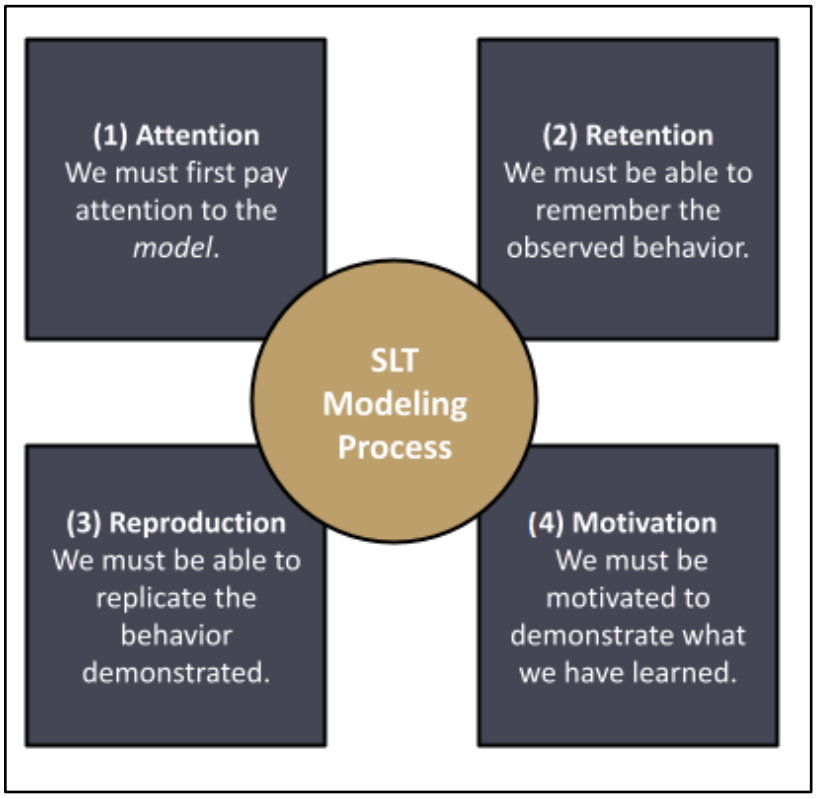


Figure 3. Specific steps in the SLT modelling process that must be followed if learning is to be successful (Sutton, 2022).

Table 1: Training elements associated with each of the three intervention groups.

Training Element	Group 1 Hands-On	Group 2 Vicarious - Directed	Group 3 Vicarious - Non-Directed
e-Learning			
Off-Site Hands-On Skills Development - Part 1			
Vicarious Learning Through Observation			
- use of Observation Tools			
Shifts Accompanied by a Preceptor			
Off-Site Hands-On Skills Development - Part 2			
Debriefing Session			

Questions - Electronic Patient Charting

- *Q1: "How many months experience do you have working on this unit*?"
  - INPUT: months experience
  - This question will verify, at 3-, 6-, and 12- months post-intervention, that CGs qualify for the same number of months experience on the unit
- *Q2: "Did you use a PLD to transfer this patient?"*

    - INPUT: Yes or No
    - This question will provide data on frequency of PLD use
- *Q3: "If you responded yes to Q2, rate your overall experience using the PLD on a scale of 1 (very poor) to 5 (very good)"*
    - INPUT: 1, 2, 3, 4, 5, or N/A
    - This question may help to explain why some new CGs did not change their behaviour despite the PLD training intervention received
- *Q4: "If you used a PLD, did you experience any barriers that interfered with the transfer?"*
    - INPUT: barriers experienced, or no barriers
    - This question will provide data on barriers experienced when PLDs are used
- *Q5: "If you did not use a PLD, but intended to, what barriers did you experience?"*
    - INPUT: barriers experienced, or no barriers
    - This question will provide data on barriers experienced when PLDs are not used

Direct Observation Checklist:

- How often PLDs are used
- Overall experience rating for PLD transfers
    - Technical skills
    - Verbal skills (e.g., patient engagement)
    - Transfer time

- Challenges, work arounds, and strategies used by the CGs during a PLD transfer
- Aspects of the environment that are relevant to CGs deciding to use PLDs
- Informal reports of barriers during PLD transfer by:
    - CG
    - Patient
    - Family member

- Barriers reported and/or observed as to why a PLD was not used

Preceptors' perceived outcomes for traditional vs alternative PLD training programs

1 Strongly Disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly Agree

Outcomes	Statement	Group 1 Hands-on Score	Group 2 VLTO-D Score	Group 3 VLTO-ND Score
PLD use	Promotes utilization of PLD devices as part of daily practice			
Staffing Levels	Helps to maintain adequate staffing levels on the unit			
Onboarding	Results in faster on-boarding of new hires on unit			
Self efficacy	Promotes a strong sense of self-efficacy			
Attitude	Promotes a positve attitude towards PLD use			
Peer values	Promotes strong values for PLD use with peers			
Morale	Promotes good morale on unit			
Job satisfaction	Promotes contentment in job			
Management support	Promotes a sense of support from management peers			
Stress	Promotes healthy stress levels			
Retention	Helps to hold CGs in their roles			
MSD risk	Helps to minimize MSD risk from patient handling			
Patient engagement	Encourages verbal engagement with patients during PLD transfer			
Trouble-shooting	Promotes strong troubleshooting skills			
Patient safety	Promotes patient safety			
Transfer time	Promotes a positive perception of PLD transfer time			
Turnover	Encourages CGs to stay on the job			
Role modelling	Promotes positive role models			
Training time	Reduces aggregate training time			
Preceptor shifts	Reduces the number of preceptor shifts			

Figure 4. Sample questionnaire to obtain rating scores for Preceptors' perceived outcomes for hands-on versus alternative PLD training programs. Note: "VLTO-D" denotes vicarious learning through observation - directed observer role and "VLTO-ND" denotes vicarious learning through observation - non-directed observer role.