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**FACULTÉ DES ÉTUDES SUPÉRIEURES
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**FACULTY OF GRADUATE AND
POSTDOCTORAL STUDIES**

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GRADE / DEGREE

Department of Epidemiology and Community Medicine

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**Standardized Functional Capacity Outcome Measures in Post-Operative Cardiac Surgery: A Survey of
Current Clinical Practice and Development of a Clinical Practice Guideline**

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**STANDARDIZED FUNCTIONAL CAPACITY OUTCOME MEASURES
IN POST-OPERATIVE CARDIAC SURGERY: A SURVEY OF
CURRENT CLINICAL PRACTICE AND DEVELOPMENT OF A
CLINICAL PRACTICE GUIDELINE (CPG)**

Tanya Mac Donald, Bsc PT

Thesis submitted to the Faculty of Graduate and Postdoctoral Studies in partial fulfillment of
the requirements for the MSc degree in Epidemiology and Community Medicine

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Your file Votre référence
ISBN: 978-0-494-61276-7
Our file Notre référence
ISBN: 978-0-494-61276-7

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Abstract

The objectives of the thesis were to determine the prevalence of functional capacity outcome measure use among physiotherapists working with post-operative cardiac surgery clients and to develop evidence-based recommendations regarding their use in clinical practice. The thesis consisted of a systematic review of the literature; a survey of outcome measure use in clinical practice; and the development of a clinical practice guideline. Thirty-one functional capacity outcome measures were included in the review. Only 2.6% of survey respondents reported almost always using outcome measures in their clinical practice. The Six Minute Walk Test, the modified Borg Rating Scale of Perceived Exertion and vital signs were recommended for routine use in clinical practice. A variety of outcome measures are available for use in clinical practice however their use in clinical practice continues to be less than optimal. There is a need for continued training in outcome measure use in clinical practice.

Expanded abstract

Statement of the problem: Evidence-based practice (EBP) contributes to the effective and efficient delivery of health care in clinical practice. The incorporation of EBP into the clinical decision making process guides the selection of interventions that have been scientifically proven to be effective resulting in improved patient outcomes. The use of standardized outcome measures in clinical practice is one way that physiotherapists can ensure that their practice is evidence-based. The limited use of outcome measures in clinical practice can be attributed to the presence of different barriers, such as knowledge, skills, physical, human and economical resources, the personal characteristics of the users and the characteristics of the working environment, that exist in the clinical setting. The identification of the prevalence of use of standardized outcome measures among physiotherapists working with post-operative cardiac surgery clients, the assessment of any potential gaps regarding their use in clinical practice and the development of recommendations regarding their use in clinical practice is an important step in ensuring EBP.

Methods: In order to meet the study objectives the thesis was divided into the following three phases: Phase I: qualitative systematic review of the literature, Phase II: a survey of outcome measure use in clinical practice, and Phase III: CPG development. The Cochrane Collaboration handbook for systematic reviews of interventions (Cochrane Collaboration, 2006) was used to guide the systematic review process (Phase I). The systematic review included published studies of standardized functional capacity outcome measures used in physical rehabilitation to assess the functional capacity of post-operative cardiac surgery clients as well as studies that described the development process and psychometric properties of the outcome measures. In Phase II a prevalence survey was developed and distributed to all Canadian cardiac surgery centers. The survey was based on the revised Ottawa Model of Research Use (Graham and Logan, 1998). The objective of the survey was to determine the prevalence of outcome measure use among physiotherapists working with post-operative cardiac surgery clients. In Phase III: recommendations were developed by a Panel of Experts.

Results: A total of 31 functional capacity outcome measures were included in the review and summarized in the form of evidence tables for the development of the evidence-based recommendations. A total of 39 physiotherapists completed the survey on outcome measure use, resulting in a survey response rate of 41.1%%. Only 2.6% of respondents reported using outcome measures almost always in their clinical practice with the majority of respondents (51.3%) reporting using them occasionally. The Six Minute Walk Test and the modified Borg Rating Scale of Perceived Exertion were the two most frequently used outcome measures in clinical practice which is consistent with the evidence-based recommendations developed for the clinical practice guideline. Of the outcome measures that clinicians are currently using in their clinical practice a total of twelve of them were not recommended by the Panel of Experts members. Therefore a gap exists between clinical practice, in terms of outcome measure use, and the evidence-based recommendations developed for the clinical practice guideline.

Conclusion: Despite an abundance of functional capacity outcome measures available for use by physiotherapist to assess the functional capacity of post-operative cardiac surgery clients, their use in clinical practice remains less than optimal. There is a need for continued training in outcome measure use in clinical practice.

Acknowledgements

Thank you to Dr. George Wells and Dr. Lucie Brosseau for their expertise, wisdom and support. I am very grateful to have had such great mentors as supervisors for my thesis. Their patience, knowledge and encouragement over the past two and a half years, was greatly appreciated. I am especially grateful to Dr. George Wells, my supervisor, for sharing his knowledge and expertise in the methods and design of surveys and clinical practice guidelines.

I would like to thank the Panel of Expert members for agreeing to participate in the development of the evidence-based recommendations for the study. The success of the consensus meeting that was held on June 6th 2008 was due to everyone's tremendous support for this project. The opportunity to participate in the discussions and debates that occurred during the consensus meeting was a great experience and one that I will never forget.

Thank you to Dr. Judy King for your assistance with the recruitment phase of my study. Your involvement as an opinion leader in the field of cardio-respiratory physiotherapy was invaluable to the success of the survey. I would also like to thank you for your continued support since I decided to embark on this journey.

Thank you to Cathy Andersen for your assistance in locating all Canadian cardiac surgery centers. Your list of cardiac surgery centers was greatly appreciated.

Thank you to the Canadian Physiotherapy Association's cardio-respiratory division for agreeing to distribute the link to the survey to its members.

Thank you to my colleagues at the University of Ottawa Heart Institute for taking time during their busy schedules to assist with the pilot-testing of the survey.

I would like to thank my partner, Patrick Brisson, for his encouragement and his support when I decided to take on the challenge of completing a master's degree. Lastly, I would like to thank Aurélie, my beautiful daughter, for deciding to come early and prolonging my journey a little longer.

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1. Introduction and Objectives

1.1. Statement of problem

Evidence-based practice (EBP) is defined as the “conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients” (1). EBP implies that the clinical decision making process will take into account the client’s values, the health care professional’s clinical experience as well as knowledge of the best research evidence (2). EBP is an important component in the delivery of care among health care professionals in demonstrating their effectiveness and efficiency in clinical practice (3). The incorporation of EBP into the clinical decision making process enables health care professionals to choose interventions that have been scientifically proven to be effective resulting in improved patient outcome (3,4).

One method of incorporating scientific research into clinical practice is the use of standardized outcome measures (2). Outcome measures allow physiotherapists to determine treatment effectiveness in a quantifiable manner providing evidence as to the value of their treatments among specific client populations (5). Despite the advantages to using outcome measures in clinical practice, they have not been adopted for widespread use among physiotherapists (6-9).

The limited use of outcome measures in clinical practice can be attributed to the presence of different barriers, such as knowledge, skills, limited resources (physical, human, economical), the personal characteristics of the users and the characteristics of the clinical environment (10). In 1992, a survey of Canadian physiotherapists was undertaken in order to assess the use of standardized outcome measure in clinical practice when evaluating client outcomes (6). A follow-up survey was done in 1998 to assess progress since the publication of the previous survey’s results (8). Both the 1992 and 1998 surveys reported on clinician’s perceived barriers to using standardized outcome measures in clinical practice. The most important barriers identified by the clinicians were limited knowledge of the outcome measure, lack of time, limited knowledge of outcome measure development, did not meet the

client's needs, lack of consensus on which outcome measure to use, limited physical resources (such as lack of equipment) and administrative barriers (6,8).

The use of standardized outcome measures has not previously been studied among physiotherapists working with post-operative cardiac surgery clients. Only 12% of respondents to the 1998 Canadian survey (8) reported working in the area of cardio-respiratory physiotherapy, which is not limited to physiotherapists working with post-operative cardiac surgery clients.

Over 17 000 Canadians have cardiac bypass surgery every year and the five-year trends indicate that the numbers of cases have increased by more than 10 700 over the past five years (11). In terms of costs associated with cardiac bypass surgery, it is estimated that it costs the health care system between \$16 400 and \$35 800 for a 70 year old individual to undergo cardiac bypass surgery in Canada (12) with an average length of stay (LOS) in the hospital of 5.4 days. In the event that the patient requires care in a special care unit (such as an intensive care unit, or a cardiac care unit) the LOS increases to 20.3 days (13). The cost of surgery is directly associated with hospital LOS, number of grafts and age. With the changing demographics of the Canadian population, in terms of age, increased number of co-morbidities and higher degree of acuity of patients having surgery, the burden on the health care system is quite substantial (12).

Therefore, an important step in ensuring that physiotherapy practice is evidence-based is through the use of standardized outcome measures to objectively evaluate client progress.

1.2. Objectives

The overall objectives of the study are to: 1) establish the prevalence of standardized functional capacity outcome measure use by physiotherapists working with post-operative cardiac surgery clients; and 2) to develop evidence-based recommendations and a clinical practice guideline (CPG) regarding their use in clinical practice. In order to meet the overall objectives of the study, the study is divided into three different phases. The initial phase consists of a systematic review of the literature. The second phase consists of a cross-sectional survey of outcome measure use in clinical practice by Canadian physiotherapists

working with post-operative cardiac surgery clients. The third phase of the study consists of the development of evidence-based recommendations and a CPG.

The study objectives according to each of the three different phases are the following.

1.2.1. Phase I: Systematic review of the literature

1.2.1.1. Primary objectives

The primary objectives of the systematic review are: 1) to identify all standardized functional capacity outcome measures used by physiotherapists in the assessment of post-operative cardiac surgery clients; and 2) to summarize each of the included outcome measures psychometric properties.

1.2.1.2. Secondary objectives

The secondary objectives are to: 1) provide a framework for the development of the cross-sectional survey (Phase II of the study); 2) provide data for the creation of the evidence tables required for the development of the evidence-based recommendations in the CPG (Phase III of the study).

1.2.2. Phase II: Survey of outcome measure use in clinical practice

1.2.2.1. Primary objective

The primary objective of the survey is to determine the prevalence of standardized functional capacity outcome measure use, by physiotherapists working in an acute cardio-respiratory setting, with post-operative cardiac surgery clients.

1.2.2.2. Secondary objectives

To identify the outcomes measures currently being adopted, in clinical practice, by cardio-respiratory physiotherapists to evaluate the functional capacity of post-operative cardiac surgery clients.

To determine the knowledge of cardio-respiratory physiotherapists working with post-operative cardiac surgery clients, with regards to the terminology used to describe the psychometric properties of physical rehabilitation outcome measures.

To determine the types of barriers preventing the use of standardized outcome measures in clinical practice among physiotherapists working with post-operative cardiac surgery clients.

To determine the types of facilitators that would assist in increasing the use of standardized outcome measures in clinical practice among physiotherapists working with post-operative cardiac surgery clients.

To determine the existence of a potential gap between the availability of evidence-based standardized functional capacity outcome measures and their use in physiotherapy clinical practice.

1.2.3. Phase III: CPG development

1.2.3.1. Primary objective

The primary objective of the third phase of the study is to develop a CPG, based on the Scottish Intercollegiate Guideline Network (SIGN) methodology (14), to assist physiotherapists, working with post-operative cardiac surgery clients, in selecting evidence-based, standardized functional capacity outcome measures in their clinical practice.

1.2.3.2. Secondary objective

To determine the existence of a potential gap between the recommendations developed for the CPG of evidence-based standardized functional capacity outcome measures and their use in physiotherapy clinical practice among Canadian physiotherapists working with post-operative cardiac surgery clients.

1.3. Relevance of the research

Physiotherapists are health care professionals who receive training in the management and prevention of acute and chronic conditions related to disease, illness, and/or injuries.

Physiotherapists are trained to understand how the body moves and how to restore mobility (www.physiotherapy.ca). Physiotherapists working in the field of cardio-respiratory are skilled and trained in the assessment and management of conditions that affect specifically the circulatory and the respiratory systems.

A working group was established in early 1990 by Health and Welfare Canada and the Canadian Physiotherapy Association (CPA) to establish criteria for measuring client outcomes in physiotherapy (6). The goals of the working group were to provide physiotherapists with a selection of standardized outcome measures and to encourage their use in clinical practice (6). Canadian physiotherapists were surveyed in 1992 and 1998 with regards to their outcome measure use in clinical practice, however only 12% of respondents reported working in the area of cardio-respiratory physiotherapy (8).

Physiotherapists working in the field of cardio-respiratory with post-operative cardiac surgery clients address issues related to abnormal breathing mechanics; shortness of breath; secretion retention; decreased range of motion of upper and lower extremities; decreased strength; mobility and endurance; as well as difficulty with transfers. The treatment goals are to prepare the client for discharge from the hospital at the highest level of independence in terms of mobility and transfers so that they can manage safely. In order to achieve this goal, the physiotherapist works in collaboration with the client, their family and other health care professionals. An important component of this collaborative work is the measurement of the effectiveness of physiotherapy treatment through the use of standardized outcome measures. An objective measurement of the effectiveness of physiotherapy treatments will enable physiotherapists to objectively quantify client progress and provide them with more concrete information about their progress, in terms of functional status, post-surgery. Current practice at Canadian cardiac surgery centers, involves the following criteria to determine when clients are ready for discharge home: 1) if they can walk approximately 120m and 2) if they can climb one flight of stairs safely and independently. The objective and more consistent measurement of physiotherapy treatment effectiveness will improve the quality of care by identifying clients who are at risk of adverse outcomes, improve communication between physiotherapists and other health care professionals, improve the client's level of confidence upon discharge from the hospital and provide direction regarding appropriate discharge

location (15). Objective data on the client's overall readiness for discharge and ability to manage safely at home provides much needed insight into the quality of life of clients who have experienced cardiac bypass surgery and information regarding the quality of care they received while in the hospital. The use of client reported measures, compared to indicators such as mortality, intensive care admission and post-operative stroke, are important quality of care indicators and have a role to play in improving client outcomes following cardiac surgery.

Therefore, there is a need to establish the prevalence of standardized outcome measure use among physiotherapists working with post-operative cardiac surgery clients. Furthermore, previous studies have reported both knowledge and limited resource as factors that limit the use of standardized outcome measures in physiotherapy clinical practice (6,8). Consequently, there is also a need to develop a CPG consisting of evidence-based recommendations as to their use in clinical practice in order to increase and facilitate their use in clinical practice. Evidence-based practice is an important component of the clinical decision making process, which also involves the availability of resources, clinical expertise and the personal characteristics of the client (16). The evidence-based recommendations developed for the CPG will therefore assist physiotherapists in the clinical decision making process when selecting standardized outcome measures to assess the functional capacity of post-operative cardiac surgery clients.

1.4. Outline of the thesis

The introduction, described above, consisted of the statement of the problem, the objectives of the thesis, and the relevance of the research. The following sections of the thesis consist of a detailed description of the background of the thesis (Chapter 2) and the three different phases of the thesis (Chapter 3-5). Phase I, the systematic review of the literature, is discussed in Chapter 3 of the thesis. The rationale for the systematic review, the objectives, the methods and the results are presented as well as the discussion which includes a description of the methodological aspects.

Phase II of the thesis, the development and administration of a cross-sectional survey of outcome measure use, is described in Chapter 4. The rationale, objectives, study design

(based on the revised Ottawa Model of Research Use, methodology (based on the Dillman method, data analysis and results are presented as well as a discussion consisting of methodological aspects.

Phase III, the development of the CPG, is described in Chapter 5 of the thesis and includes the rationale and objectives for the development of a CPG, the study design, which is based on the SIGN methodology for CPG development (14), the results and a discussion of the results and methodological aspects. The SIGN methodology consists of an eight step process for guiding the development of CPGs which include: 1) guideline topic selection; 2) composition of the guideline development group; 3) systematic review of the literature; 4) formation of the recommendations; 5) consultation and peer review; 6) presentation and dissemination; 7) local implementation; and 8) audit and review (14).

Finally, an overall discussion is provided in Chapter 6 of the thesis. The overall discussion consists of a summary of the results of the three different phases of the study, a discussion of the study's limitations, and provides recommendations and areas for future research.

2. Background

2.1. Standardized outcome measures

The clinical decision making process implies that physiotherapists have a professional and ethical responsibility to provide the best possible care to their patients. Physiotherapy interventions must also be provided in an effective manner in order to achieve the best possible clinical outcomes (17). Outcome measures are one of the many tools that are used by physiotherapist's to assess the effectiveness of their interventions, to measure health, to document changes or improvements in client's outcomes over time, to improve quality of care, to demonstrate accountability for their services and to ensure that their practice is evidence-based (18,19,5,9). Physical rehabilitation outcome measures were initially based on the theoretical framework of the International Classification of Functioning and Disability and Health (ICF) (18,20). ICF is a member of International Classifications developed by the World Health Organization (21) which provides a framework for defining and coding health related information.

Physiotherapists are involved in the management of post-operative cardiac surgery clients to prevent the development of post-operative pulmonary complications and to improve function/ability to mobilize (22). Post-operative cardiac surgery clients are at risk of developing pulmonary complications secondary to atelectasis, poor oxygenation, pain, and decreased mobility (22). Physiotherapists use breathing exercises, mobility and secretion clearance techniques to prevent post-operative cardiac surgery clients from developing pulmonary complications following surgery. Outcome measures enable physiotherapists to measure, in an objective manner, the client's improvement in response to their treatment interventions (15). Benefits associated with outcome measures are the identification of patients who are at risk for poor outcomes, improved continuity of care, decision making in terms of most appropriate discharge location, evaluation of performance (individual and organizational) and decision making as to the most effective treatment intervention (15). The recognized importance of using outcome measures in clinical practice had led to improvements in outcome measure training within the physiotherapy curriculum. Previously,

physiotherapists were taught to evaluate patients using our own physiotherapy assessment tools/documents compared to more recent trends of using of standardized outcome measures.

Standardized outcome measures are published measurement instruments containing detailed instructions with regards to their administration, their scoring scheme, as well as the interpretability of the results (18,20,9). Different standardized outcome measures have been developed to assess a range of dimensions including physical capacity, symptoms, global judgment of health, psychological well being, social well being, cognitive function, role activities, personal constructs, and satisfaction with care (23). There are two main types of client related outcome measures: 1) generic; and 2) disease specific. Generic instruments are designed to measure health status in the broad sense of the term (20,24). They are applicable to any type of health condition allowing for comparison across different patient populations (24). Disease specific instruments focus more on the impact of the disease itself and are more sensitive to changes in the client's clinical status (20,24).

Generic and disease specific outcome measures have both their advantages and disadvantages. Generic outcome measures are designed to assess a wide range of health problems, which reduces the burden on the client, by reducing the number of questionnaires required when collecting data on client based outcomes (20,23). Their design, in terms of their ability to assess a wide range of health problems, also allows for comparisons among different client populations (20,23). Finally, generic outcome measures can also be used to assess the health status of the general population allowing for the generation of normative values (20). However, due to the nature of the generic outcome measure, in terms of its ability to assess a wide variety of health problems, it can be less sensitive to change following an intervention (20,23). In comparison, one of the main advantages of the disease specific outcome measure relates to its content. It is more relevant to the particular disease and therefore more likely to detect important changes that can occur over time (20,23). Furthermore, due to its more relevant content, disease specific outcome measures may be more acceptable to clients as the items will be more relevant to their problems (23). In terms of disadvantages, disease specific outcome measures cannot be used among different client populations or among healthy individuals. Therefore one single outcome measure cannot be used to compare different client populations (23).

In addition to the different types of outcome measures (generic and disease specific) available to physiotherapists for use in their clinical practice, clinicians must also take into account the psychometric properties of the different outcome measures prior to incorporating them into clinical practice (23,19,25). The strength and accuracy of the clinical decision based on a specific outcome measure is dependent on the quality of its psychometric properties (5). The psychometric properties that need to be considered prior to adopting an outcome measure in clinical practice are the following: validity, reliability, internal consistency, responsiveness, ceiling and floor effects, and interpretability (23,5,26).

2.2. Definition of psychometric properties

2.2.1. Validity

The validity of an outcome measure is the degree to which the instrument measures what it is intended to measure (23,5). Validity is measured in several different ways: content, criterion, construct and face validity. Content validity is the extent to which the items in the instrument represent the concept that is being measured and criterion validity is the extent to which the scores on an instrument relate to a gold standard (26). Construct validity is the extent to which scores on an instrument relate to scores on other instruments that measure similar concepts (26). Face validity relates to the outcome measure itself in terms of the clarity, and the relevance of the content of the instrument (5).

2.2.2. Reliability

A reliable outcome measure is one that produces results that are reproducible, consistent and free from random error (23,5). Reliability is measured by testing the test-retest reliability of the instrument (intra-rater reliability) as well as through agreement between observers and among the same observers (inter-rater reliability) (23).

2.2.3. Internal consistency

The internal consistency of the outcome measure, which is described as a form of reliability by some authors (5,23), describes the extent to which similar questions on a questionnaire are measuring the same concepts (23,5,26).

2.2.4. Responsiveness

Responsiveness refers to the ability of the outcome measure to detect changes over time within an individual due to the intervention. Responsiveness has also been categorized as a type of longitudinal validity (27).

2.2.5. Ceiling and floor effects

The ceiling and floor effects refer to the proportion of clients who obtain either the highest or the lowest possible score on the instrument (23,26).

2.2.6. Interpretability

Finally, the interpretability of the outcome measure refers to the degree to which one can assign meaning to the scores resulting from the administration of the instrument (26).

In addition to the evaluation of the outcome measures psychometric properties, clinicians must ensure that the outcome measure is appropriate for the client population as well as the clinical setting. When selecting an outcome measure in clinical practice, physiotherapists must ensure that the outcome measure is measuring what they want it to measure and that the measurement will assist them in the clinical decision making process (1).

2.3. Outcome measures and clinical practice

A review of the scientific literature has shown that many different outcome measures, both generic and disease-specific, are being used to measure the functional capacity of post-operative cardiac surgery clients (28-34,24,35,36). The different types of outcome measures currently being used in clinical practice to assess the functional status of post-operative cardiac surgery clients include walk tests, physiological measures, general health measures, and quality of life measures. The lack of consensus of a definition of “function” is responsible for the wide variety of outcome measures currently being used in clinical practice to assess the functional capacity of post-operative cardiac surgery clients (30,32).

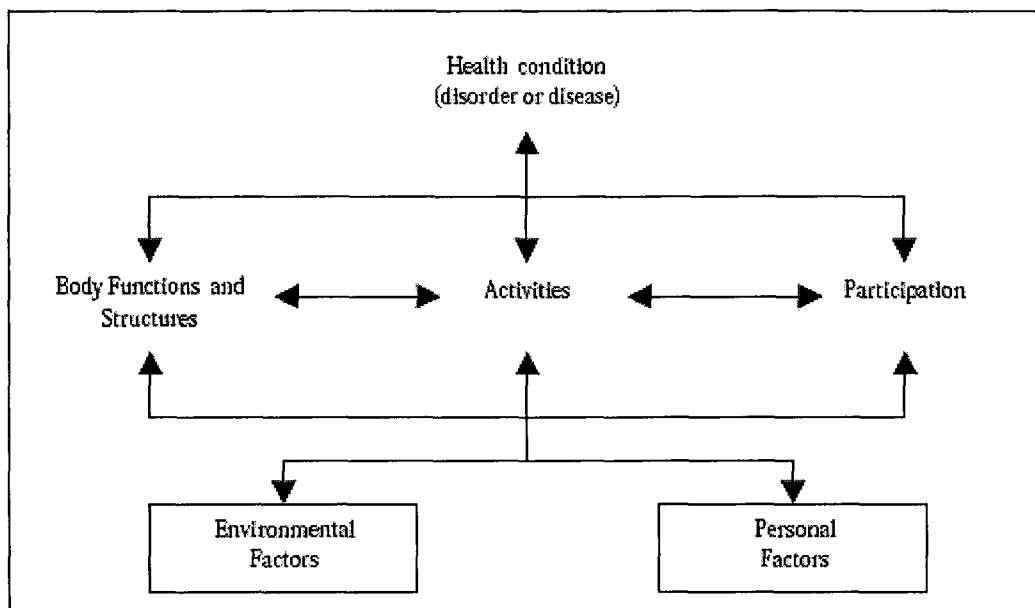
The client’s ability to function is an important criterion for physiotherapists when determining readiness for discharge from an inpatient hospital setting following a surgical

intervention (29,37). The World Health Organization (21) refers to function as an umbrella term that encompasses all body functions, activities and participation and refers to the positive aspects of the interaction between an individual with a health condition and their contextual factors (environmental and personal) (21) (Figure 1).

Capacity is defined as the highest level of functioning that an individual may reach in a domain in the Activities and Participation list provided by the ICF (21) (Figure 2). Mobility is included in the list of activities provided by the ICF. Therefore, for the purpose of this study, functional capacity is defined as the client's ability to mobilize or function at the highest level. Within the context of the thesis, functional capacity is different from the client's performance, which represents a higher level compared to ability.

Figure 1: World Health Organization International Classification of Functioning and Disability and Health (ICF) framework

Towards a Common Language for Functioning, Disability and Health: ICF (The International Classification of Functioning, Disability and Health (WHO, 2001)



As mentioned above, a review of the scientific literature has identified a variety of standardized physical rehabilitation outcome measures available for use in clinical practice. Despite the availability of an abundance of standardized outcome measures, their adoption in clinical practice has been less than optimal. A survey of 309 Canadian physiotherapists and charge physiotherapists, which obtained an 80% response rate, established that only 41% of physiotherapists and 32% of charge physiotherapists were using standardized outcome measures in their clinical practice (6). Furthermore, of the physiotherapists who reported using outcome measures in their clinical practice, 20% of them were only able to identify one outcome measure (6).

A survey of both physiotherapy and occupational therapy departments in Scotland obtained similar results (7). A total of 247 questionnaires were mailed to senior therapists working in hospitals and to their equivalents working in the community. The survey, which obtained a response rate of 74%, revealed that only 39% of respondents reported using standardized outcome measures in their clinical practice (7).

Figure 2: Activities and participation domains of ICF framework

Towards a Common Language for Functioning, Disability and Health: ICF (The International Classification of Functioning, Disability and Health (WHO, 2001)

Body	
Function:	Structure:
Mental Functions Sensory Functions and Pain Voice and Speech Functions Functions of the Cardiovascular, Haematological, Immunological and Respiratory Systems Functions of the Digestive, Metabolic, Endocrine Systems Genitourinary and Reproductive Functions Neuromusculoskeletal and Movement-Related Functions Functions of the Skin and Related Structures	Structure of the Nervous System The Eye, Ear and Related Structures Structures Involved in Voice and Speech Structure of the Cardiovascular, Immunological and Respiratory Systems Structures Related to the Digestive, Metabolic and Endocrine Systems Structure Related to Genitourinary and Reproductive Systems Structure Related to Movement Skin and Related Structures
Activities and Participation	
Learning and Applying Knowledge General Tasks and Demands Communication Mobility Self Care Domestic Life Interpersonal Interactions and Relationships Major Life Areas Community, Social and Civic Life	
Environmental Factors	
Products and Technology Natural Environment and Human-Made Changes to Environment Support and Relationships Attitudes Services, Systems and Policies	

Comparable results were obtained in a survey of physiotherapists who attended the Nigeria Society of Physiotherapy conference in 2000 (9). All physiotherapists (N=301) who attended the conference were given a copy of the survey. The goals of the survey were to assess the physiotherapist's familiarity with a list of sixteen outcome measures, to assess their use in clinical practice and to assess the physiotherapist's knowledge with regards to the administration of the listed outcome measures (9). A total of 236 surveys were completed and returned to the investigators, resulting in a 76.1% response rate (9). Only 3.1% to 12.2% of respondents stated that they were familiar with each of the outcome measures listed in the

survey. In terms of their use in clinical practice, only 10% of respondent reported using the outcome measures “often” (9).

Finally, a follow-up survey of Canadian physiotherapists in 1998 was undertaken in order to assess any progress in outcome measure use since the 1992 survey by Mayo et al (6).

Physiotherapists working in five academically affiliated facilities in Toronto, Ontario were recruited for the study. The physiotherapists were required to complete a questionnaire regarding the use of outcome measures in their clinical practice, as well as their level of confidence in administering the outcome measures. A total of 131 surveys were distributed across the five facilities. A total of 91 completed surveys were returned, which represents a response rate of 69% (8). Only 43% of clinicians reporting using outcome measures in their daily practice, which represented a 2% increase from the previous survey that was done in 1992 by Mayo et al (6,8).

The physiotherapists who participated in the Canadian surveys (6,8), were not completely representative of the different areas of physiotherapy clinical practice. The majority of respondents were practicing in either orthopaedic or neurology settings. Physiotherapists working in acute cardio-respiratory settings with post-operative client populations, clients with chronic respiratory diseases or cardiovascular diseases only represented 12% of respondents (8). Furthermore, the majority of physiotherapists who reported working with these types of clients also reported working with other types of client populations. Therefore the use of standardized outcome measures among physiotherapists working in an acute cardio-respiratory setting with post-operative cardiac surgery clients has not been established. There are also no existing CPG related to the selection of standardized outcome measures when assessing the functional capacity of post-operative cardiac surgery clients by cardio-respiratory physiotherapists.

2.4. Outcome measures resources

The task of searching for standardized outcome measures specific to post-operative cardiac surgery clients, and the task of determining both the quality and the appropriateness of the outcome measures for the setting, is an extremely time consuming endeavor. Several resources have been published to assist physiotherapists in accessing standardized outcome

measures such as the Physical Rehabilitation Outcome Measures I (18) and II (38), Répertoire des outils d'évaluation en français pour la réadaptation (39) and Measuring Health: a guide to rating scales and questionnaires (2nd edition) (20).

In addition to published resources, several databases also exist to assist physiotherapists in accessing standardized outcome measures. The Patient Reported Outcome and Quality of Life Instruments Database (www.proqolid.org) is an outcome measure database consisting of a list of approximately 649 outcome measures. The outcome measure database can be searched either alphabetically or by disease/pathology. Non-members are provided with the abbreviation of the instrument, the full name of the instrument as well as the author. A subscription to the database is required in order to access the outcome measure itself.

However, these resources, other than the Patient Reported Outcome and Quality of Life Instrument Database, are not specific to a particular client population. Therefore, in order to facilitate the decision making process, there is a need for the development of evidence-based recommendations, in the form of a CPG, concerning the use of standardized outcome measures in physiotherapy clinical practice (19). Specifically, the CPG will be directed towards physiotherapists working with post-operative cardiac surgery clients.

3. Phase I: Systematic Review of the Literature

3.1. Rationale

Several studies have been conducted both in Canada and abroad concerning the use of standardized outcome measures among physiotherapists (6,7,8,9). A survey regarding outcome measure use among Canadian physiotherapists conducted in 1992 by Mayo et al (6), lead to the publication of “Physical Rehabilitation Outcome Measures”, a manual of standardized physical rehabilitation outcome measures (18). Despite the availability of numerous publications related to outcome measures in physical rehabilitation, only 42% of physiotherapists reported using outcome measures in their clinical practice (8). Due to the availability of an abundance of physical rehabilitation outcome measures, it has been suggested that a systematic review and the development of a CPG would facilitate the selection of appropriate outcome measures in physiotherapy clinical practice by providing clinicians with practical recommendations (27). A CPG consisting of practical recommendations regarding standardized outcome measure would increase the use standardized outcome measures in clinical practice (19).

Physiotherapists are health care professionals who receive training in the management and prevention of physical problems caused by disease, sport, work, aging and long periods of inactivity (www.physiotherapy.ca). Physiotherapists have an understanding of how the body moves and how to restore mobility (www.physiotherapy.ca). Cardio-respiratory physiotherapists are physiotherapists with skills and training in the assessment and management of conditions that affect specifically the circulatory and the respiratory systems. CPG have been developed for different cardio-respiratory interventions, such as cardiac rehabilitation (40), pulmonary rehabilitation (41), peri-operative cardio-respiratory physiotherapy (42) and suctioning the airway of intubated and non-intubated patient (43). These CPG were developed to guide treatment decisions, not measurement decisions. There are currently no CPG to guide the selection of standardized outcome measures in cardio-respiratory physiotherapy.

CPG are defined as systematically developed recommendations to assist both health care professionals and clients when making decisions with regards to the delivery of health care for specific clinical situations (14). CPG are important tools in ensuring evidence-based practice when there is evidence of variation in clinical practice and when there is a strong research base regarding effective practice (14). CPG assist health care providers in the clinical decision making process by summarizing the evidence and providing recommendations based on the best possible evidence.

The development of a CPG consists of many different steps including a systematic review of the scientific literature on the topic chosen by the CPG development group (14). Systematic reviews of the scientific literature identify and summarize data from the existing literature and provide health care providers with recommendations regarding evidence-based practice (14). A meta-analysis, which is part of a systematic review process, is a statistical technique for combining the results from different studies in order to provide one summary result (44). The objective of the present systematic review is to identify outcome measures and summarize their psychometric properties, which does not require the combination of the results into one summary result. Therefore, the present systematic review is a qualitative one and does not involve the meta-analysis component.

3.2. Objectives

3.2.1. Primary objectives

The primary objectives are: 1) to identify all standardized functional capacity outcome measures available for use by physiotherapists working with post-operative cardiac surgery clients; and 2) to summarize their psychometric properties.

3.2.2. Secondary objectives

Secondary objectives are to: 1) provide a framework for the development of the cross-sectional survey of outcome measure use in clinical practice; and 2) to collect data for the creation of the evidence tables for the development of evidence-based recommendations to be included in the CPG.

3.3. Methods

The Cochrane Collaboration handbook for systematic reviews of interventions (45) was used to guide the systematic review process.

3.3.1. Identification of outcome measures

3.3.1.1. *Inclusion criteria*

The systematic review included published studies of standardized functional capacity outcome measures used in physical rehabilitation to assess the functional capacity, or the ability to function/mobilize, of post-operative cardiac surgery clients. Studies that described the development process of the outcome measures as well as studies that evaluated their psychometric were also included in the review. Only studies that were published in either English or French were included in the review. The grey literature was not searched for any unpublished outcome measures. In order to identify unpublished and/or non-standardized functional capacity outcome measures, Canadian physiotherapists at each of the twenty- six cardiac surgery centers were surveyed as to the types of outcome measures that were currently being used in their clinical practice. Prior to the development of the CPG, a total of eleven experts in the field of cardio-respiratory physiotherapy (BR, DB, JK, SP, RB, AM, LL, FB, GAP, LS, and ML) were also given the list of standardized outcome measures identified by the literature search. They were asked to identify any other potential outcome measures that should be included in the review in an attempt to identify any un-published and/or published outcome measures.

3.3.1.2. *Information sources*

The standardized physical rehabilitation functional capacity outcome measures were identified using seven different sources. The first source consisted of a literature search of the following three databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), EMBASE and MEDLINE using the Ovide interface. The CINAHL database was searched from 1982 to September 2007 week 4; the EMBASE database was searched from 1980 to 2007 week 39 and the MEDLINE database was searched from 1950 to September 2007 week 2.

Additional sources included: 1) published references of physical rehabilitation outcome measures; 2) a database of Patient Reported Outcome and Quality of Life Instruments (www.proqolid.org); 3) a survey of Canadian physiotherapists on outcome measure use in clinical practice; 4) consultation with Canadian experts in the field of cardio-respiratory physiotherapy; 5) reference searching of identified standardized functional capacity outcome measures; and 6) clinical experience.

3.3.1.3. Search strategy

The search strategy was developed with the assistance of an experienced scientific librarian (JM). The following keywords were used to search each of the three databases listed above (CINAHL, EMBASE, and MEDLINE): outcome measures; measurement; assessment; questionnaire; index; self-report; ability; function; capacity; life habits; activities of daily living (ADL); walking; endurance impairment; handicap; disability; quality of life (QOL); and health status index. See Appendix A for search strategy.

An additional search of PubMed, the U.S. National Library of Medicine database (www.ncbi.nih.gov/pubmed/) was performed in order to identify outcome measures specific to the assessment of dyspnea in post-operative cardiac surgery clients. The PubMed search was performed using the following keywords: dyspnea; shortness of breath; breathlessness; exercise; perception; scaling; and assessment.

3.3.1.4. Study selection

A. Initial screening

Upon completion of the literature search, each of the identified standardized functional capacity outcome measures was screened for eligibility for inclusion in the review. Screening of the outcome measures was performed by one reviewer (TM) for financial reasons. Specific and generic outcome measures that were identified by the different search strategies were included in the review. In terms of the responses to the survey, all standardized outcome measures reported by physiotherapists as measures that were currently being used in clinical practice were included in the review. Finally, in terms of the consultation with the Canadian experts in the field of cardio-respiratory physiotherapy (N=11), all standardized

functional capacity outcome measures suggested by the eleven Canadian experts in the field of cardio-respiratory physiotherapy were included in the review.

B. Eligibility screening

All outcome measures that met the initial screening criteria were reviewed for eligibility to be included in the systematic review. The eligibility screening was performed by one reviewer (TM). The Cochrane Handbook for systematic reviews of interventions (45) recommends that a minimum of two reviewers perform the eligibility screening. However, due to limited resources, only one reviewer performed the eligibility screening for the systematic review. The content of the outcome measure was reviewed in order to determine its applicability and appropriateness for the client population being studied.

3.3.1.5. Data collection

Data collection on each of the identified functional capacity outcome measures was done using the “Quality Criteria were proposed for measurement properties of health status questionnaires” by Terwee et al (26) (Appendix B). The quality criteria for measurement properties of health status questionnaires is a quality assessment tool for evaluating the design, methods and outcomes of studies related to the development and evaluation of health status questionnaires (26). This quality assessment tool requires the collection of data on eight different psychometric properties. Each psychometric property is clearly defined in the article in order to guide the reader in the data collection and quality assessment process. Data on the following eight psychometric properties was collected: content validity (which included data on the measurement aim of the questionnaire, the target population, the concepts that the questionnaire is intended to measure, the methods used for item selection and reduction, and the interpretability of the items); criterion validity; construct validity; reproducibility (which includes agreement and reliability); responsiveness; ceiling or floor effects; and interpretability.

3.3.2. Identification of psychometric properties

3.3.2.1. *Information sources*

Several different sources were used to identify studies pertaining to the investigation of the psychometric properties of each of the included standardized functional capacity outcome measures. Psychometric property studies were identified by searching the following three databases: CINAHL, EMBASE and MEDLINE, by searching published references in physical rehabilitation outcome measures (18,38,39), and by searching the references of the included outcome measures.

3.3.2.2. *Search strategy*

In order to identify studies that investigated the psychometric properties of the included outcome measures, the title of the outcome measure was entered into the search engine accompanied by each of the following keywords: validity; reliability; reproducibility; responsiveness; internal consistency; floor effects; and ceiling effects. An additional search was performed using the title of the outcome measure, the different psychometric properties listed above and keywords related to cardiac surgery. The cardiac surgery keywords used in the search strategy were the following: thoracic surgery, cardiac surgery, heart surgery, cardiovascular surgery, cardiovascular diseases, and cardiovascular surgical procedures.

3.3.2.3. *Study selection*

All studies that described the development process of the outcome measures, the evaluation of the outcome measures psychometric properties and the evaluation of the outcome measures in a post-operative cardiac surgery setting were included in the review.

3.3.2.4. *Data collection*

Data from the studies describing the psychometric properties of the included functional capacity outcome measures was collected on eight psychometric properties based on the assessment scale developed by Terwee et al (26).

3.3.2.5. Quality assessment

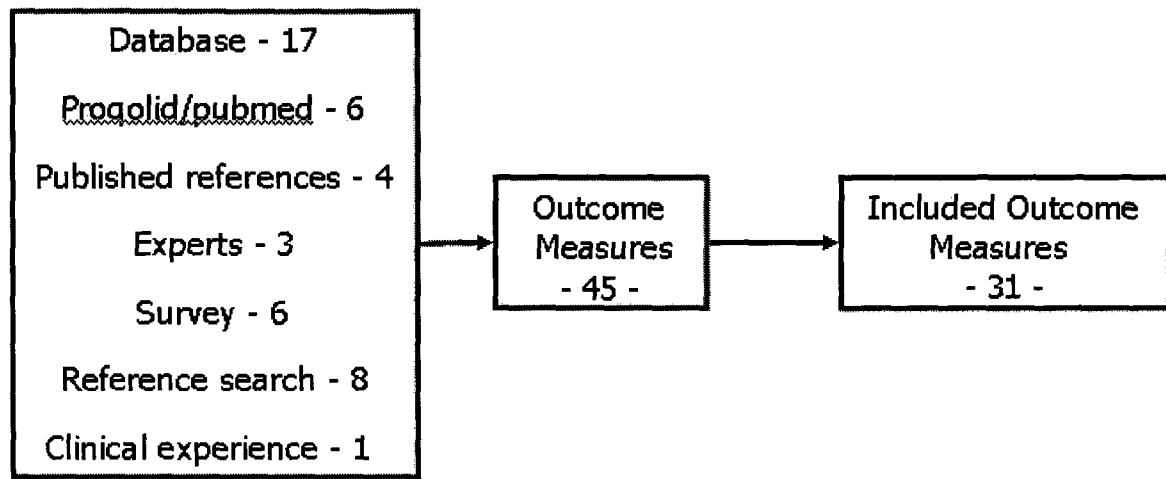
The quality of each of the included standardized functional capacity outcome measures was evaluated using the “Quality Criteria were proposed for measurement properties of health status questionnaires” (26) (Appendix B). As mentioned above, this quality criteria tool was designed as a method for evaluating the quality of the methodology of the development of health status questionnaires (26). The quality assessment tool consists of eight psychometric properties. The quality of each property is assessed and assigned one of three ratings. A positive (+) rating is given when the methods used to evaluate that property meet the criteria proposed by authors; an indeterminate (?) rating is given when doubt exists as to the methods used when designing the study to determine that property; a negative (-) rating is given when the results of the study used to determine that property did not meet the criteria defined by the authors and a rating of (0) is given when no information is available on the interpretation of that property (26). Each property is assessed independently from one another. No overall summary score can be obtained from the quality assessment scale.

3.4. Results

3.4.1. General database search

The literature search involving the three databases (CINAHL, EMBASE, and MEDLINE) identified a total of seventeen physical rehabilitation functional capacity outcome measures for assessing post-operative cardiac surgery clients (Appendix C). The CINAHL search yielded a total of 215 citations, identifying a total of eight functional capacity outcome measures, of which fourteen articles were included in the review (Appendix D). The EMBASE search yielded a total of 611 citations, also identifying a total of eight functional capacity outcome measures, of which sixteen articles were included in the review (Appendix E). Finally, the MEDLINE search yielded a total of 606 citations, identifying six functional capacity outcome measures, of which eighteen articles were included in the review (Appendix F).

Figure 3: Results of database search



The remaining 201 CINAHL citations, 595 EMBASE citations and 588 MEDLINE citations were excluded for the following reasons: studies consisting of clinical trials in cardiac surgery that were investigating the outcome measures of interest as a trial endpoint; studies involving functional capacity outcome measures with different client populations; studies involving pediatric client populations; and clinical trials evaluating outcome measures in other client populations such as stroke; renal and peripheral vascular disease.

All three database searches identified the two Minute Walk Test (2MWT) (46), the Medical Outcomes Study Short Form-36 (SF-36) (47) and the Minnesota Living with Heart Failure Questionnaire (MLWHFQ) (48). The CINAHL and EMBASE searches both identified the Coronary Revascularization Questionnaire (CROQ) (49) and the Quality of Life after Myocardial Infarction (QLMI) (50). The MEDLINE and CINAHL searches both identified the Heart Surgery Symptom Inventory (HSSI) (51). A total of seventeen functional capacity outcome measures were identified by searching the three databases.

After screening the records obtained by the database searches for duplications and for eligibility, a total of thirteen functional capacity outcome measures were identified and included in the review: the University of California San Diego Shortness of Breath Questionnaire (SOBQ) (52); 2) the CROQ (49); 3) the HSSI (51); 4) the SF-36 (47); 5) the

QLMI/ MacNew Heart Disease Quality of Life Instrument (50,53); 6) the 2MWT (46); 7) the Six Minute Walk Test (6MWT) (46); 8) Duke Activity Status Index (DASI (36); 9) Reduced Version of the DASI (24); 10) A Global Measure of Physical Functioning (AGMPF) (54); 11) Seattle Angina Questionnaire (55); 12) Veteran's Specific Activity Questionnaire (VSAQ) (56); and 13) the MLWHFQ (48). A total of four outcome measures that were identified by the database search were excluded from the review based on the pre-defined eligibility criteria. They are discussed in further detail in section 3.4.3 *Study selection and eligibility screening*.

3.4.2. Specific database searches

3.4.2.1. *National Library of Medicine search*

The National Library of Medicine search (www.ncbi.nih.gov/pubmed/) identified three dyspnea outcome measures: the Baseline and Transitional Dyspnea Index (BDI and TDI respectively) (57); the Numerical Rating Scale as a Measure of Dyspnea (NRS dyspnea) (58); and the Visual Analog Dyspnea Scale (VADS) (59).

3.4.2.2. *Proqolid.org database search*

A search of the Patient Reported Outcome and Quality of Life Instruments Database (www.proqolid.org) identified three standardized functional capacity outcome measures. The search was performed by pathology/disease under cardiovascular diseases. One generic outcome measure for cardiovascular disease was identified as well as two heart disease specific outcome measures. The three outcome measures identified were the DASI (36), the MacNew Heart Disease Health Related Quality of Life Questionnaire (48) and the Seattle Angina Questionnaire (SAQ) (55). The QLMI (50) instrument, identified by the database search, is an updated and modified version of the MacNew Heart Disease Health Related Quality of Life Questionnaire developed by Oldridge et al in 1991 (53).

All three outcome measures identified by searching this specific database were identified by the database searches and were considered to be duplicate outcome measures.

3.4.3. Published references

Existing published references of physical rehabilitation outcome measures were also consulted in order to identify standardized functional capacity outcome measures specific to post-operative cardiac surgery clients. A total of three outcome measures were identified through “Physical Rehabilitation Outcome Measures” (18) and one was identified through the Répertoire des outils d’évaluation en Français pour la réadaptation (39). The four measures identified through consultation with the publications listed above are the Physiotherapy Functional Mobility Profile (PFMP) (60), the Functional Independence Measure (FIM) (61), the Lower Extremity Functional Scale (LEFS) (62) and the Physiotherapy Clinical Outcome Variables (COVS) (63).

3.4.4. Canadian experts in cardio-respiratory physiotherapy

Consultation with eleven Canadian experts in the field of cardio-respiratory physiotherapy and CPG development resulted in the identification of one additional functional capacity outcome measure. The panel of experts consisted of researchers in cardiovascular disease and researchers in the field of cardio-respiratory physiotherapy, academics and experts in the field of cardio-respiratory physiotherapy, experts in the field of CPG development methodology, clinical managers and clinicians with expertise in the field of cardio-respiratory physiotherapy. They also recommended the inclusion of vital signs as an additional category of outcome measures to be included in the review. The additional outcome measure, which was identified by one of the eleven experts, is a disease specific quality of life measure: the Quality of Life Index-Cardiac version III and/or IV (64).

3.4.5. Survey of outcome measures used in clinical practice

A cross-sectional survey, which was developed specifically for the thesis, of Canadian physiotherapists working with post-operative cardiac surgery clients identified four additional standardized functional capacity outcome measures, two dyspnea measures as well as vital signs, pulmonary function tests, chest x-rays and arterial blood gas values. The four standardized functional capacity outcome measures identified by the survey were: 1) the Berg Balance Scale (BBS) (65); 2) the Elderly Mobility Scale (EMS) (66); 3) the Time-Up

and GO (TUG) (67); and 4) the Timed-Stand test (TST) (68). The two dyspnea measures identified by the survey were: 1) the Borg Rating Scale of Perceived Exertion (Borg scale) (69); and 2) the Medical Research Council Dyspnea Scale (MRC Dyspnea) (70).

3.4.6. Hand reference searching

Finally, another eight functional capacity outcome measures were identified by searching the references of the outcome measures identified using one of the methods listed above: 1) the Specific Activity Questionnaire (71); 2) the Specific Activity Scale (SAS) (72); 3) the Euro-QOL Cardio-QOL (73); 4) AGMPF (54); 5) the SOBQ (52); 6) the reduced version of the Duke Activity Status Index (24); 7) the VSAQ (56); and 8) the 6MWT (46).

The SOBQ (52), the 6MWT (46), AGMPF (54), the Reduced Version of the Duke Activity Status Index (24) and the VSAQ (56) were considered to be duplicate outcome measures as they had been identified in the database search. The Euro-QOL Cardio-QOL (73) is the fifth outcome measure that was excluded from the review and is discussed in greater detail in *section 3.4.3*.

3.4.7. Other method

A final outcome measure was included in the review based on the personal experience of the reviewer. The Post-Operative Discharge Scoring Tool (POP-DST) (74) is a generic post-operative discharge tool that includes function as one of its components.

3.4.8. Study selection and eligibility screening

A total of forty-five functional capacity outcome measures for use among post-operative cardiac surgery clients were identified by the search methods described above. The forty-five outcome measures that were identified by the search strategy consisted of both generic and cardiovascular disease specific outcome measures. Nine of the forty-five identified outcome measures were duplicates. The eligibility screening phase of the study selection process resulted in the exclusion of five of the forty-five outcome measures. All five excluded outcome measures were generic health related quality of life (HRQOL) measurement tools. The Euro-QOL Cardio QOL (73), a heart disease specific HRQOL instrument, was excluded

as it had not been developed yet. The European Quality of Life Scale (EUROQOL) (75), a generic HRQOL instrument, was excluded from the review as its measurement goal is to describe and value health. Therefore, it is not meant to be used as a functional capacity outcome measure. The Sickness Impact Profile (SIP) (76), which is a general health measure, was excluded as it was developed to measure the behavioral impact of sickness. Therefore, the SIP was also not developed as a functional capacity outcome measure. The fourth outcome measure excluded from the review was the Nottingham Health Profile (NHP) (77). The NHP is also a generic HRQOL instrument that measures perceived health problems. Despite the fact that this measurement tool contains a mobility component, it was not intended to be used as a functional capacity outcome measure. Finally, the fifth outcome measure to be excluded was the Medical Outcomes Short-Form 12 (SF-12) (78), a generic health related quality of life measure based on the Short Form-36 (47).

Therefore, following both the initial screening phase as well as the eligibility screening, a total of thirty-one standardized functional capacity outcome measures were included in the review (Appendix G). The thirty-one outcome measures that were included in the review also include vital signs as a single outcome measure. Vital signs were identified as an important outcome measure by both the experts in the field of cardio-respiratory physiotherapy and by the survey respondents (physiotherapists working with post-operative cardiac surgery clients). The thirty-one outcome measures were divided into four distinct domains: dyspnea measures (six), quality of life measures (four), function measures (twenty), and vital signs.

3.4.9. Data collection

The data collection process involved the inclusion and review of studies pertaining to the psychometric properties of each of the included standardized functional capacity outcome measures. A total of one-hundred and one (101) studies pertaining to the investigation of the psychometric properties of each of the thirty-one standardized functional capacity outcome measures were included in the review. The studies were identified through searching the U.S. National Library of Medicine database, through reference searching of identified outcome measure and by consulting published references of physical rehabilitation outcome measures (14,33,34). Data was collected on eight psychometric properties (previously listed in section

3.3.2.4 *Data collection*). The studies included in the data collection process were general studies describing the development of the outcome measure and the initial testing of the outcome measures psychometric properties as well as studies specific to post-operative cardiac surgery client populations.

Data was collected on a total of six dyspnea measures: the BDI (57); the TDI (57); the Borg scale (69); the MRC Dyspnea Scale (70); the NRS dyspnea (58); the SOBQ (52); and the VADS (59). All six measures provided evidence for content validity, construct validity, and reliability. In terms of internal consistency, studies were found for the BDI/TDI (57) and the SOBQ (52). Studies regarding the internal consistency of the four other measures were not identified. Studies pertaining to the criterion validity of the Borg scale (69), the NRS dyspnea (58), the SOBQ (52) and the VADS (59) were identified. Only two dyspnea measures evaluated agreement: the Borg scale (69) and the VADS (59) and only two measures evaluated the responsiveness: the Borg scale (69) and the SOBQ (52). Evidence supporting the evaluation of floor and ceiling effects was identified for the Borg scale (69), the SOBQ (52) and the VADS (59). Finally, evidence regarding the interpretability of the BDI/TDI (57), the MRC dyspnea (70), The SOBQ (52) and the VADS (59) were also identified.

Data was also collected on four quality of life measures: the CROQ (49); the HSSI (51); the SF-36 (47); and the QLMI (50). Studies evaluating the content validity, the internal consistency and the construct validity of all four measures were identified. The SF-36 (47) was the only measure that evaluated criterion validity. No studies were found regarding the evaluation of agreement for each of the four quality of life measures. Evidence was provided regarding the reliability of all four measures except one: the QLMI (50). Finally, the HSSI (51) was the only measure that did provide evidence as to its responsiveness, floor and ceiling effects and interpretability.

Data was collected on a total of twenty function measures. All twenty measures provided evidence to support their content validity. Only eight outcome measures evaluated internal consistency: 1) BBS (65); 2) the COVS (63); 3) the Reduced Version of the Duke Activity Status Index (24); 4) the FIM (61); 5) the LEFS (62); 6) the PFMP (60); 7) the Quality of Life Index Cardiac Version (64); and 8) the MLWHFQ (48). Evidence for criterion validity

was identified for ten of the twenty function measures. Only three outcome measures did not provide evidence for construct validity: the DASI (36); the PFMP (60); and the Specific Activity Questionnaire (35). Of the twenty measures included in the review, only the 6MWT (46) and the LEFS (62) evaluated agreement. In terms of reliability, evidence was identified for all but three outcome measures: the DASI (36); the Specific Activity Questionnaire (35); and the VSAQ (56). A total of eleven outcome measures provided evidence for responsiveness, four provided evidence for ceiling and floor effects and nineteen studies provided evidence for interpretability.

The majority of the thirty-one outcome measures that were include in the review had evidence of content and construct validity, internal consistency, and reliability. Evidence of interpretability of the included outcome measures, which is defined by Terwee et al (26) as “the degree to which one can assign qualitative meaning to quantitative scores”, only met part of the quality criteria definition. Outcome measures were successful in meeting the criteria if they presented means and standard deviations for a least four relevant client subgroups as well as having defined the minimal important change score. Studies consistently presented scores for different patient groups however a minimal important change score was rarely defined.

Criterion validity was often not established due to the lack of a gold standard against which to compare the outcome measure. In terms of reproducibility, there was also limited evidence available regarding agreement for the majority of the outcome measures. In terms of responsiveness and floor and ceiling effects, very few studies presented the data necessary to fulfill these two criteria. The responsiveness of a measurement instrument is defined as the instruments ability to detect clinically important change over time which is important for a measurement tool that is being used to evaluate progress (26). Finally, the ceiling and floor effects are an indication of the measurement tools ability to detect patients with wide ranges of scores and ultimately will have an affect on the responsiveness of the instrument. Both criteria are therefore very important in the overall assessment of a measurement tool that is being considered for use in clinical practice.

3.4.10. Quality assessment

The quality assessment component of the outcome measures was based on the “Quality Criteria were proposed for measurement properties of health status questionnaires” by Terwee et al (26). The quality of the data collected on each of the eight different psychometric properties was assessed using the quality assessment criteria proposed by Terwee et al (26). Each psychometric property is assessed independently from one another. The tool does not allow for the calculation of an overall quality score. Judgment is used to assess the overall quality of the outcome measure, based on the ratings that each of the different psychometric properties obtained.

In terms of the quality assessment of each of the different outcome measures, the majority of the measures received a rating of “0” for the following properties: criterion validity, agreement (reproducibility), responsiveness and floor and ceiling effects. A rating of “0” indicates that there was no information available to assess the quality of that specific property. The two psychometric properties that received the highest number of positive ratings (+) were: content validity and internal consistency.

All the included outcome measures that were reviewed explained in great detail the following: 1) measurement aim of the questionnaire; 2) the target population; 3) the concepts that were being measured; and 4) the methods use to select and delete items. Therefore all outcome measures that were included in the review met the criteria for a positive rating (+) for content validity.

The internal consistency of the measures was also consistently evaluated using the method suggested by the quality assessment tool which is the use of Cronbach’s alpha. An area that was lacking for some of the measures, in terms of meeting the quality criteria standard, was the presence of a factor analysis.

The properties that received indeterminate ratings were construct validity, reliability and interpretability. In terms of the construct validity of the outcome measures, studies consistently presented the results of the comparisons that were made between the outcome measure being studied and similar measures. However, the majority of these comparisons

were not based on pre-determined hypotheses. The quality criterion requires that hypotheses concerning the concepts being measured be established prior to the construct validity testing of the instrument. The studies that did base their construct validity testing on pre-determined hypotheses often failed to confirm more than 75% of these hypotheses, which is the standard required by the quality assessment tool. In terms of reliability, the majority of the outcome measures included reliability information, however this information usually presented in terms of correlations and not the method required by the quality assessment criteria which is either an intra-class correlation coefficients or a weighted kappa. Finally, in terms of interpretability, most outcome measures did not have a minimally important clinical change score defined and therefore did not meet the full requirements of the quality assessment criteria for this property.

In terms of the six dyspnea measures, all but two measures had positive scores for content validity. The MRC dyspnea (65) and the SOBQ (52) both received indeterminate scores for content validity as they did not present the methods used to select and delete items from their respective scales. A total of four of the six scales did not provide any information on internal consistency. The BDI and TDI (57) scored positively for internal consistency and the SOBQ (52) scored negatively as no factor analysis was performed and the sample size was less than 100 subjects. In terms of criterion validity scores, only the BDI/TDI (57) and the MRC dyspnea (70) scored a “0” while the remaining four measures all obtained positive ratings. Only two dyspnea measures tested hypotheses when evaluating construct validity: the MRC dyspnea (70) and the SOBQ (52). The other four measures received indeterminate ratings as they did not perform any hypotheses tests when evaluating the construct validity of the measures. In terms of reproducibility, none of the six dyspnea measures received positive scores for agreement and all but one measure, the SOBQ (52), received positive ratings for reliability. Finally, in terms of responsiveness, floor and ceiling effects and interpretability, only the SOBQ (52) scored positively for those three psychometric properties. The other five dyspnea measures were either given a score of “0” due to a lack of information or given an indeterminate rating due to the method used to evaluate the particular psychometric property (Appendix H).

A total of four quality of life measures were included in the review. All four quality of life measures scored positively in terms of content validity and all but one measure, the HSSI (51) scored positively in terms of internal consistency. None of the four measures scored positively for criterion validity, construct validity, and reproducibility (agreement and reliability). In terms of responsiveness, floor and ceiling effects and interpretability, only the Quality of Life after Myocardial Infarction (50) scored positively while the other three measures all received either, a negative score, an indeterminate score or a score of “0” due to a lack of information (Appendix I).

A total of twenty function measures were included in the review. Sixteen of twenty function measures obtained positive scores for content validity. In terms of internal consistency, only five measures obtained positive scores, twelve obtained a score of “0” and three obtained a negative score. The LEFS (62), the PFMP (60) and the BBS (65) all received negative scores for internal consistency as the alpha obtained was greater than 0.95. Six function measures received positive scores for criterion validity 2MWT (46), 6MWT (46), the BBS (65), the SAS (72) and the VSAQ (55), as comparisons were made with a gold standard measure. In terms of construct validity, seven measures obtained positive scores for performing the required hypothesis testing 6MWT (46), BBS (60), Seattle Angina Questionnaire (55), SAS (72), the TUG (67), the POP-DST (74) and the MLWHFQ (48). Only the 6MWT (46) and the LEFS (62) obtained a positive score for agreement. None of the other eighteen measures provided information on agreement. In terms of reliability, eleven measures obtained positive scores, six measures obtained indeterminate ratings for not presenting intra-class correlation coefficients, and three measures did not provide any data on reliability. In terms of responsiveness, only four measures presented effect sizes: 6MWT (46); the BBS (65); the FIM (61); and the MLWHFQ (48). Floor and ceiling effects were discussed for only four measures. The Reduced version of the DASI (24) and the MLWHFQ (48) both received negative scores, while AGMPF (54) and the LEFS (62) both received positive scores.

Finally, in terms of responsiveness, twelve measures received indeterminate ratings for not defining the minimal important difference. Only the 6MWT (46), the BBS (65), the DASI (36), the LEFS (62), the Seattle Angina Questionnaire (55), the TUG (67) and the MLWHFQ (48) received positive scores for responsiveness (Appendix J).

3.5. Discussion

The objectives of the systematic review of the scientific literature were to 1) identify all standardized functional capacity outcome measures used by physiotherapists in the assessment of post-operative cardiac surgery clients, 2) to summarize the included outcome measures psychometric properties, 3) to provide a framework for the development of the cross-sectional prevalence study survey regarding outcome measure use among physiotherapists working with post-operative cardiac surgery clients and 4) to provide a framework (creation of evidence tables) for the development of evidence-based recommendations to be included in a CPG regarding outcome measure use in physiotherapy clinical practice.

The Cochrane Collaboration handbook for systematic reviews of interventions (40) was used to guide the systematic review process.

A search strategy was developed with the assistance of a medical librarian (JM) for the purpose of the study and used in three databases (CINAHL, EMBASE and MEDLINE). In addition to the databases, six other sources were searched which included: other specific database (proqolid.org and pubmed.com), existing outcome measure inventories (published references), consultation with Canadian experts in cardio-respiratory physiotherapy, cross sectional survey of Canadian physiotherapists, hand reference searching of identified outcome measures and clinical experience.

One reviewer was responsible for the initial screening, the study selection process, the data collection process and the quality assessment of the included functional capacity outcome measures. The involvement of only one reviewer was for financial reasons. For this reason, the inclusion criteria was left general and liberal and all issues that arose during the different levels of screening, during data collection and during quality assessment were brought forward for discussion with the thesis supervisors (GAW and LB).

A total of forty-five standardized physical rehabilitation outcome measures were identified through the different searches. A total of five outcome measures were excluded as they did not meet the pre-defined eligibility criteria and a total of nine outcome measures were

duplicates. Therefore a total of thirty-one outcome measures were included in the review. The thirty-one outcome measures consisted of thirty outcome measures divided into the following three categories (dyspnea (six), quality of life (four), and function (twenty) and one outcome measure in the category representing vital signs.

Once the included outcome measures had been identified, a search was performed in order to retrieve studies relating to their psychometric properties. Data was collected on eight psychometric properties. The quality of the outcome measures was assessed using the “Quality Criteria were proposed for measurement properties of health status questionnaires” by Terwee et al (26). The data collected on the eight different psychometric properties was used to create the evidence tables for the development of the evidence-based recommendations pertaining to the use of standardized functional capacity outcome measures by physiotherapists working with post-operative cardiac surgery clients. A total of one-hundred and one studies were identified by the search and summarized using the framework established by Terwee et al (26).

Data was collected on six dyspnea measures: the BDI and TDI (57), the Borg Scale (69), the MRC Dyspnea Scale (70), the NRS dyspnea (58), SOBQ (52) and the VADS (59). All six measures had evidence of construct validity, content validity and reliability. Internal consistency was established for both the BDI/TDI (57) and the SOBQ (52). The Borg scale (69) and the SOBQ (52) had evidence of criterion validity, responsiveness, and floor and ceiling effects. Criterion validity has also been established for the NRS dyspnea (58), and the VADS (59). The VADS (59) also has evidence of agreement, floor and ceiling effects and interpretability. The MRC dyspnea (70) only had evidence of interpretability.

Data was collected on four quality of life measures: the CROQ (49); the HSSI (51); the SF-36 (47); and the QLMI (50). All four quality of life measures had evidence of content validity, internal consistency and construct validity. None of the included measures had evidence of agreement. Reliability testing had been carried out for all measures except the QLMI (50). The HSSI (51) was the least studied measure with evidence lacking with regards to its responsiveness, floor and ceiling effects and interpretability.

Finally, data was collected on a total of twenty function measures: 1) the BBS (65); 2) the COVS (63); 3) the Reduced Version of the Duke Activity Status Index (24); 4) the FIM (61); 5) the LEFS (62); 6) the PFMP (60); 7) the Quality of Life Index Cardiac Version (64); 8) the MLWHFQ (48); 9) the DASI (36); 10) the Specific Activity Questionnaire (35); 11) the 6MWT (46); 12) the 2MWT (46); 13) the VSAQ (56); 14) the EMS (66); 15) AGMPF (54); 16) the Seattle Angina Questionnaire (55); 17) the SAS (72); 18) the TST (68); 19) the TUG (67); and 20) the POP-DST (74). All twenty function outcome measures had evidence of content validity. The most consistent properties were reliability and interpretability. The least consistent properties were agreement, responsiveness, floor and ceiling effects, internal consistency and criterion validity. Criterion validity was the least explored psychometric property due to the lack of gold standards available for comparing outcome measures. In terms of responsiveness, very few outcome measures had defined minimal important difference values.

The quality assessment of the included outcome measures was also based on the “Quality Criteria were proposed for measurement properties of health status questionnaires” (26). The lack of evidence for a specific property resulted in an indeterminate rating with had an effect on the overall quality of the outcome measures being evaluated.

In terms of positive ratings, the highest number of positive ratings was given to both content validity and internal consistency. Studies effectively described the measurement aim of the outcome measure, the target population, the underlying concept of the outcome measure, the item selection and reduction process and the interpretability of the outcome measures items. In terms of internal consistency, studies included in the review consistently presented results in terms of Cronbach alpha which was the methodology required by quality criterion (26). In addition to presenting results in terms of Cronbach alpha, the criterion also required a factor analysis which was less consistently described in the included studies.

There was a lack of information on agreement, responsiveness, and ceiling and floor effect resulting in a large number of ‘0’ ratings being assigned to those properties. A rating of ‘0’ signifies that there was no information found on the interpretation of that psychometric property for that outcome measure.

The final three psychometric properties: construct validity, reliability and interpretability, received the majority of the indeterminate ratings. In terms of construct validity, indeterminate ratings were given to studies that did not provide hypotheses regarding expected correlations between the outcome measure and the comparator. Indeterminate ratings were given for reliability testing to the studies that presented results as correlations (Pearson's). Reliability testing results should be presented as either intra-class correlation coefficients or weighted kappa. Finally, in terms of responsiveness, few studies presented minimal important difference values therefore resulting in an indeterminate rating.

The most consistent outcome measures, in terms of both data collection and quality assessment, were the 6MWT (46) and the BBS (65). The 6MWT (46) received a positive rating for content validity, criterion validity, construct validity, agreement, reliability, responsiveness and interpretability and received a rating of 0 (no information available) for internal consistency and floor and ceiling effects. The BBS (65) received positive ratings for content validity, criterion validity, construct validity, reliability, responsiveness and interpretability, received a negative rating for internal consistency and received a rating of 0 for agreement and floor and ceiling effects (Appendix J).

The objective of the systematic review of the literature was to identify all standardized functional capacity outcome measures available for use among physiotherapists working with post-operative cardiac surgery clients. The following section discusses methodological aspects of this phase of the study.

3.5.1. Methodological aspects

3.5.1.1. *Search strategy*

Three databases were searched in order to identify standardized functional capacity outcome measures. Therefore potential standardized outcome measures may have been omitted if they were not listed in the databases that were searched. In order to address this issue, several other sources were also searched for potential outcome measures. The combined search resulted in the inclusion of a total of thirty-one functional capacity outcome measures.

In addition to searching for functional capacity outcome measures, studies involving the evaluation of the measure's psychometric properties were also included in the review. The same strategy used to identify the functional capacity outcome measures was used to identify studies related to their psychometric properties with the addition of the following terminology: validity, reliability, reproducibility, responsiveness, internal consistency, floor effects, and ceiling effects. Therefore, due to the limitations of the search strategy, potential studies related to the psychometric properties of the different outcome measures may have been missed. In order to address this issue, experts in the field of cardio-respiratory physiotherapy were sent the reference list for the thirty one outcome measures and they were asked to identify any potential studies that may not have been captured by the search strategy. The experts did not identify any other additional references to be included in the review.

3.5.1.2. Publication bias

The search strategy used to identify outcome measures was limited to outcome measures that were published in peer reviewed journals or in existing published references. The search strategy did not include a search of the grey literature and therefore did not identify any unpublished outcome measures currently being used in clinical practice. In order to address the issue of possible publication bias of the included outcome measures, a cross-sectional survey was developed and distributed among clinicians. The objective of the survey was to identify any unpublished functional capacity outcome measures that were currently being used in clinical practice by physiotherapists working with post-operative cardiac surgery clients. The survey did not result in the identification of any unpublished functional capacity outcome measures. All additional outcome measures identified by the survey had been published in peer reviewed journals. Despite the attempt to identify unpublished outcome measures currently being used in clinical practice, all included outcome measures have been published in peer reviewed journals. Therefore there is the possibility of publication bias in terms of the included outcome measures in the review due to the methods used to identify the outcome measures.

In addition to the search for standardized outcome measures, a search was also performed in order to identify studies pertaining to the psychometric properties of the outcome measures.

There is the potential for publication bias in terms of the studies pertaining to the psychometric properties of the included outcome measures as the grey literature was not searched in order to identify any unpublished studies. Experts in the field of cardio-respiratory physiotherapy were consulted in order to identify any references that may have been missed in an attempt to identify any new research regarding the included outcome measures. However no additional references were included in the review as a result of this consultation.

3.5.1.3. Initial screening process and study selection

The initial screening process and the study selection process were guided by the inclusion criteria established prior to initiating the systematic review and involved a certain degree of judgment. The Cochrane Collaboration handbook for systematic reviews of interventions (45) suggests that more than one reviewer be involved in the initial screening and study selection process. The involvement of more than one reviewer contributes to a certain level of reproducibility with regards to the studies that are screened, selected and included in the review.

The initial screening and study selection process for the qualitative systematic review of the literature involved only one reviewer. One reviewer (TM) was responsible for establishing the inclusion criteria, carrying out the initial screening process and selecting the studies that were to be included in the systematic review. Only one reviewer was involved in this process for financial reasons. The screening process and study selection process were extremely liberal and inclusive, and all issues that arose during the screening and selection process were discussed with the thesis supervisors (GAW and LB). The involvement of only reviewer could have resulted in the omission of outcome measures that were appropriate for inclusion in the review as well as the inclusion of outcome measures that were inappropriate. In order to address this issue, feedback was sought from both expert clinicians in the field of cardio-respiratory physiotherapy by means of a cross section survey and from experts in the field of cardio-respiratory physiotherapy, including academics and researchers. As a result of the feedback process, an additional eleven outcome measures were included in the review: five function outcome measures, two dyspnea measures and vitals signs.

Furthermore, a Panel of Experts meeting was held and recommendations were developed concerning the use of standardized functional capacity outcome measures among physiotherapists working with post-operative cardiac surgery clients. The meeting involved the review of a total of thirty-one physical rehabilitation outcome measures. Therefore, the Panel of Experts meeting provided opportunity for further feedback and peer review of the included outcome measures.

3.5.1.4. Data collection

The data collection process involved extraction of data from the included studies. The Cochrane Collaboration handbook for systematic reviews of interventions (45) suggests that more than one reviewer be involved in the data collection process. The involvement of more than one reviewer contributes to increasing the reliability of the data that is being collected. Only one reviewer was involved in the data collection process for the thesis for financial reasons. Issues that arose during the data collection process were discussed with the thesis supervisors (GAW and LB) and the data was peer reviewed during a Panel of Experts meeting.

3.5.1.5. Quality assessment

The quality assessment process involves the objective assessment of the quality of the included studies or outcome measures. The Cochrane Collaboration handbook for systematic reviews of interventions (45) suggests that more than one reviewer be involved in the quality assessment process. Despite the use of an objective measurement scale, the “Quality Criteria were proposed for measurement properties of health status questionnaires” by Terwee et al (26), a certain level of judgment is also involved in the process. Only one reviewer was involved in the quality assessment of the thirty-one included functional capacity outcome measures for financial reasons. However, the quality of the identified outcome measures was discussed with the thesis supervisor’s (GAW and LB) throughout the process and with a Panel of Experts during the development of the recommendations for the CPG.

3.5.1.6. *Quality assessment scale*

The quality of the identified outcome measures was assessed using a quality assessment scale developed specifically for health status questionnaires (26). The scale was designed to assess the quality of the design, methods and outcomes of studies on the development and evaluation of health status questionnaires (26). The quality criteria are not summarized into a single overall quality score. The ratings for each of the different measurement properties are considered together when deciding on the overall quality.

Despite the comprehensiveness of the quality criteria, several limitations exist. The quality criteria were based on opinion as no explicit quality criteria are currently supported by evidence (26). The scale does not provide an overall summary score therefore it is important to assess all psychometric properties together. The ratings given to each of the measurement properties depends on the availability of information. Therefore a high quality questionnaire could receive a greater number of indeterminate ratings if the measurement properties have not yet been evaluated. Finally the quality criteria have not been standardized as a quality assessment scale which may have an impact on the quality assigned to each of the different outcome measures.

The data obtained from qualitative systematic review of the literature provided a framework for the development of the survey, which was the secondary objective of this phase of the study.

4. Phase II: Survey of Outcome Measure Use in Clinical Practice

4.1. Rationale

Evidence based practice is the use of the best available evidence in the clinical setting (25). The use of standardized outcome measures in clinical practice is an important part of the evidence based practice movement as they enable physiotherapists to measure in a quantifiable manner, the effects of their interventions, which will assist in improving quality of care (25,19). In addition to the clinical aspects of evidence based practice, scientific research also plays an important role in the incorporation of evidence based information into the clinical practice setting (79). Despite the abundance of scientific research being conducted, one of the challenges associated with evidence-based practice is the application of those research results into clinical practice in a timely manner (79).

One approach to incorporating evidence based knowledge into physiotherapy clinical practice is the use of outcome measures (19). A standardized physiotherapy outcome measure has been defined as a “test or scale administered and interpreted by physical therapists that has been shown to measure accurately a particular attribute of interest to patients and therapists and is expected to be influenced by intervention” (6). Outcome measures provide physiotherapists with a quantitative estimate of impairment, enable physiotherapists to assess the client’s progress over time, identify clients that respond better to interventions and provide information regarding the value of physiotherapy (27,5). Therefore, it is important to choose outcome measures that are relevant, valid and reliable in order to ensure a positive effect on the clinical decision making process (80). The measurement properties of the selected outcome measures will have a profound effect on the clinical decisions that are made based on the scores obtained by the outcome measure (5). In order to improve the quality of care, outcome measures that are being used in physiotherapy clinical practice must be standardized and evidence-based. The use of outcome measures that are common to both the research and the clinical setting will assist in improving the link between research and practice (2).

An important source of information that can be used to identify gaps in knowledge between practice and research is the administration of a health survey. Health surveys enable researchers to collect information on a specific topic in a timely and economically efficient manner (81). The information that is collected from the health surveys can then be analyzed and generalized to the group that was represented by the survey respondents (81). The information that is collected from the health survey can be used to evaluate, plan and/or implement health programs and policies (81).

Therefore, in order to collect data on the prevalence of standardized functional capacity outcome measures use among Canadian physiotherapists working with post-operative cardiac surgery clients, a cross sectional survey was developed.

4.2. Objectives

4.2.1. Primary objective

4.2.1.1. Prevalence of outcome measure use in clinical practice

The objective of the prevalence study component of the thesis was to determine the prevalence of standardized functional capacity outcome measure use, by Canadian physiotherapists, working in an acute cardio-respiratory hospital setting, with post-operative cardiac surgery clients. The data was collected by questionnaire in a survey format. The prevalence was based on the physiotherapist's outcome measure use in the six months prior to receiving the survey.

4.2.2. Secondary objectives

4.2.2.1. Identification of outcomes measures used in clinical practice

To determine which outcomes measures are currently being adopted by Canadian cardio-respiratory physiotherapists working in an acute care hospital setting with post-operative cardiac surgery clients.

4.2.2.2. Knowledge of terminology

To determine the knowledge of Canadian physiotherapists working with cardiac surgery clients with regards to the terminology used to describe the psychometric properties of physical rehabilitation outcome measures being adopted in physiotherapy clinical practice.

4.2.2.3. Identification of barriers

To determine the types of barriers, that are preventing or limiting, the use of standardized functional capacity outcome measures in clinical practice among Canadian physiotherapists working with post-operative cardiac surgery clients.

4.2.2.4. Identification of facilitators

To determine the potential facilitators that would assist in increasing the use of standardized functional capacity outcome measures in clinical practice by Canadian physiotherapists working with post-operative cardiac surgery clients.

4.2.2.5. Identification of a gap between research and clinical practice

To determine the existence of a potential gap between the availability of evidence-based standardized functional capacity outcome measures and their use in physiotherapy clinical practice (in the 6 months that preceded the distribution of the survey) among Canadian physiotherapists working with post-operative cardiac surgery clients.

4.3. Study design

The prevalence study consisted of a cross sectional survey, regarding the use and the knowledge of functional capacity outcome measures, of physiotherapists, working with post-operative cardiac surgery clients in cardiac surgery centers across Canada..

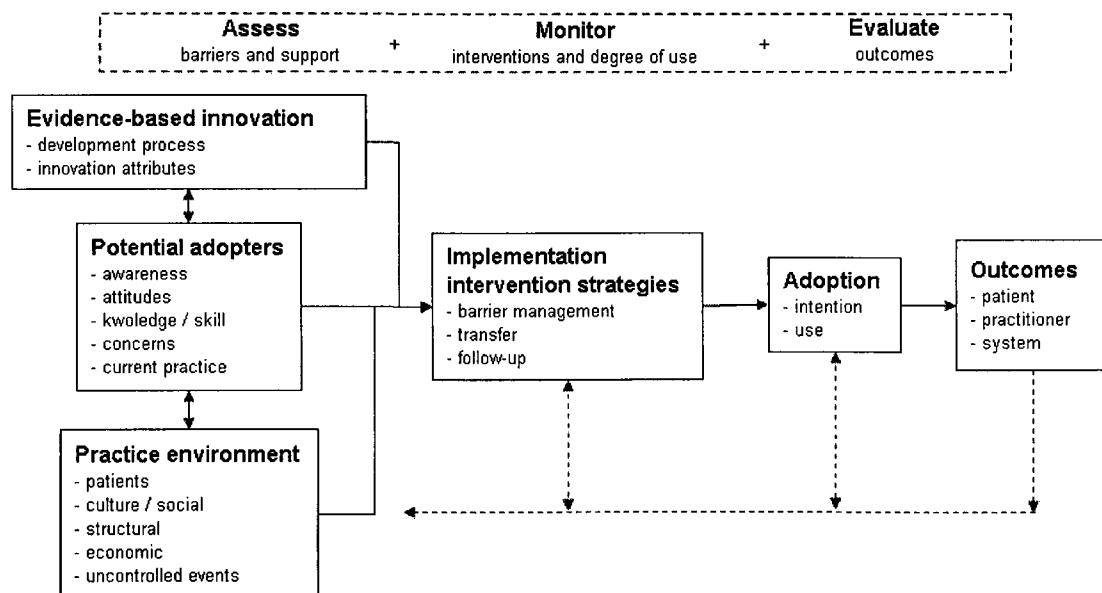
The format of the survey was based on the Dillman method for total survey design (82,83). The Dillman method gives instructions regarding the format of the survey, the questions themselves, the response formats and the use of scales in order to improve survey response rates (82,83).

4.3.1. Revised Ottawa Model of Research Use (84)

The design of the survey was based on the revised Ottawa Model of Research Use (OMRU)(84) (Figure 4). The revised Ottawa Model of Research Use model was used to structure the survey questions. The revised Ottawa Model of Research Use is a conceptual framework that was designed to guide and implement knowledge transfer activities in clinical practice (85). It is a dynamic and multidisciplinary model of research use. The revised Ottawa Model of Research Use was designed to assess, monitor and evaluate the planning of knowledge transfer activities (84). The model is not unidirectional and the knowledge transfer process can be influenced by all of the elements at any stage (85). The model is divided into three main elements: I) assess, II) monitor and III) evaluate (84). Knowledge transfer activities based on the revised Ottawa Model of Research Use involve the identification of appropriate change agents, the identification of a health care innovation and the identification of the consequences of its implementation prior to initiating the knowledge transfer process (85).

Figure 4: The Revised Ottawa Model of Research Use

Graham ID, Logan J. Innovations in Knowledge Transfer and Continuity of Care, CJNR, V.36, N.2, 89-103.



4.3.1.1. Assess

The assess component of the model is the assessment of barriers and supports to the knowledge transfer process. The assess component identifies issues that could have a negative impact on the adoption of the health care innovation (85). The identification of these barriers will then guide the change agents in their selection of intervention strategies in order to target the identified barriers (85). The assess component consists of a barrier assessment of the evidence-based health care innovation, the potential adopters of the innovation and the practice environment (84).

A. Evidence-Based Innovation

The evidence-based health care innovation component consists of a barrier assessment of the potential adopter's perceptions of the development process of the proposed evidence-based innovation as well as their perception of the innovations characteristics (85). The goal of the evidence-based barrier assessment is to clarify any misconceptions surrounding the innovation, to address any negative perceptions and to promote the positive perceptions (85).

B. Potential Adopters

The barrier assessment of the potential adopters consists of the following assessments: 1) the potential adopters awareness of the evidence-based health care innovation; 2) the potential adopters attitudes towards change in general and change specific to the innovation; 3) required knowledge and/or skills for the implementation of the innovation; 4) the adopters concerns regarding the proposed innovation and their intention to adopt the innovation; and 5) the adopters currently and/or established clinical practice for comparison with the proposed evidence-based innovation (85).

C. Practice Environment

The barrier assessment of the practice environment takes into account the patients, the culture/social, structural, economic and uncontrolled events aspects of the environment. The cultural and social aspects include an assessment of the culture, the belief system in place, the local policies, the personality, the leadership, the peer influence and the endorsement of

local opinion leaders that could have an impact on the innovation (85). The structural aspects assessment includes both the decision making structure as well as the physical structure of the work environment, including workload (85). The economic assessment involves the assessment of availability of resources, equipment and supplies required to support the innovation (85).

4.3.1.2. Monitor

A. Monitoring the Implementation Strategy

The monitoring component of the model consists of the implementation intervention based on the barrier assessment described above (85). The monitor component consists of three elements: barrier management, transfer strategies and follow-up (84). The implementation intervention is monitored to ensure that they are addressing the barriers that were identified during the assessment phase of the model (85).

B. Barrier Management

Barrier management requires that the implementation interventions target barriers at both the organizational level as well as the system level (85).

C. Transfer Strategies

Transfer strategies are the selection of appropriate strategies to ensures that all potential adopters are aware of the innovation, understand how they must change and have the skills and training to change (85).

D. Follow-Up

Follow-up interventions are interventions that are used to support the initial transfer strategies (85).

E. Monitoring the Adoption

Once the innovation has been implemented, the adoption of the innovation must be monitored to determine the extent of its diffusion throughout the potential adopters (85).

4.3.1.3. *Evaluate*

The evaluation component consists of the evaluation of the impact of the innovation on the health care practitioner, the health of the patients and the system (85). The evaluation of the innovation requires the selection of the most appropriate outcomes to determine the impact of the innovation, and the time frame for the evaluation process (85).

Only the Assessment component of the revised Ottawa Model of Research Use was used to design the prevalence study survey.

4.4. Methods

4.4.1. Survey development

The survey was developed in consultation with experts in the field of survey methodology, and by consulting previously conducted evidence-based practice surveys of health care professionals (86,79). Results from the systematic review of the literature, described in Phase I of the study, were used in the Current Practice section of the survey.

The survey was divided into three sections (Appendix K). The first section consisted of demographic questions. The second and third sections of the survey consisted of: Practice Environment and Physiotherapists (which represents the Potential Adopters of the Ottawa Model of Research Use) based on the concept described in Part I: Asses of the revised Ottawa Model of Research Use (84).

4.4.1.1. *Survey sections*

Section I: Demographic questions

The first section consisted of demographic questions. The demographic questions were modifications of questions from a previously developed survey targeting health care professionals (86).

Section II: Practice environment

The second section consisted of questions related to physiotherapy practice environment, based on the concepts described in the Assess component (Part I) of the revised Ottawa Model of Research Use (85). The practice environment questions were divided into two categories: structural and client. The structural questions related to the structure of the practice environment and the client questions related to the types of clients treated in the respondents practice environment. The structural questions were modifications of questions from previously conducted surveys (86). The client questions were modifications of questions from previous published health questionnaires as well as from clinical experience from working with post-operative cardiac surgery clients (87,4,79,89).

Section III: Physiotherapists

The third section consisted of questions related to the personal characteristics of the physiotherapists. This section represents the Potential Adopters in Part I of the revised Ottawa Model of Research Use (85). The questions in this section were divided into the following five categories: awareness, attitudes, knowledge/skills, concerns, and current practice. All five categories refer to the role and to the importance of evidence-based practice and the use of standardized outcome measures in physiotherapy clinical practice.

A. Awareness

The questions pertaining to the awareness of the physiotherapists were developed in discussion with an expert in the field of evidence-based physiotherapy (LB), and adapted from surveys previously published in the literature (86).

B. Attitudes

The questions regarding the attitudes of physiotherapists were adapted from previously developed questionnaires related to evidence-based physiotherapy (86,79).

C. Knowledge and skills

The knowledge/skills section consisted of a list of thirteen psychometric properties of outcome measures and statistical tests used in their evaluation. The list of psychometric properties was developed by searching the literature and in discussion with experts (GAW and LB) in the field of standardized outcome measures (23,26). Respondents were asked to determine their level of understanding of each of the different terms. The grading system consisted of a five point Likert-scale pertaining to the physiotherapists level of understanding of the different psychometric properties was adapted from a previous survey of evidence-based physiotherapy practice (4).

D. Concerns

The fourth category consisted of questions related to barriers and facilitators to using standardized outcome measures in physiotherapy clinical practice. The questions in this section were adapted from previously developed surveys related to evidence-based physiotherapy (79,6).

E. Current practice

Finally, the current practice category consisted of a list of standardized functional capacity outcome measures as well as three reality based case studies. The list of standardized functional capacity outcome measures was developed based on the results of a systematic review of the literature of physiotherapy based outcome measures specific to post-operative cardiac surgery clients. Respondents were asked whether or not they used each of the identified outcome measures in their clinical practice (within a six month period prior to receiving the survey). The current practice section also provided space for the respondents to include other outcome measures that they were currently using in clinical practice to assess the functional capacity of this specific client population.

In addition to the list of standardized functional capacity outcome measures, a total of three reality based case studies were also included in this section of the survey. The three case studies were developed by two physiotherapists working at the University of Ottawa Heart Institute (GAP and TM) for the physiotherapy program at the University of Ottawa.

Respondents were required to indicate which outcome measure they would use to assess the functional capacity of the clients described in each of the three different clinical scenarios.

4.4.2. Pilot and pre-testing

The survey was pilot tested by two experts in the field of survey methodology (GAW and LB). The goal of the pilot testing was to ensure that the survey met the study objectives. The pilot testing of the survey resulted in the addition of a cover page, the addition of descriptive paragraphs at the beginning of each of the different survey sections, the addition of definitions to assist respondents with the understanding of the terminology used in the survey, and the re-organization of the survey questions themselves according to Part I: Assess component of the revised Ottawa Model of Research use (85) which categorized questions according to Practice Environment and Potential Adopters (Physiotherapists section in survey).

The survey was also pre-tested amongst a group of six physiotherapists working in the area of cardio-respiratory physiotherapy. The goal of the pre-testing phase of the questionnaire development process was to ensure that the questionnaire was acceptable for distribution among the targeted population (physiotherapists working with post-operative cardiac surgery clients). The sample of physiotherapists who participated in the pre-testing of the survey was one of convenience. They were asked to comment on the questions themselves, the clarity of the questions, the flow of the questionnaire, the ease of use of the questionnaire as well as the time to complete the questionnaire. A total of three physiotherapists commented on the questionnaire. No changes resulted from the pre-testing phase of the questionnaire. A paper copy of the survey was used for the pre-testing of the questionnaire.

Finally, once the survey was set-up on the surveymonkey.com website, the survey was pre-tested by an independent, non-health related professional, to ensure the ease of use of the format of the survey and to determine the time required to complete the survey.

4.4.3. Ethics approval

The research protocol was submitted to the ethics committee at the University of Ottawa. Ethics approval was obtained on November 7th, 2007 (H 09-07-04). A copy of the Certificate of Ethical Approval has been included as Appendix L.

4.4.4. Target Population

The target population for the survey was all physiotherapists working in Canadian cardiac surgery centers. A total of twenty-six cardiac surgery centers were identified using two different sources: a list of twenty centers that was developed by a researcher in London Ontario (CA), and the Guide to Canadian Healthcare Facilities, 2006-2007 Edition (88) (Appendix M).

The cardio-respiratory division of CPA was contacted in order to assist with the delivery of the survey to the target population. CPA agreed to distribute the electronic version of the survey by email to members of the Cardio-Respiratory Division of CPA.

The physiotherapy clinical managers (or equivalent) from each of the different sites were contacted the first week of December 2007. The goal of the initial contact was to establish contact with each of the different sites and to request their site's participation in the study. The initial contact with each of the different clinical managers was made by telephone.

Once the clinical manager agreed to participate in the study, they were sent, by email, an information letter (Appendix N), an information letter for the clinicians employed at their site (Appendix O), the consent form (Appendix P) and the link to the web-based survey. The clinical managers role in the study was to forward the appropriate information to the clinicians. This method of recruitment ensured the confidentiality of the identities of the physiotherapists who volunteered to participate in the study. Participation in the study was on a voluntary basis and neither the clinical manager nor the primary researcher could identify the survey respondents.

4.4.5. Sample size calculation

The sample size calculation for the study was based on the primary objective which was to determine the prevalence of standardized functional capacity outcome measures use among physiotherapists working with post-operative cardiac surgery clients in the last six months.

Previous studies have reported a prevalence rate of approximately 40% with regards to outcome measure use among physiotherapists practicing within various clinical settings (6,8). A total of twenty-six Canadian cardiac surgery centers were identified prior to the start of the study. The average number of physiotherapists at each of the identified sites was 3.3 physiotherapists. This results in a target population of eighty-six physiotherapists (3.3 physiotherapists per site x 26 sites =86 eligible physiotherapists). The intended goal of the survey was to obtain a response rate of 66%. A 66% response rate was based on the average response rate from eight previously conducted surveys of health care professionals regarding evidence-based practice (range of response rates: 49% to 80%) (86,87,89,4,79,6,7,9). Therefore, in order to obtain a 66% response rate, a total of 57 physiotherapists would be required to respond to the survey.

For a prevalence of 40% and a sample of 57, the bound on the error of estimation is 5%. That is:

$$\begin{aligned} b &= \sqrt{Z_{\alpha}^2 p(1-p) / N} \\ &= \sqrt{1.96^2 (0.4)(1-0.4) / 57} \\ &= 12.7 \end{aligned}$$

where:

N= sample size

p= rate

q= 1-p

$Z_{\alpha} = 1.96$

b= bound on the error of estimation

4.4.6. Survey administration

The survey was administered electronically to the study participants using the surveymonkey.com website. Survey Monkey is a web-based survey development tool that allows individuals to design and distribute surveys through the internet.

In order to include French speaking physiotherapists working primarily in the province of Quebec, translated postal versions of the survey were available upon request. Therefore, all sites outside of Quebec received an electronic version (in English) of the survey and sites within the province of Quebec received both an electronic (English) and a translated (French) paper version of the survey. The postal questionnaires included stamped return envelopes in order to increase response rates.

In order to increase response rates to the mail questionnaires, the following methods were employed based on methods described by Dillman (82,83) and Edwards et al (90).

4.4.6.1. Methods used to increase response rates

In terms of the questionnaire itself, it was short, included descriptors and introductory sentences for each of the different sections, and was accompanied by a personalized letter. The questions in the first section were applicable to all respondents and easy to answer.

Study participants were given two months to complete the survey. During the two month period they received a total of three reminders. Each reminder included the link to the survey. Reminders were sent to each of the participating sites one month after the initial contact had been made and every two weeks thereafter.

In addition to the methods described above, the assistance of an independent, influential opinion leader in cardio-respiratory physiotherapy (JK) was requested in order to improve response rates to the survey. The opinion leader contacted the sites who had not responded to the initial participation requests. The opinion leader supported the project and encouraged all sites to participate.

4.5. Data analysis

Data analysis was performed using SPSS for Windows version 11.5 and SAS version 9 statistical package for Windows.

The survey data that was collected from the survey monkey website was downloaded directly into a Microsoft Excel file. Therefore no data entry was required for the electronic data.

Survey data that was collected from the paper surveys was entered manually into the Microsoft Excel file by the primary investigator of the study (TM).

4.5.1. Exclusion criteria

Clinical physiotherapists who were not involved in the direct assessment and treatment of post-operative cardiac surgery clients were excluded from the study. Physiotherapy students were also excluded from the study as well as physiotherapy clinical managers who were no longer involved in direct client care. Physiotherapists working in a cardiac rehabilitation setting were also not included in the study as they are no longer involved in the management of the acute post-operative cardiac surgery client.

4.5.2. Survey return and response rate

The survey return and response rates were calculated. The survey return rate represents the percentage of returned surveys and the response rate represents the percentage of eligible surveys that were returned to the primary investigator.

$$\text{Return Rate} = \left(\frac{\text{Number of surveys returned}}{\text{Number of surveys distributed}} \right) \times 100$$

$$\text{Response Rate} = \left(\frac{\text{Number of eligible surveys returned}}{\text{Number of eligible surveys distributed}} \right) \times 100$$

4.5.3. Characteristics of the sample

A descriptive analysis of the demographic variables of the survey respondents was performed in order to determine the characteristics of the sample. The goal of the descriptive

analysis is to determine whether or not the sample of physiotherapists who responded to the survey is representative of all Canadian physiotherapists working in this particular area of clinical practice. Means were calculated for continuous variables and frequency tables were created for discrete variables.

4.5.4. Analysis of primary objective

4.5.4.1. *Prevalence of outcome measure use in clinical practice*

The proportion of physiotherapists who reported using standardized functional capacity outcome measures in their clinical practice was calculated. Physiotherapists were asked how often they used standardized outcome measures in their daily clinical practice. Survey respondents were required to select one of five response categories: “never”; “rarely”; “occasionally”; “most of the time”; and “almost always”. The proportion of responses for each of the five different categories was calculated.

4.5.5. Analysis of secondary objectives

4.5.5.1. *Identification of outcomes measures used in clinical practice*

Frequency tables were created to summarize the prevalence of each of the identified outcome measures currently being used in physiotherapy clinical practice. The outcome measures that were summarized were listed in question number 1 of the Current Practice section of the survey.

4.5.5.2. *Knowledge of terminology*

Survey participants were asked to rate their knowledge of the terminology used to describe the psychometric properties of measurement instruments. The grading system consisted of a five point Likert-scale with the following response categories: “never heard of the term”; “don’t understand the term”; “have some understanding of the term”; “understand the term”; and “could explain the term to others”. The proportion of responses for each of the five response categories was calculated.

4.5.5.3. Identification of barriers

A list of potential barriers, regarding the use of standardized outcome measures in physiotherapy clinical practice were given to the survey respondents. Survey respondents were asked to select all those that they perceived as barriers in their clinical practice. Survey respondents also had the choice of adding their own perceived barriers to the list. The proportion of respondents who identified each of the listed potentials barriers as actual barriers was presented.

4.5.5.4. Identification of facilitators

A list of potential facilitators, regarding the use of standardized outcome measures in clinical practice were given to the survey respondents. Survey respondents were asked to select all those that they perceived as facilitators in their clinical practice. Survey respondents also had the choice of adding their own perceived facilitators to the list. The proportion of respondents who identified each of the listed potentials facilitators as actual facilitators was presented.

4.5.5.5. Identification of a gap between research and clinical practice

The frequency tables calculated for each of the identified outcome measures were compared to the results of the systematic review of the literature and the quality assessment of the included outcome measures.

4.6. Results

4.6.1. Survey return and response rates

A total of twenty-six cardiac surgery sites were contacted to participate in the study. A total of twenty-three sites agreed to participate in the study, which represented a site participation rate of 88.5%.

The survey response rate was 41.1%, which was below the target response rate of 66%.

$$Response\ Rate = \left(\frac{39}{95} \right) \times 100$$

As previously mentioned, a total of twenty-six cardiac surgery centers were identified prior to the beginning of the study. Of the twenty-six sites identified, three sites refused to participate in the study and the seven sites located in the province of Quebec did not respond to the electronic version of the survey. Therefore, a total of sixteen sites responded to the electronic version of the survey. The average number of physiotherapists involved in the assessment and treatment of cardiac surgery clients was estimated at 3.3 physiotherapists per site. Therefore, with a total of sixteen sites, and a total number of eligible respondents of fifty-three physiotherapists (16 x 3.3) receiving the electronic version of the survey, the response rate was estimated at 49.1% (26/53x100).

All surveys from respondents within the province of Quebec were returned to the primary investigator by mail. A total of forty-five surveys were mailed to seven cardiac surgery centers within the province of Quebec. A total of sixteen surveys were returned to the primary investigator which resulted in a survey return rate, for the province of Quebec exclusively, of 35.5% (16/45x100). A total of three surveys were deemed ineligible for inclusion into the study as the physiotherapists did not report treating any post-operative cardiac surgery clients. Therefore the survey response rate, exclusively for the province of Quebec, was 31% (13/42x100).

4.6.2. Sample characteristics

A total of thirty-nine Canadian physiotherapists responded to the survey. The average age of the respondents was 34.9 years (range 22-59), with the majority being female (76.9%). The average number of years of clinical experience was 9.5 years, ranging from 1 year to 26 years) of clinical experience as a physiotherapist. In terms of province of clinical practice, 41.0% of respondents practice in Ontario, 33.3% practice in Quebec, 5.1% practice each in Alberta, Manitoba and New Brunswick, and 2.6% practice each in Saskatchewan, Newfoundland and Labrador and Nova Scotia. No respondents currently practicing in British-Columbia responded to the survey.

The majority of survey respondents graduated from McGill University (17.9%), followed by Université de Laval (10.3%), University of Ottawa (10.3%), Queen's University (10.3%), Dalhousie University (7.7%), University of Western Ontario (7.7%), Université de Montreal (7.7%), McMaster University (5.1%), University of Toronto (5.1%), University of Alberta (5.1%), University of Manitoba (5.1%), University of Saskatchewan (2.6%) and physiotherapy school in Belgium (2.6%). Finally, in terms of the highest level of degree obtained, 84.6% (n=33) of respondents reported having obtained a bachelor's degree and 12.8% (n=5) having obtained a master's degree. None of the respondents reported having either a diploma or a doctorate degree (Table 1).

4.6.3. Analysis of primary objective

4.6.3.1. *Prevalence of outcome measure use in clinical practice*

Respondents were asked how often they used standardized outcome measures in their daily clinical practice. They were given the five following response options: “never”; “rarely”; “occasionally”; “most of the time”; and “almost always”. A total of 51.3% of respondents (n=20) reported using standardized outcome measures occasionally in their daily clinical practice. Only 1 (2.6%) respondent reported always using them in clinical practice and 1 (2.6%) respondent reported never using them (Table 2).

The majority of respondents (51.3%) reported using outcome measures occasionally in their clinical practice. There were no significant differences between the physiotherapists in the different response categories in terms of their ages, years of clinical experience and attitudes towards evidence based practice. Physiotherapists who reported using outcome measures either most of the time or almost always tended to be more confident in their skills and tended to attribute a higher level of usefulness to the use of outcome measures in clinical practice.

Table 1 Demographic characteristics of sample

		Characteristics	N (range)	%
Gender	Female		30	76.9%
	Male		7	77.9%
Province of Practice	Ontario		16	41.0%
	Quebec		13	33.3%
	Saskatchewan		1	2.6%
	Newfoundland and Labrador		1	2.6%
	Alberta		2	5.1%
	Manitoba		2	5.1%
	Nova Scotia		1	2.6%
	New-Brunswick		2	5.1%
School of Training	McGill University		7	17.9%
	Queens University		4	10.3%
	University of Laval		4	10.3%
	University of Ottawa		4	10.3%
	University of Montreal		3	7.7%
	Dalhousie University		3	7.7%
	University of Western Ontario		3	7.7%
	University of Alberta		2	5.1%
	McMaster University		2	5.1%
	University of Toronto		2	5.1%
	University of Manitoba		2	5.1%
	Belgium School of Physiotherapy		1	2.6%
	University of Saskatchewan		1	2.6%
Highest Degree Obtained	Bachelors		33	84.6%
	Masters		5	12.8%
Years of Clinical Experience	Average		9.5 years (1-27)	
Age	Average		34.9 years (22-59)	

Table 2 Prevalence of outcome measure use in clinical practice

	Never n (%)	Rarely n (%)	Occasionally n (%)	Most of the time n (%)	Almost always n (%)
Prevalence of Outcome Measures	1 (2.6%)	6 (15.4%)	20 (51.3%)	7 (17.9%)	1 (2.6%)

Respondents were asked whether or not they considered themselves to be leaders in terms of standardized outcome measure use in their clinical practice. A total of 38.4% reported that they “neither agreed nor disagreed” with the statement and a total of 38.4% responded that they “disagreed” with the statement. Only one respondent reported agreeing with the statement. In terms of usefulness of outcome measures in guiding clinical practice, 56.4% (n=22) of respondents find them “useful” with less than 10% finding them “not very useful”.

The clinician’s level of confidence with using standardized outcome measures in clinical practice was also questioned. A total of seventeen respondents, representing 43.6% of all responses reported feeling “somewhat” confident with their use in clinical practice and thirteen (33.3%) reported being confident (Table 3).

Despite the fact that 51.3% of survey respondents reported only using standardized outcome measures “occasionally” in their clinical practice, 79.5% of respondents reported that their use was encouraged by their facility. Reasons given for the lack of facility support for the use of standardized outcome measures in clinical practice were high caseload volumes and lack of support for continued education. Furthermore, 38.5% of respondents did not feel that they were leaders in outcome measure use in their current clinical practice (Table 3).

In terms of evidence-based practice, 69.2% of respondents reported a positive attitude regarding the current movement towards evidence-based practice. However, the majority of respondents either disagreed or failed to state their position regarding their leadership in terms of evidence-based practice. A total of 38.5% of respondents reported neither disagreeing nor agreeing with the following statement: “I consider myself to be a leader in evidence-based practice in my current clinical practice” and 33.3% of respondents reported disagreeing with the statement. Finally, in terms of perceived percentage of clinical practice that is evidence-based, the average, amongst all survey respondents, was 61.5% ranging from 25% to 80% (Table 3). The majority of respondents (53.8%) felt that the percentage of their clinical practice that was evidence-based was not sufficient and 53.8% plan on increasing the percentage of their clinical practice that is evidence-based (Table 3).

In terms of methods to be used to improve their evidence-based practice, the majority of clinicians planned on reviewing the literature and attending courses. Other methods included

education, application of outcome measures, research, patient surveys, discussion with peers and increased awareness of best practice evidence. Despite the positive attitudes towards evidence-based practice and intentions of increasing the percentage of their practice that is evidence-based, clinicians acknowledged difficulties in basing practice entirely on the evidence as research is becoming compartmental and inefficient. Clinicians also admit that the literature continues to show little or no effect of some chest physiotherapy treatments despite their continued use in clinical practice.

Table 3 Outcome measures and evidence-based practice

	Characteristics	N (range)	%
Usefulness of Outcome Measures in Practice	Not at all useful	0	0%
	Not very useful	3	7.7%
	Somewhat useful	7	17.9%
	Useful	22	56.4%
	Very Useful	3	7.7%
Leader in Outcome Measures Use	Strongly disagree	1	2.6%
	Disagree	15	38.5%
	Neither disagree nor agree	15	38.5%
	Agree	4	10.3%
	Strongly agree	0	0%
Confidence in Outcome Measure Use	Not at all confident	0	0%
	Not very confident	3	7.7%
	Somewhat confident	17	43.6%
	Confident	13	33.3%
	Very confident	2	5.1%
Leader in Evidence-Based Practice	Strongly disagree	0	0%
	Disagree	13	33.3%
	Neither disagree nor agree	15	38.5%
	Agree	7	17.9%
	Strongly agree	0	0%
Feelings towards Evidence-Based Practice	Very negative	0	0%
	Negative	0	0%
	Neither negative nor positive	2	5.1%
	Positive	27	69.2%
	Very positive	6	15.4%
Percentage of Clinical Practice that is Evidence-Based	Average	61.5% (25% to 80%)	

4.6.4. Analysis of secondary objectives

4.6.4.1. *Identification of outcome measures used in clinical practice*

A list of sixteen generic and disease specific standardized physical rehabilitation functional capacity outcome measures was provided and clinicians were asked to check off all outcome measures that they had used in clinical practice in the last 6 months (question #1 of Current Practice section of survey). The list was not exhaustive and a section entitled “others” was provided to allow clinicians to specify any additional outcome measures that they were using in clinical practice to assess the functional capacity of post-operative cardiac surgery clients.

Clinicians reported using eleven of the sixteen listed standardized outcome measures in clinical practice (in the last 6 months): the 6MWT (46); the SF-36 (47); the FIM (61); the 2MWT (61); the Specific Activity Questionnaire (35); the 12 Minute Walk Test (46); the Shuttle Walk Test (91); the LEFS (62); the COVS (63); the MRC Dyspnea Scale (70); and the Borg scale (69).

A total of nine respondents (23.1%) also reported other outcome measures in addition to the list provided in the survey. One respondent reported using vital signs, seven (17.9%) reported using the BBS (65), one reported using the Chedoke-McMaster Stroke Assessment (for stroke clients only) (92), one reported using arterial blood gas analysis results, chest x-rays and pulmonary function tests, one reported using the EMS (66), one reported using the TUG (67), one reported using the TST (68), one reported using the Tinetti Gait and Balance Assessment Scale (93), and one reported using the Foam and Dome Balance Test (94).

A frequency table summarizing the number of physiotherapists who report using each identified outcome measures in physiotherapy clinical practice has been created and is listed in Table 4.

Table 4 Frequency table of outcome measure use in clinical practice

Outcome Measures	Use (f)	Relative Frequency (f/n * 100)
The Physiotherapy Functional Mobility Profile (PFMP)	0	0%
The Six-Minute Walk Test	17	43.6%
The Medical Outcomes Study Short-Form 36 (SF36)	1	2.6%
Functional Independence Measure (FIM)	8	20.5%
Sickness Impact Profile (SIP)	0	0%
The Nottingham Health Profile (NHP)	0	0%
The Two-Minute Walk Test	10	25.6%
The Duke Activity Status Index (DASI)	0	0%
The Specific Activity Questionnaire	1	2.6%
Euro-Qol	0	0%
The Twelve-Minute Walk Test	1	2.6%
The Shuttle Walk Test	4	10.3%
The Lower Extremity Functional Scale (LEFS)	1	2.6%
The Clinical Outcomes Variable Scale (COVS)	3	7.7%
The Medical Research Council Dyspnea Scale (MRC dyspnea)	4	10.3%
The Borg Rating Scale of Perceived Exertion (BORG)	29	74.4%
Vital Signs	1	2.6%
The Berg Balance Scale (BBS)	7	17.9%
The Chedoke McMaster Stroke Assessment	1	2.6%
Arterial Blood Gas analysis, chest roentogrammes and pulmonary function tests	1	2.6%
Elderly Mobility Scale (EMS)	1	2.6%
Time up and Go (TUG)	1	2.6%
Timed Stand Test (TST)	1	2.6%
Tinetti Gait and Balance Assessment Scale	1	2.6%
Foam and Dome	1	2.6%
Specific Distance Walk Test	4	10.3%

4.6.4.2. Knowledge of terminology

Survey respondents knowledge of terminology used to described and/or evaluate the psychometric properties of outcome measures was included in the survey. A total of thirteen terms were included in the survey (Section III: Knowledge and Skills). Respondents were asked to select their level of understanding of the different terms according to the following 5 point Likert-scale: “never heard of the term”; “don’t understand the term”; “have some understanding of the term”; “understand the term”; and “could explain the term to others”. Over 30% of respondents could explain the following terms to others: validity; reliability; inter-rater reliability; intra-rater reliability; and sensitivity to change. The terms that were the least known to the respondents were the following statistical concepts: internal consistency, Cronbach’s alpha, intra-class correlation coefficient, Kappa statistic and Pearson’s correlation coefficient (Table 5).

4.6.4.3. Identification of barriers

A total of eleven barriers regarding the use of standardized outcome measures in clinical practice were listed in question 3 of section III the survey. Respondents were asked to select which of the listed barriers they felt limited their use of standardized outcome measures in clinical practice. A section was also provided for respondents to include additional barriers that were not listed in the survey question. Lack of resources, time consuming, limited training with outcome measure and not appropriate for clinical setting were the four most commonly reported barriers. Lack of resources was selected by 74.4% of respondents, time consuming by 76.9%, limited training with outcome measures by 66.7% and not appropriate for setting by 61.5%. In addition to the barriers enumerated above, clinicians also reported that language barriers, not appropriate for client population, and equipment needs also had an impact on outcome measure use in clinical practice.

Lack of confidence in one’s abilities was only perceived as a barrier by 23.1% of respondents and training (physiotherapist’s beliefs) was only perceived as a barrier by 15.4%. The most important barriers were resources related and not related to the physiotherapist’s abilities and/or training (Table 6).

Table 5: Knowledge of terminology

Psychometric Property	Never heard of the term N (%)	Don't understand the term N (%)	Have some understanding of the term N (%)	Understand the term N (%)	Could explain the term to others N (%)
Validity	0	0	7 (17.9%)	14 (35.9%)	14 (35.9%)
Content validity	0	5 (12.8%)	12 (30.8%)	12 (30.8%)	6 (15.4%)
Construct validity	2 (5.1%)	7 (17.9%)	14 (35.9%)	6 (15.4%)	6 (15.4%)
Reliability	0	0	5 (12.8%)	16 (41.0%)	14 (35.9%)
Inter-rater reliability	1 (2.6%)	2 (5.1%)	1 (2.6%)	15 (38.5%)	16 (41.0%)
Intra-rater reliability	1 (2.6%)	2 (5.1%)	1 (2.6%)	15 (38.5%)	16 (41.0%)
Sensitivity to change	1 (2.6%)	3 (7.7%)	3 (7.7%)	15 (38.5%)	13 (33.3%)
Internal consistency	11 (28.2%)	3 (7.7%)	9 (23.1%)	8 (20.5%)	4 (10.3%)
Cronbach's alpha	27 (69.2%)	4 (10.3%)	1 (5.1%)	2 (5.1%)	1 (5.1%)
Intra-class correlation coefficient	10 (25.6%)	11(28.2%)	9 (23.1%)	4 (10.3%)	1 (5.1%)
Kappa statistic	16 (41.0%)	9 (23.1%)	7 (17.9%)	3 (7.7%)	0
Pearson's correlation coefficient	11 (28.2%)	10 (25.6%)	10 (25.6%)	3 (7.7%)	1 (5.1%)

Table 6 Perceived barriers to outcome measure use in clinical practice

Barriers	Yes (n)	%	No (n)	%
Limited Training with Outcome Measure	26	66.7%	8	20.5%
Lack of Interaction with colleagues	9	23.1%	20	51.3%
Limited Experience with Outcome Measure	23	59.0%	10	25.6%
Unfamiliar with required equipment	15	38.5%	14	35.9%
Lack of resources	29	74.4%	6	15.4%
Time consuming	30	76.9%	4	10.3%
Not appropriate for setting	24	61.5%	8	20.5%
Lack of Confidence in my Abilities	9	23.1%	21	53.8%
Overwhelmed by scientific Information	8	20.5%	22	56.4%
Training Beliefs	6	15.4%	23	59.0%
Patient's Preferences	5	12.8%	22	56.4%

4.6.4.4. Identification of facilitators

Perceived facilitators regarding the use of standardized outcome measures in clinical practice consisted of both resource and training related issues. Accessibility of experienced colleagues and experience were reported as important facilitators by 79.5% of respondents, availability of resources and time were reported as important facilitators by 82.1% of respondents and training with the specific outcome measure was reported as an important facilitator by 87.1% of respondents.

Clinicians would also be more likely to choose a particular outcome measure if: 1) they had knowledge about the outcome measure; 2) they had experience administering it; 3) the outcome measure was valid and reliable; and 4) the outcome measure met the client's needs and was easy to use (Table 7).

Table 7 Perceived facilitators to outcome measure use in clinical practice

Facilitators	Yes (n)	%	No (n)	%
Opportunity to interact with colleagues	29	74.4%	2	5.1%
Training	34	87.1%	0	0%
Participation in Research	21	53.8%	10	25.6%
Experience	31	79.5%	1	2.6%
Availability of Resources	32	82.1%	1	2.6%
Time	32	82.1%	2	5.1%
Accessible of Experienced Colleagues	31	79.5%	1	2.6%
Supportive Clinical Environment	30	76.9%	3	7.7%
Motivation	25	64.1%	5	12.5%
Encouragement by Facility	28	71.8%	3	7.7%
Encouragement by Colleagues	26	66.7%	4	10.3%

4.6.4.5. Identification of a gap between research and clinical practice

In order to identify any potential gaps in knowledge between research and clinical practice, the outcome measures identified in the current practice section of the survey were compared to the results of the systematic review of the literature. The Borg scale (69) and the 6MWT (46) were the two most frequently used outcome measures in clinical practice, as reported by clinicians. In terms of the quality assessment of the outcome measures that were included in the review, the Borg scale (69) and the 6MWT (46) were two of the stronger outcome measures, in terms of their development and their psychometric properties. However only 43.6 % of respondents reported using the 6MWT (46) in clinical practice and only 74.4% reported using the Borg scale (69) which represents a gap in terms of frequency of outcome measure use in clinical practice.

4.7. Discussion

The primary objective of the survey was to determine the prevalence of functional capacity outcome measure use among physiotherapists working with post-operative cardiac surgery clients. Secondary objectives were to: 1) determine which outcome measures were currently being used in clinical practice, both standardized and non-standardized/un-published outcome measures; 2) to identify barriers; and 3) facilitators to the use in clinical practice; 4) to determine the level of knowledge of physiotherapists regarding terminology used to evaluate outcome measures; and 5) to identify a potential gap between the evidence and clinical practice.

In order to determine the prevalence of use of standardized outcome measures, a survey was developed with the assistance of experts in the field of outcome measures and survey methodology (GAW and LB). The format of the survey was based on the Dillman method (82,83). The design of the survey was based on the Asses component of the revised Ottawa Model of Research Use (84) and consisted of the following three sections: 1) demographics; 2) practice environment; and 3) physiotherapists. The survey was piloted among two experts in survey methodology (GAW, LB) in order to ensure that the survey met the objectives of the prevalence study component of the thesis. The survey was then pre-tested among a group of three physiotherapists in the field of cardio-respiratory physiotherapy in order to ensure the clarity of the questions.

The survey was administered electronically through email using the [suveymonkey.com](https://www.surveymonkey.com) website. The survey was also available in paper format by mail for sites that did not have access to the internet. In order to include all Canadian physiotherapists, the survey was available in both official languages (English and French). The target population was physiotherapists working in all twenty-six cardiac surgery centers across Canada. The clinical managers at each of the twenty-six sites were contacted by phone by the primary investigator (TM) and asked to participate in the survey. Upon entry into the study the clinical managers were sent the information letters, the consent form and the link to the survey. They were responsible for distributing the information to the clinicians employed at each of the participating sites. This ensured the confidentiality of the respondents as the primary investigator did not have direct contact with the clinicians. A total of twenty-three

cardiac surgery centers agreed to participate in the study which resulted in a response rate of 41.1%. The response rate of 41.1% was below the target response rate of 66% that was anticipated for the study.

4.7.1. Outcome measure use in clinical practice

The majority of clinicians (51.3%) reported using outcome measures occasionally in clinical practice within the last six months. Only 17.9% and 2.6% reported using outcome measures most of the time and almost always respectively. Despite the fact that the majority of clinicians reported only using outcome measures occasionally in their clinical practice, 56.4% feel that outcome measures are useful in clinical practice. Therefore there is a gap between the perceived usefulness of outcome measures and their application in clinical practice. Furthermore, there is a gap in terms of the education of physiotherapists regarding the benefits of using outcome measures in clinical practice. Previous surveys of Canadian physiotherapists (6,8) reported a prevalence of 41% and 43% respectively in terms of outcome measure use in clinical practice which is slightly less when compared with the findings of this survey (prevalence of 51.3%). In both surveys, clinicians were asked whether or not they used outcome measures in clinical practice. They did report on the frequency of their use and therefore the prevalence of outcome measure use obtained from the previous study cannot be compared directly to the findings of the current survey which specifically asked the frequency of use. Additionally, the previous surveys (6,8) asked whether the department's were using outcome measures and did not target the physiotherapist directly. The survey that was designed for this study collected data on individual physiotherapist use of outcome measures in clinical practice.

Standardized outcome measures provide a quantitative estimate of impairment and provide an objective estimate of a client's progress over time ensuring that our practice is efficient and evidence-based (19,5,27). Therefore, the fact that 51.3% of respondent report using outcome measures only occasionally in their clinical practice is not sufficient in ensuring that their treatment is effective, efficient and evidence-based.

4.7.2. Knowledge of terminology

In terms of physiotherapist's knowledge of terminology of psychometric properties of outcome measures, the most consistently understood terms were validity and reliability. Approximately 40% of respondents either understood the term or could explain the term to others. The least consistently understood terms were Cronbach's alpha, kappa statistic, intra-class correlation coefficient and Pearson's correlation coefficient with approximately only 10% (or less) of respondents reporting that they understand the term. This lack of a consistent understanding of the terminology use to either define or evaluate an outcome measures psychometric properties could have an impact on both the perceived usefulness of outcome measures in clinical practice (56.4%) and their use (51.3% occasional users). Physiotherapists may not have an adequate knowledge base when selecting, administering and interpreting data from outcome measures which would impact their use in clinical practice.

4.7.3. Barriers and facilitators

Perceived barriers regarding the use of outcome measures in clinical practice were both resource and training related. Lack of resources was perceived as a barrier by 74.4% of respondents, time consumption by 76.9% of respondents and not appropriate for clinical setting by 61.5%. In terms of training related issues, 66.7% perceived limited training with outcome measure as a barrier and 59% perceived limited experience with the outcome measure as a barrier.

Despite this lack in outcome measures training, only 23.1% perceived a lack of confidence in their abilities as being a barrier to outcome measure use in clinical practice. However, when clinicians were asked more specifically about their confidence level with using outcome measures in clinical practice, 43.6% reported that they were only somewhat confident. Therefore, there is a huge lack of knowledge and training with regards to the administration of outcome measure in clinical practice. This lack of training with outcome measures has a direct impact on the clinician's level of confidence in terms of their use in clinical practice and ultimately on the use of outcome measures in clinical practice.

Perceived facilitators to the use of outcome measures in clinical practice were related to the clinical environment (both facility and colleagues), resources and training. The opportunity to interact with colleagues was perceived as a facilitator by 74.4% of respondents and accessibility of experienced colleagues was perceived as a facilitator by 79.5% of respondents. However the lack of interaction with a colleague was only reported as a barrier by 23.1%. Therefore a supportive clinical environment that encourages interaction among colleagues facilitates and encourages the use of outcome measures in clinical practice.

4.7.4. Identification of a gap between research and clinical practice

The Borg scale (69) and the 6MWT (46) were the two most frequently used outcome measures in clinical practice and they were the among the strongest outcome measures in terms of their psychometric properties. However, only 74.4% of respondents reported using the Borg scale and only 43.6% of respondents reported using the 6MWT in clinical practice.

4.7.5. Methodological aspects

Several methodological issues were encountered during the development and distribution of the prevalence study survey. The following section discusses methodological issues related to the prevalence study survey and the limitations associated with the distribution of a survey as a data collection method.

4.7.5.1. *Recruitment of the target population*

The recruitment of the target population was challenging as the physiotherapists were not contacted directly. Contact was made indirectly through their clinical managers due to confidentiality issues with requesting a list of email addresses of physiotherapists from professional organizations. The clinical manager was contacted, asked to participate in the study and was responsible for distributing the survey to the physiotherapists. Therefore, if the clinical manager did not respond to the request or refused to participate in the study, then the physiotherapists working at that particular site were not given the opportunity to respond to the survey.

The recruitment process was also more time consuming than initially planned. A two month period had initially been allocated to the recruitment process. However due to the initial low response rate, the recruitment period was extended over an additional two months. In addition to the prolonged recruitment period, the assistance of a respected opinion leader (JK) in the field of cardio-respiratory physiotherapy was requested in order to increase participation rates. The opinion leader facilitated contact with the sites who did not respond to the invitation to participate in the study and provided encouragement and support for the study. Finally, the cardio-respiratory division of the Canadian Physiotherapy Association (CPA) was also contacted in order to assist with the distribution of the survey. The head of the division (DHR) was sent the link to the survey and she was responsible for distributing the survey to the members. The CPA's assistance in the distribution of the survey enabled the primary researcher to gain access the physiotherapists, who were members of the organization, and working in cardiac surgery centers that refused to, participate.

4.7.5.2. Survey administration

The survey was administered electronically to all cardiac surgery centers across Canada except for the province of Quebec. The Quebec sites were sent postal questionnaires with information regarding the electronic version of the survey. Both methods of survey administration have advantages and disadvantages. The electronic method of survey administration facilitates access to the target population in a timely and economically efficient manner. Despite the efficiency of the electronic distribution of the survey, studies have reported lower response rates with electronic surveys compared to postal surveys, especially in populations with low rates of internet access (95,96). However, 87.2% of survey respondents reported having access to the internet at their work facility. The two respondents that reported not having access to the internet from their work facility were employed in the province of Quebec and were sent the postal version of the survey, Therefore, the electronic method of distributing the survey was appropriate for the target population.

4.7.5.3. Sample size

Previous surveys of Canadian physiotherapists have reported outcome measure use of approximately 30 to 40% (6,8). A prevalence of 40% in terms of outcome measure use among physiotherapists working with post-operative cardiac surgery clients would require a sample size of 369 physiotherapists. However, within each of the 26 cardiac surgery sites across Canada, it is estimated that on average 3.3 physiotherapists work with post-operative cardiac surgery clients resulting in a target population of 87 (3.3 x 26) physiotherapists. A 66% response rate was expected, representing a total of 57 respondents. Therefore, the error on the bound of the estimate obtained from the survey would be larger due to the smaller target population (bound of 12.7%). The prevalence obtained by the study was 51.3% compared to 40% and 42% obtained from previous Canadian surveys on outcome measure use among physiotherapist (6,8).

4.7.5.4. Survey response rate

The electronic method of survey administration was chosen as the main method for distributing the survey in order to access the target population in a timely and economically efficient manner. Despite the efficiency of the internet, studies have reported lower response rates with electronic surveys compared to postal surveys (95). However, internet based surveys have been shown to be useful, especially in populations with high rates of internet access (96). Furthermore, internet surveys are more effective in terms of data collection and data compilation. In a recent survey of Canadian orthopedic physiotherapists, 62% of respondents reported having access to the internet at their practice setting and 35% reported having access to the internet at home or at another location (86). Only 3% of respondents reported not having any access to the internet (86). Therefore the use of the internet as the method for distributing the survey is justified by the large percentage of physiotherapists who reported having access to the internet either from home or from their work environment.

The targeted survey response rate for the study was 66%. A 66% response rate represented the average response rate (range: 49%-80%) from eight previously conducted surveys of health care professionals regarding evidence-based practice (86,87,89,4,79,6,7,9).

The response rate to the survey was 41.1% which was below the targeted response rate of 66% and just below the lower end of the range from the previous surveys. The response rate to the electronic version of the survey was significantly higher than the response rate to the postal survey. A response rate of 49.1% was obtained from the electronic survey compared to 31% for the postal version of the survey. All respondents to the postal survey were from the province of Quebec. No postal questionnaires were sent to sites outside the province of Quebec.

The lower response rate from the cardiac surgery centers within the province of Quebec could be explained by the challenges associated with contacting the clinical managers at those sites. The contact with the clinical manager was vital to ensuring that all physiotherapists working at that site were given the opportunity to complete the survey. Contact was made with only one clinical manager prior to the distribution of the surveys. That site had a 100% response rate to the survey.

In terms of the response rate obtained from the electronic survey, there was the potential for physiotherapists working at the same site to complete the survey as a group. During the initial contact with each of the clinical managers, it was requested that all physiotherapists at the site complete the survey individually however this request could not be enforced by the primary researcher.

4.7.5.5. Self-selection bias

Physiotherapist's participation in the study was on a voluntary basis. Therefore survey respondents could potentially be more likely to consistently use outcome measures in clinical practice compared to non-responders. This could bias the results and therefore have an impact on the prevalence obtained by the survey. The results would not be representative of all physiotherapists working with cardiac surgery clients as the non-responders would be less likely to use outcome measures in clinical practice. Based on the results of the study, there is little evidence of bias, in terms of outcome measures use in clinical practice, as the majority of respondents (51.3%) reported only using outcome measures occasionally in clinical practice and only 56% of respondents find them useful. Furthermore, only 10.3% of respondents report being leaders in terms of outcome measure use in clinical practice. The

prevalence of outcome measures use obtained by the survey is consistent with results from previous surveys of Canadian physiotherapists who reported prevalence's of 40% and 42% (6,8).

The data obtained from the prevalence study survey assisted in the development of the evidence-based recommendations to be included in the CPG.

5. Phase III: Clinical Practice Guideline Development

5.1. Rationale

CPGs are defined as systematically developed recommendations to assist both health care professionals and clients when making decisions with regards to the delivery of health care for specific clinical situations (11). CPGs are one of the many tools available to health care professionals to ensure both efficient and effective client care (97,98,99).

Research has shown that clinical decision based on evidence, such as CPGs, standardized outcome measures and decision aids, improve both the quality and delivery of health care services (100,101). CPGs provide health care professionals with a summary of the best available evidence and they facilitate the incorporation of this evidence into practice by improving the clinical decision making process (102,103). CPGs also provide a link between research and practice, as well as provide direction for future research (102,104).

One of the most important benefits associated with CPGs are their ability to improve quality of care (99). CPGs based on sound scientific evidence are beneficial to clients, to health care providers and to the health care systems. They have the potential to improve health outcomes by encouraging interventions that have proven to be beneficial in terms of client outcomes and by discouraging ineffective ones (99).

5.2. Objectives

5.2.1. Primary objective

The primary objective of the third phase of the study was to develop evidence-based recommendations for a CPG regarding the use of standardized functional capacity outcome measures among physiotherapists working with post-operative cardiac surgery clients. The objective of the evidence-based recommendations was to guide physiotherapists in selecting evidence-based, standardized outcome measures when assessing the functional capacity of post-operative cardiac surgery clients.

5.2.2. Secondary Objective

To determine the existence of a potential gap between the availability of evidence-based standardized functional capacity outcome measures and their use in physiotherapy clinical practice (in the 6 months that preceded the distribution of the survey) among Canadian physiotherapists working with post-operative cardiac surgery clients. This objective will be met by comparing the results of the prevalence study survey to the evidence-based recommendations included in the CPG developed by the Panel of Experts.

5.3. **Study design**

The development of the clinical practice recommendations was based on the Scottish Intercollegiate Guideline Network (SIGN) methodology for the development of CPGs (14).

The SIGN methodology for the development of CPGs consists of the following eight step process: 1) guideline topic selection; 2) composition of the guideline development group; 3) systematic review of the literature; 4) formation of the recommendations; 5) consultation and peer review; 6) presentation and dissemination; 7) local implementation; and 8) audit and review (14).

5.3.1. SIGN methodology description

5.3.1.1. *Guideline topic selection*

According to the SIGN methodology, the selected guideline topic must address a specific health care issue where change is possible. The issue being addressed must represent an area of health care where the development of a guideline will have an impact on both the quality of care and patient outcomes. Finally, the recommendations on which the guideline is based must be supported by strong evidence and be based on effective practice. Therefore, there must be strong evidence available to support recommendations on the topic of interest (14).

5.3.1.2. Guideline development group selection

The guideline develop group must consist of representatives from key groups and disciplines involved in the area of health care being addressed. The guideline development group must have clinical expertise, expertise in other specialties, an understanding of the problems encountered by front line health care professionals responsible for the delivery of care, communication and team working skills and critical appraisal skill (14).

5.3.1.3. Systematic review of the literature

The systematic review component of the guideline development process is the basis on which the recommendations in the guideline are founded. The systematic review component consists of the following methodology: identification of the relevant literature through an explicit search strategy; selection of the relevant literature based on pre-defined inclusion and exclusion criteria; evaluation of the evidence (study methodology and quality assessment); and development of evidence tables to synthesize the evidence (14).

5.3.1.4. Formation of the recommendations

The recommendations to be included in the guideline are based on an objective assessment of the evidence identified through the systematic review of the literature. The recommendations are developed through a process known as “considered judgment”. Considered judgment is the process in which recommendations are made based on the summary of the entire body of evidence. The entire body of evidence is presented to the guideline groups in the form of evidence tables which were used to synthesize the evidence obtained through the systematic review of the literature (14). The recommendations to be included in the guideline are presented in terms of their level of evidence and are given a grade of recommendation.

5.3.1.5. Consultation and peer review

Once the recommendations have been developed, it is important for the guideline to be peer reviewed by independent stakeholders. This process allows the guideline

development group to obtain valuable feedback regarding the recommendations that were developed prior to their presentation and dissemination (14).

5.3.1.6. Presentation and dissemination

The presentation and dissemination of the guidelines must then be evaluated to ensure that the recommendations are being implemented into clinical practice (14).

5.3.1.7. Local implementation

Once the guideline is developed it must be implemented into clinical practice and the implementation must be monitored (14). CPG implementation strategies are addressed in the discussion component of the thesis.

5.3.1.8. Audit and review

All CPGs must be reviewed every two years after publication. The review process ensures that the recommendations are current and still valid by taking into account new research developments (14).

5.4. Methods

5.4.1. Application of SIGN methodology

5.4.1.1. Guideline topic selection

The evaluation of outcome measure use among physiotherapists has previously been studied in Canada and abroad (6,7,8,9). However, the prevalence of outcome measures use among physiotherapists working with post-operative cardiac surgery clients has not been established. Cardiovascular disease is the leading cause of death in North America (100). It is estimate that approximately 80% of the Canadian population has at least one modifiable risk factor for the development of cardiovascular disease (101). Another 33% are estimated to have at least two modifiable risk factors and 11% are estimated to have three or more modifiable risk factors for the development of cardiovascular disease (101). Over 17 000 Canadians undergo cardiac by-pass surgery every year (11) and the costs associated with this

procedures is between \$16 400 and \$35 800 per patient (12). In addition to the current prevalence of both disease and modifiable risk factors within the Canadian population, the population is also aging. It is estimated that 15% of the Canadian population will be 65 years of age and older by the year 2011 (106). The costs associated with cardiac by-pass surgery are directly related to the age of the patient (12). Therefore there is a need to allocate health care resources in both an efficient and effective manner.

In order to ensure that health care is delivered in an efficient and effective manner, one must ensure that their practice is evidence-based. One method of ensuring that our practice, as physiotherapists, is evidence-based is the use of standardized outcome measures.

Standardized outcome measures allow physiotherapists to objectively evaluate the effects of their interventions in order to treat their clients in a more efficient manner which will ultimately result in improved client outcomes and improved quality of care (19).

Therefore, the topic of outcome measure use among physiotherapists working with post-operative cardiac surgery clients was chosen as it responds to the criteria established by SIGN (14). It is an area where change is possible, where the recommendations will have an impact on both quality of care and client outcomes and where there is a body of evidence available to researchers on which to base their recommendations.

5.4.1.2. Guideline development group selection

The guideline development group was chosen in discussion with Dr. George A. Wells and Dr. Lucie Brosseau. The CPG development group members were chosen because of their expertise in one of the following areas: research in cardiovascular disease, research and expertise in the field of cardio-respiratory physiotherapy, expertise in the field of cardio-respiratory physiotherapy clinician and expertise in the field of CPG methodology and development. The guideline development group members were initially contacted by email through a formal letter of invitation to participate in the guideline development group. Information was given regarding the nature of the study, their role as members of the guideline development group as well as the tasks that would be expected of them. The CPG group members consisted of a total of fourteen members. Three members were part of the standardized outcome measures development group and were responsible for the selection of

the guideline topic, the systematic review of the scientific literature, the prevalence study survey, the summary of the evidence and the creation of the evidence tables. The remaining eleven members made up the Panel of Experts. The Panel of Experts was responsible for interpreting the evidence and developing the evidence-based recommendations to be included in the CPG.

A list of the members of the guideline development group is attached under Appendix Q.

5.4.1.3. Systematic review of the literature

The third step involved in the development of the CPG is the systematic review of the scientific literature. The systematic review of the scientific literature was the process by which the standardized functional capacity outcome measures were identified. The Cochrane Collaboration handbook for systematic reviews of interventions (45) was used to guide the systematic review process. The methodology for the systematic review was discussed in detail in the “Phase I: Systematic Review of the Literature” chapter 3 of the thesis.

5.4.1.4. Formation of the recommendations

The evidence-based recommendations that were included in the CPG were developed through a Panel of Experts consensus meeting that was held on June 6th, 2008. The evidence-based recommendations were based on the findings from the qualitative systematic review of the scientific literature and the prevalence study survey. Studies evaluating the psychometric properties of the standardized functional capacity outcome measures were included in the systematic review in order to summarize the evidence in a comprehensive manner. The information was summarized and presented to the Panel of Experts in the form of evidence tables. Evidence tables were created for a total of thirty-one functional capacity outcome measures.

The formation of the evidence-based recommendations of the CPG consisted of a five step process. The following is a description of the five step process used to develop the evidence-based recommendations.

A. Summary of the evidence

The summary of the evidence was based on the “Quality criteria were proposed for measurement properties of health status questionnaires” by Terwee et al (26). The quality criteria were developed to assist researchers in determining the methodological quality of outcome measures and health status questionnaires and required the collection of data on eight psychometric properties (26). The quality of the measurement properties is assessed using explicit criteria defined by the authors. The scoring system consists of assigning one of the following grades: (+), (-), (?) or (0), to each of the measurement properties. Each measurement property is scored independently from one another. The overall evaluation of the questionnaire takes into account the ratings for each of the different measurement properties together (21).

B. Creation of evidence tables

The evidence tables that were created for the development of the evidence-based recommendations were based on the measurement properties listed in the quality criteria for health status questionnaires by Terwee et al (26). One reviewer (TM) was responsible for the systematic review of the scientific literature (identification of outcome measures and summary of psychometric properties), the summary of the evidence and the creation of the evidence tables. The reviewer (TM) discussed all issues and received feedback from Dr. George A. Wells and from Dr. Lucie Brosseau as to the format and content of the evidence tables.

The evidence tables incorporated the data from the studies pertaining to the psychometric properties of each of the included standardized functional capacity outcome measures. The properties were assessed according to the Terwee criteria (26) and were graded accordingly. One evidence table was created for each included standardized functional capacity outcome measures, for a total of thirty-one evidence tables (See Appendix R for example of evidence table).

C. CPG development process

One month prior to the Panel of Experts consensus meeting, the Panel of Experts members were sent a list containing the twenty eight included standardized functional capacity outcome measures that were to be reviewed during the meeting, and the references used to develop the evidence tables. The Panel of Experts members were asked to identify any outcome measures or references that may have been missed by the systematic review of the scientific literature. Any additional outcome measures suggested by the Panel of Experts members would be included for discussion at the consensus meeting. As a result of the requested feedback, three additional functional capacity outcome measures were added to the list. Therefore, a total of thirty-one functional capacity outcome measures were to be reviewed during the consensus meeting.

Two weeks prior to the scheduled consensus meeting, the Panel of Experts members received a binder containing the following information: 1) a list with the guideline group members; 2) a description of the study methodology and the panel of expert's involvement; 3) a summary table of the "Quality Criteria for Measurement Properties"; 4) a guideline for the "Overall Assessment" of the outcome measures; 5) a description of each of the identified outcome measures; 6) a list of abbreviations; 7) the evidence tables for each of the included outcome measures; and 8) the "Quality Criteria for Measurement Properties of Health Status Questionnaires" (26).

During the consensus meeting, the standardized outcome measures were reviewed by category (dyspnea, health related quality of life and function) which allowed the Panel of Experts to decide which outcome measure was/were most appropriate for use in clinical practice for that particular category. The objective of the consensus meeting was to review each standardized outcome measure, to provide an overall assessment of the outcome measure, to determine its appropriateness for use in clinical practice and to make evidence-based recommendations as to their use in clinical practice. See Appendix S for a description of the guideline development methodology and Panel of Experts involvement.

D. Overall assessment of outcome measures

The Panel of Experts members were required to review each of the included standardized outcome measures based on the following criteria: 1) the concepts that the outcome measure is intended to measure; 2) the psychometric properties of the outcome measure; 3) the outcome measures applicability for use in clinical practice based on time, efficiency and resources required to administer it in clinical practice; and 4) the quality assessment.

Following the review of the outcome measure, the Panel of Experts members were required to provide an overall assessment. The overall assessment criteria were developed specifically for this study and were based on the “Overall Judgment” component of the AGREE tool (107). The overall assessment criteria consisted of the three following categories: strongly recommend for use in clinical practice, recommend with provisions, and would not recommend for use in clinical practice.

Overall Assessment categories definitions:

Strongly Recommend:	high overall quality outcome measure recommended for use in clinical practice based on the strong performance of its measurement properties, strong content validity and appropriateness for this patient population.
Recommend with provisions:	moderate overall quality outcome measure that could be considered for use in clinical practice however requires further evaluation of its measurement properties as more information is needed to provide an overall assessment.
Would not recommend:	low overall quality outcome measure that is not recommended for use in clinical practice due to the poor performance of its measurement properties, poor content validity and inappropriateness for this patient population.

E. Formal evidence-based recommendations

The Panel of Experts members were required to make evidence-based recommendations regarding the use of each of the included standardized functional capacity outcome measures in clinical practice. The evidence-based recommendations were to be made: 1) prior to the consensus meeting based on the evidence tables that were provided to each of the members of the Panel of Experts; and 2) during the consensus meeting as a result of discussions that were held at the June 6th, 2008 Panel of Experts consensus meeting. The final evidence-based recommendations resulting from the discussions held at the Panel of Experts meeting and were made based on consensus.

5.4.1.5. *Consultation and peer review*

The final document summarizing the evidence-based recommendations developed by the Panel of Experts was distributed to the cardiac surgery sites that participated in the initial prevalence study survey. The survey respondents were asked to review the summary document and provide feedback on the recommendations. A feedback questionnaire was included in the final document that was distributed to the participating centers.

The Panel of Experts members were also sent a copy of the summary document. Their feedback was requested regarding the presentation of the recommendations as well as to the inclusion of pain related outcome measures into the recommendations. This dimension was not included in the initial systematic review of outcome measures and was not discussed at the Panel of Experts consensus meeting that was held on June 6th, 2008 in Ottawa.

5.4.1.6. *Presentation and dissemination*

The document summarizing the evidence-based recommendations consisted of a graphical presentation of the recommendations outlining the different measures that were included in each of the different cores (inner, middle, and outer), definitions of the different cores used to categorize the evidence-based recommendations, a brief summary of the recommended outcome measures, the methodology used to develop the guideline as well as a feedback questionnaire (Appendix T). The document was short, easy to read and presented the evidence-based recommendations in a graphical manner in an attempt to be more user-

friendly. The recommendations that resulted from the Panel of Experts meeting are discussed in greater detail in the results section (section 5.5) of this chapter.

5.4.1.7. Local implementation

The implementation component, which represents the manner by which the knowledge is transmitted to the clinicians and implemented into clinical practice, was not included in the goals of the study. However, the implementation component is addressed in the discussion component of the thesis.

5.4.1.8. Audit and review

The review component of the guideline process was not addressed by the present study. However it is recommended that all CPG be reviewed two years after completion in order to ensure that the recommendations are still supported by the evidence and applicable to the clinical setting given the changes that may have occurred (14).

5.5. Results

5.5.1. Primary objective: development of evidence-based recommendations for the CPG

5.5.1.1. Evidence tables

As a result of the systematic review and the prevalence study survey, a total of twenty-eight functional capacity outcome measures were identified and summarized in the form of evidence tables. The twenty-eight outcome measures were divided into three distinct categories: six dyspnea measures, four quality of life measures and eighteen function measures. The twenty-eight outcome measures that resulted from the systematic review of the literature did not include pain related outcome measures.

5.5.1.2. CPG development process

As a result from the initial feedback request regarding additional outcome measures to be included for discussion at the meeting, two additional outcome measures were added to the list as well as the creation of a fourth category for a total of thirty-one outcome measures

divided into four different categories. The two additional outcome measures that were suggested by the Panel of Experts members were the Quality of Life Index-Cardiac Version III or IV (64) and the Minnesota Living with Heart Failure Questionnaire (48). Evidence tables were created for the two additional outcome measures. They were presented and discussed during the consensus meeting along with the other twenty-eight outcome measures.

One Panel of Experts member also suggested adding vital signs to the list of outcome measures. Therefore, a fourth category was created to accommodate the suggestion and included the following measures: heart rate, respiratory rate, oxygen saturation (SpO₂) and blood pressure. The vital signs category is represented by the outcome measure number thirty-one.

5.5.1.3. Overall assessment of outcome measures

The “Overall Assessment” of the included outcome measures was discussed at the consensus meeting and evidence-based recommendations were developed based on these discussions. In addition to the “Overall Assessment” of the outcome measures, Panel of Experts members suggested that the burden, or barrier level, of administering the outcome measures in clinical practice be considered when deciding which outcome measures should be included in the evidence-based recommendations. The burden represents the additional time and resources that are required to administer the outcome measure in clinical practice. It was decided by the Panel of Experts members to categorize the outcome measures using the following two burden descriptors: low burden and high burden. One Panel of Experts member suggested that burden be replaced by barrier as it is a more positive qualifier compared to burden. Therefore, in addition to the overall assessment categories, Panel of Experts members were required to take into account the barrier level, either low or high, associated with the administration of each of the included outcome measures in clinical practice.

5.5.1.4. Issues discussed during the Panel of Experts consensus meeting

In addition to the discussions that were held concerning the overall assessment and the barrier levels of each of the included standardized functional capacity outcome measures,

several other issues were raised during the consensus meeting. Both general process issues as well as specific issues related to the different concepts being measured (dyspnea, quality of life, and function) were discussed during the meeting.

Each of the issues that were discussed during the Panel of Experts consensus meeting is described below.

A. Target client population

In terms of general issues with regards to the client population being targeted, clarification was requested as to the definition of post-operative and whether or not this included clients who were ventilated. For the purpose of the study, post-operative was a general term to describe any client who had undergone an open procedure requiring a sternotomy incision. This included adults (over 18 years of age) who had experienced any of the following procedures: coronary artery bypass graft, valve repair or replacement, heart transplant, cardiac tumor excision, or congenital heart defect repair. Clients who still required mechanical ventilation were not considered as part of the target population as they would be unable, at that point, to participate in the administration of the functional capacity outcome measures.

B. Inter-professional involvement

Issues related to the involvement of other health care professionals in the administration of the outcome measures were also discussed. It was determined that the outcome measures that would be included in the evidence-based recommendations would be solely administered by the physiotherapist.

C. Proxy compared to client responses to the outcome measure

Clarification was requested as to who would be expected to respond to the outcome measure/questionnaire: the client themselves or a proxy (such as a family member, friend). Due to the performance based nature of the outcome measures being reviewed, it was decided that the client themselves should perform or respond to the outcome measure/questionnaire.

D. Pre-operative physiotherapy education

The role and the importance of pre-operative physiotherapy teaching/education were also discussed by the Panel of Experts. The use of outcome measures in the pre-operative assessment unit (PAAU) was discussed as an area that could provide important information for comparing the functional capacity of cardiac clients before and after surgery. Initiating outcome measures in the PAAU would ensure a continuum of care for clients undergoing cardiac surgery procedures. However, it is currently not common practice for all cardiac surgery clients to be assessed by a physiotherapist prior to their surgery. A survey of physiotherapy practice in 1997 reported that only 40% of physiotherapists provided pre-operative care to surgical clients (upper abdominal, thoracic and cardiac surgery) (42). A CPG on peri-operative cardio-respiratory physiotherapy published in 2001 (42) did not make any recommendations regarding the pre-operative assessment and treatment of cardiac surgery clients. Recommendations were only made for the pre-operative assessment and treatment of abdominal surgery clients (42).

E. Other dimensions

The role and impact of other dimensions on the health of cardiac clients such as spiritual and emotional dimensions were also discussed. Despite the important impact on cardiac surgery clients, it was decided not to include outcome measures that target the assessment or evaluation of emotional and spiritual dimensions.

5.5.1.5. Formal recommendations

The final evidence-based recommendations were based on the summary of the evidence presented in the evidence tables, the overall assessment of the outcome measures based on the descriptors defined above, as well as on the barrier level, on the clinician, of administering the outcome measures in clinical practice.

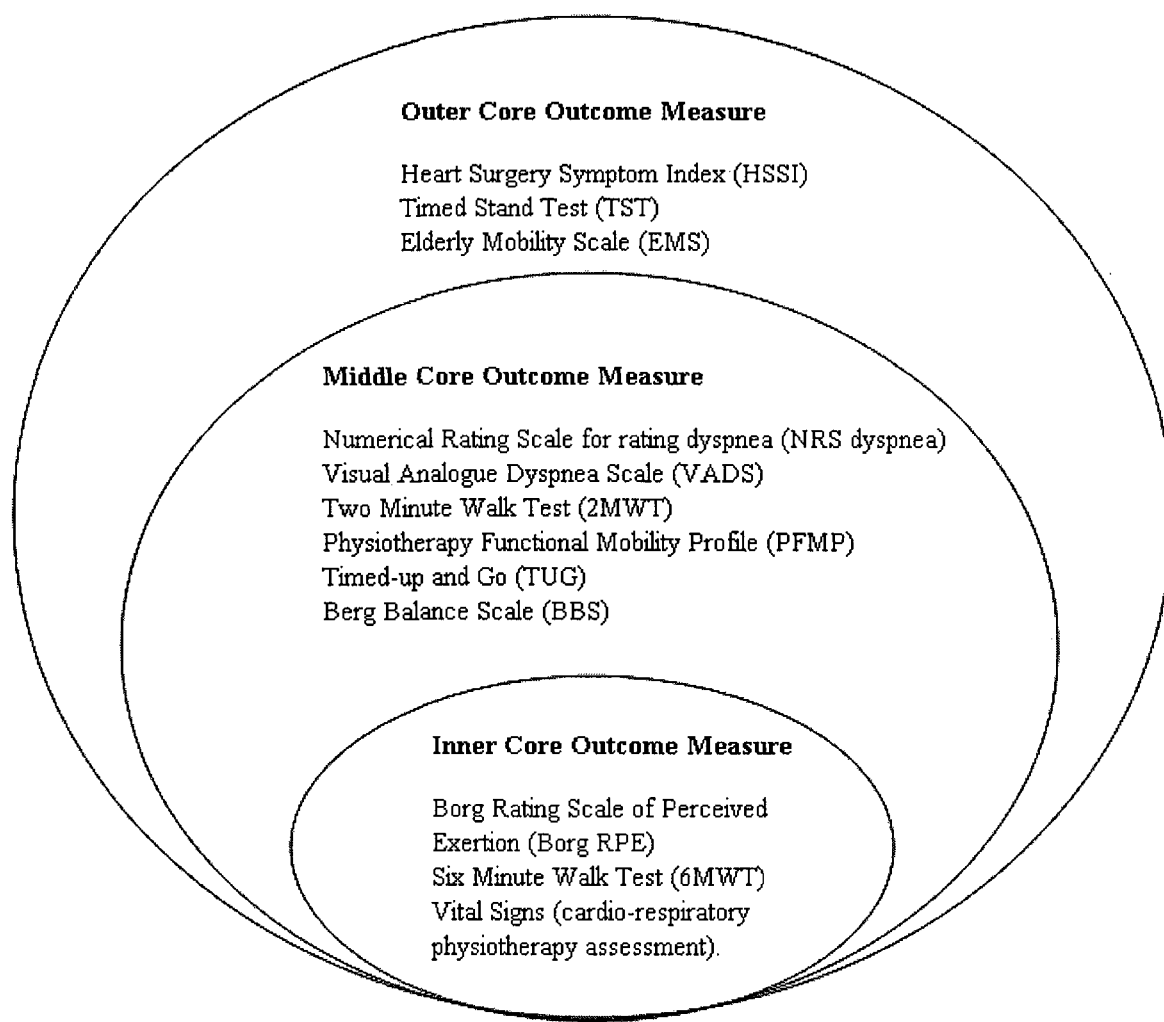
The evidence-based recommendations that resulted from discussions held at the Panel of Experts consensus meeting were based on consensus and all outcome measures were unanimously chosen to be part of the final recommendations.

In terms of outcome measures, nineteen of the thirty-one outcome measures discussed at the meeting were deemed inappropriate or not relevant for use among physiotherapists working with post-operative cardiac surgery clients. Therefore, only twelve outcome measures were included in the evidence-based recommendations. In terms of the different categories, three dyspnea category measures were included in the recommendations, one health related quality of life measure and seven function measures. A fourth additional category, vital signs, was also included in the recommendations that were developed by the Panel of Experts.

During the consensus meeting, the format in which the recommendations should be presented was discussed. It was decided that the twelve recommended outcome measures be divided into the following three categories: inner core outcome measures, middle core outcome measures and outer core outcome measures (See figure 5).

The inner core outcome measures are defined as the outcome measures that were strongly recommended for routine use in clinical practice to assess the functional capacity of all post-operative cardiac surgery clients. The middle core outcome measures were also recommended for use in clinical practice however only with specific post-operative cardiac surgery clients (based on the physiotherapist's assessment). Finally the outer core outcome measures were not recommended for use in clinical practice. They were found to be interesting to the Panel of Experts members and were thought to have potential for use in clinical practice. However they require further research and further psychometric testing prior to making recommendations regarding their adoption in clinical practice.

Figure 5 Recommendations for use of standardized functional capacity outcome measures



A. Inner Core Outcome Measures

The inner core outcome measures, which are the measures to be used in routine clinical practice, consisted of the Borg scale (69), the 6MWT (46) and vital signs (as part of a cardio-respiratory physiotherapy assessment). During the consensus meeting, it was decided that dyspnea should only be measured during activity and not at rest for this specific client population. The Borg scale (69) was chosen as one of the two inner core outcome measures as it has the strongest psychometric properties of all dyspnea scales. It is easy to use (low burden to the clinician), and it is low cost to administer. The only equipment required is a

paper version of the scale. The Borg scale (69) is a 12 grade scale that is used to quantify perceived exertion during exercise (69). Clients are shown the scale during exercise and are asked to rate their level of perceived exertion by taking into account how hard the exercise work rate is (69). All Panel of Experts members agreed that the Borg scale (69) should be part of the inner core measures and that dyspnea should only be measured during activity.

The 6MWT (46) was chosen as the second inner core outcome measure due to its strong psychometric properties. In addition to its strong psychometric properties, normative values also exist for the 6MWT (46) which facilitates the interpretation of the results obtained on the test for both the health care professional as well as the client. The 6MWT (46) received a unanimous vote in terms of its psychometric properties. However clinicians felt that the barrier level associated with administering the 6MWT (46) in clinical practice would be quite high. After discussing the issue, it was decided that the 6MWT (46) would remain an inner core outcome measure as the barrier level of the 6MWT (46) decreases over time due to the learning effect that occurs during the required practice trials. The American Thoracic Society Guidelines for administering the 6MWT states that two practice walks must be performed prior to carrying out the 6MWT (108). Furthermore, the Borg scale (69) is a component of the 6MWT (46) therefore reducing the barrier level on the clinician as the two inner core outcome measures are administered simultaneously. The measurement of the client's perceived exertion is required prior to initiating the 6MWT (46) and immediately following the test using the Borg scale (103). In addition to the measurement of perceived exertion, the measurement of heart rate, blood pressure and oxygen saturation is also required before and after the administration of the 6MWT (108). Therefore, the recommended inner core outcome measures are all integrated into the administration of the 6MWT (46,108) resulting in a reduced barrier level in terms of the administration of the recommended inner core outcome measures.

B. Middle Core Outcome Measures

The middle core measures, the measures recommended for use in clinical practice with specific client populations only, consisted of the NRS dyspnea (58), the VADS (59), the 2MWT (46), the PFMP (60), the TUG (67), and the BBS (65).

The NRS dyspnea scale (58) and the VADS (59) are two dyspnea scales that have been recommended for use in clinical practice with specific client populations due to their low barrier level to the clinician. In addition to their low barrier level, both scales are familiar to clients as they are based on the numeric and visual analogue pain rating scales (VAS) (109). As mentioned above, dyspnea is only to be measured with activity, not at rest.

The 2MWT (46), which is a modified and shortened version of the 6MWT (46), was determined to be in the middle core category due to its weaker psychometric properties when compared to the 6MWT (46). Only one study has been done, by Brooks et al (110) to evaluate the psychometric properties of the 2MWT (46) amongst cardiac surgery clients. Furthermore, no normative values currently exist for the 2MWT (46). With further psychometric testing among this specific client population, the 2MWT (46) has the potential to move up into the inner core measures as it represents a much lower barrier level to the clinician than the 6MWT (46).

The PFMP (60) is an outcome measure that was developed to assess and measure changes in functional mobility in adult hospitalized clients. The PFMP (60) was determined to be a middle core outcome measure as it only applies to specific client populations who are experiencing difficulties with lower level functional activities such as bed mobility and transfers. This results in issues around the measures applicability to this specific client population due to the potential for large ceiling effects. Issues have also been raised regarding the responsiveness of the instrument. Therefore, it was determined that the PFMP (60) should only be used to assess the functional capacity of post-operative cardiac surgery clients who are experiencing difficulties with low level functional activities. Further psychometric testing is also required among post-operative cardiac surgery clients prior to making any further recommendations as to its use in clinical practice.

The TUG (67) is an outcome measure with strong psychometric properties that was developed to assess balance disturbances in an elderly population. Therefore the TUG (67) is only applicable to specific post-operative cardiac surgery clients who are experiencing balance related difficulties. In addition to the specificity of the test, the TUG (67) has not been formerly tested in post-operative cardiac clients, which may have an impact on the TUG (67) psychometric properties. Cardiac surgery clients cannot use their upper extremities

to assist with transfers, which is one of the main components of the TUG (67). Therefore, further psychometric testing is required among post-operative cardiac surgery clients prior to making any recommendations regarding its use in physiotherapy practice.

The final outcome measure that was included in the middle core category is the BBS (65). The BBS (65) is a performance based measure of balance that is sensitive to a client's risk of falling. Balance impairments are not experienced by all post-operative cardiac surgery clients. Therefore, the BBS (65) is only applicable to assess the functional capacity of specific post-operative cardiac surgery clients who are experiencing balance impairments.

C. Outer Core Outcome Measures

Finally, the outer core outcome measures consist of the HSSI (51), the TST (68) and the EMS (66). All three outer core outcome measures require further research regarding their psychometric properties prior to being strongly recommended for use in clinical practice as part of the inner core measures.

The HSSI (51) is a health related quality of life measure that was designed to provide a disease specific outcome measure for clients following coronary artery bypass surgery (CABG). Issues related to the concepts that the instrument is intended to measure were raised during the meeting (surgery related symptoms and/or quality of life post surgery). It was decided that the HSSI (51) requires further psychometric testing prior to being recommended for use in clinical practice. Therefore, the HSSI (51) was determined to be in the outer core category as a potential physiotherapy outcome measure that requires further research.

The TST (68) is a test that was developed to quantify lower extremity muscle strength. The TST (68) is a time based functional capacity outcome measure where the client is required to perform ten sit to stand transfers. The demands of the TST (68) were questioned during the meeting as well as the concept that it is intended to measure: strength versus endurance. In addition to the issues surrounding the concept being measured, the TST (68) has poor psychometric properties (according to the "Quality Criteria were proposed for measurement properties of health status questionnaires" (26). Therefore it was included in the outer core measures as an interesting research agenda. With further psychometric testing, the TST (68)

may have the potential to be recommended for use in clinical practice once its purpose is clearly defined (strength versus endurance) and its psychometric properties have been assessed.

The third outer core outcome measure is the EMS (66). The EMS (61) is a reflection of a physiotherapy assessment of a geriatric client population. The EMS (66) assesses the client's ability to perform transfers, to walk a defined distance and measures their functional reach. Only one study has been done to evaluate the concurrent validity and the inter-rater reliability of the EMS (66). This measure requires a complete evaluation of its psychometric properties prior to making any recommendations for its use in clinical practice.

The document summarizing the evidence-based recommendations developed by the Panel of Experts members consists of a graphical presentation of the recommended outcome measures according to their respective categories (inner core, middle core and outer core), the definitions of the different categories, a description of the recommended outcome measures, a description of the guideline development process (methodology) as well as a feedback questionnaire (Appendix T).

5.5.1.6. Consultation and peer review

The summary document as well as the request for clinician feedback was distributed to the cardiac surgery centers electronically during the first week of September 2008. No clinician feedback was received regarding the recommendations for use of standardized functional capacity outcome measures in a post-operative cardiac surgery setting.

The summary document and request for feedback from the Panel of Experts members were also distributed electronically to all eleven Panel of Experts members during the first week of September, 2008. Feedback was received from six of the eleven members.

Five of the six guideline group members agreed that pain should be included in the evidence-based recommendations. They agreed that pain should be included as one of the inner core outcome measures. They all recommended that pain be measured using the Visual Analogue Scale (109). One Panel of Experts member did not agree with the addition of pain as a recommended outcome measure in the assessment of post-operative cardiac surgery clients.

Pain is generally treated by administering medications. In this client population, pain is not considered to be a physiotherapy related treatment goal and therefore is not required to be evaluated in an objective manner. According to this Panel of Experts member, the “Ordre Professionnel des Physiothérapeutes du Québec” does not require physiotherapists to objectively measure pain that is treated by medications (personal correspondence, September, 2008). Due to the lack of consensus on the inclusion of pain it was not included in the evidence-based recommendations.

5.5.1.7. Presentation and dissemination

The summary document containing the evidence-based recommendations was distributed electronically to each of the cardiac surgery sites across Canada that participated in the initial prevalence study survey. The recommendations were distributed electronically to each of the sites clinical managers who were then responsible for distributing the evidence-based recommendations to their respective clinicians. The evidence-based recommendations were sent to the clinical managers as they were the designated contact persons for each of the sites that participated in the prevalence study survey.

5.5.1.8. Local implementation

Implementation strategies are addressed in the discussion section of the thesis. The implementation of the CPG itself was not one of the objectives of the present study. The CPG summary document, describing the evidence-based recommendations, was distributed to the participating cardiac surgery centers. The CPG was not implemented in clinical practice.

5.5.2. Secondary objective: identification of a gap between research and clinical practice

In order to identify any potential gaps in knowledge between research and clinical practice, the outcome measures identified in the current practice section of the survey were compared to the outcome measures recommended by the Panel of Experts. The comparison of the two results identified a gap in terms of the use of outcome measures that were either: 1) not recommended by the Panel of Experts; or 2) identified as inappropriate for post-operative cardiac surgery client populations. A gap was also found with regards to the number of

physiotherapists currently using the recommended outcome measures in clinical practice. Only 43% of physiotherapists are using the 6MWT and approximately 75% are using the Borg.

Physiotherapists report using six functional capacity outcome measures in clinical practice that were determined to be inappropriate for post-operative cardiac surgery clients by the Panel of Experts: the SF-36 (47); the FIM (61); the Specific Activity Questionnaire (35); the LEFS (62); the COVS (63); and the MRC Dyspnea (70).

The EMS (61) and the TST (63) are two outcome measures being used in clinical practice that were not recommended for use in clinical practice by the Panel of Experts as they require further psychometric testing. The two outcome measures were identified as Outer Core outcome measures as they require further research prior to be adopted in clinical practice (see figure 5).

A total of six outcome measures were identified by the Panel of Experts as Middle Core outcome measures. The Middle Core Outcome Measures were defined as measures to be used for specific client populations based on the physiotherapist's assessment. A total of three of the Middle Core outcome measures were identified by survey respondents: 1) the BBS (65); 2) the TUG (67); and the 2MWT (46). A fourth Middle Core outcome measure, the PFMP (60) was listed in the question however none of the survey respondents reported using that measure within the last six months. The other two Middle Core outcome measures, the NRS for rating dyspnea (58) and the VADS (59) were not identified by clinicians as measures that were being used in clinical practice.

In terms of agreement between the evidence-based expert recommendations described in the CPG and clinical practice, the two most commonly used outcome measures by clinicians was the 6MWT (43%) (46) and the Borg scale (75%) (69). The 6MWT (46) and the Borg scale (64) were the two outcome measures that were recommended by the Panel of Experts for routine use in clinical practice to measure the functional capacity of post-operative cardiac surgery clients and were identified as Inner Core outcome measures. However, the third Inner Core Outcome Measures, vital signs, was only identified by one survey respondent.

Finally, a total of five outcome measures were identified by clinicians as measures that had been used in clinical practice in the last six months that were not included in the review or discussed at the Panel of Experts meeting: the Chedoke-McMaster Stroke Assessment (92); the Tinetti Gait and Balance Assessment Scale (93); the Foam and Dome (94); the Twelve Minute Walk Test (46); and the Shuttle Walk Test (91).

Therefore, based on the comparison between the evidence-based expert recommendations and the clinical practice of the survey respondents, a gap exists between the clinical use of the outcome measures listed above and the evidence-based recommendations developed by experts in the field of cardio-respiratory physiotherapy. Clinicians are using outcome measures that have not been recommended by the Panel of Experts for this particular population and they are all not consistently using the two outcome measures recommended by the Panel of Experts (6MWT and the Borg scale).

5.6. Discussion

The primary objective of the CPG development phase of the study was to develop evidence-based recommendations for a CPG regarding the use of standardized functional capacity outcome measures among physiotherapists working with post-operative cardiac surgery clients. The secondary objective was to identify a gap between research and clinical practice by comparing the results from the prevalence study survey and the evidence-based recommendations developed for the CPG. The evidence-based recommendations would guide physiotherapists in selecting evidence-based, standardized outcome measures when assessing the functional capacity of post-operative cardiac surgery clients.

5.6.1. CPG development

The development of the evidence-based recommendations for the CPG was based on the Scottish Intercollegiate Guideline Network (SIGN) methodology for the development of CPG (14).

The CPG topic was chosen based on both clinical interest and the need to establish evidence-based recommendations regarding outcome measure use in clinical practice among

physiotherapists working with post-operative cardiac surgery clients. The Panel of Experts members, who were to be involved in the development of the CPG, were chosen in discussion with Dr. George A Wells and Dr. Lucie Brosseau and consisted of Canadian experts in CPG development and cardio-respiratory physiotherapy.

The systematic review of the scientific literature discussed in chapter 3: Qualitative systematic review of the literature. The Cochrane Collaboration handbook for systematic reviews of interventions (45) was used to guide the systematic review process.

The results from the systematic review of the scientific literature were summarized in the form of evidence tables and were presented to the Panel of Experts. One month prior to the Panel of Experts meeting, each member received a binder containing a description of the thirty-one included outcome measures, their quality assessment and a description of the methodology for the development of the evidence-based recommendations for the CPG. The Panel of Experts was responsible for developing recommendations as to their use in clinical practice based on: 1) evidence tables summarizing each of the outcome measures psychometric properties; and 2) their barrier level in terms of their administration in clinical practice. The outcome measures were assigned one of three different overall assessment ratings: 1) recommended for use in clinical practice; 2) recommended with provisions; and 3) not recommended. A total of thirty one functional capacity outcome measures were reviewed during the consensus meeting that was held in Ottawa on June 6th, 2008: six dyspnea measures, six quality of life measures, eighteen function measures and vital signs. Consensus was reached for each of the outcome measures that were included in the evidence-based recommendations that were developed for the CPG.

Nineteen of the thirty-one outcome measures were deemed inappropriate for the physiotherapy assessment of the functional capacity of post-operative cardiac surgery clients. Evidence-based recommendations were developed for the remaining twelve functional capacity outcome measures according to the following three categories: inner core outcome measures; middle core outcome measures; and outer core outcome measures, which correspond to the three overall assessment categories: recommended in clinical practice, recommended with provision and not recommended.

A summary of the recommendations was distributed to each of the cardiac surgery sites that participated in the prevalence study survey and to each of the eleven Panel of Experts members. Feedback was requested as to the format and content of the evidence-based recommendations. A total of six Panel of Experts members provided feedback regarding the addition of pain as an outcome to be measured by physiotherapists working with post-operative cardiac surgery clients. Five of the six Panel of Experts members recommended that pain be included as an inner core measure and that it should be measured using the visual analogue pain scale (104). The sixth respondent did not agree that pain should be included as a recommended outcome measure as pain is generally treated by medications and therefore is not required to be measured in an objective manner.

In terms of clinician feedback, no respondents provided feedback as to the feasibility of implementing the developed CPG regarding the use of standardized functional capacity outcome measures in clinical practice.

5.6.2. Gaps in knowledge

Gaps in knowledge were identified in terms of: 1) outcome measures that are currently being used in clinical practice to assess the functional capacity of post-operative cardiac surgery clients; and in terms of 2) the knowledge of physiotherapists pertaining to the terminology used to evaluate the psychometric properties of the outcome measures.

The two most commonly used standardized functional capacity outcome measures were the 6MWT (46) and the Borg scale (69) with reported frequency of use of 43.6% and 74.4% respectively. This represents a gap in terms of outcome measure use as the 6MWT and the Borg scale were recommended by the Panel of Experts to be used with every post-operative cardiac surgery client. Therefore we are failing to objectively evaluate our clients with the recommended outcome measures 55% of the time in terms of endurance and 25.6% of the time in terms of dyspnea. In addition only one survey respondent reported using vital signs as an outcome measure.

Clinicians also reported using several different outcome measures that were not recommended for use in clinical practice (by the Panel of Experts) due to either their lack of

psychometric testing (in general) or their inappropriateness for the assessment of post-operative cardiac surgery clients. Specifically, clinicians reported using a total of six outcome measures that were not recommended by Panel of Experts: the MRC-dyspnea (70); the COVS (63); the LEFS (62); the FIM (61); the Specific Activity Questionnaire (35); and the SF-36 (47). Clinicians also reported using four outcome measures that were identified as requiring further psychometric testing among post-operative cardiac surgery clients: the 2MWT (46); the EMS (66); the TST (68); and the TUG (67). Finally, clinicians reported using a total of five outcome measures in clinical practice that were not considered during the Panel of Experts meeting: the Foam and Dome (94); The Tinetti Gait and Balance Assessment Scale (93); the Chedoke McMaster Stroke Assessment (92); the Shuttle Walk Test (91); and the Twelve Minute Walk Test (46).

In terms of the knowledge of the terminology used to evaluate the psychometric properties of outcome measures, further gaps in knowledge were identified. Specifically, there is a lack of understanding of the statistical terminology used to evaluate the different psychometric properties which may be impacting the choice of outcome measures used in clinical practice. This impact on the choice of clinical practice was demonstrated by the gaps in knowledge that were identified in terms of outcome measures being used in clinical practice compared to those recommended by experts in the field of cardio-respiratory physiotherapy.

Several methodological aspects were associated with the development of the CPG. The methodological aspects are discussed in the next section.

5.6.3. Methodological aspects

5.6.3.1. *Guideline development group*

The guideline development group consisted of a total of fourteen members. Three members formed the methods group and the remaining eleven members formed the Panel of Experts. The Panel of Experts members consisted of clinicians, experts in the field of CPG development and experts in the field of cardio-respiratory physiotherapy. There was no client representation on the Panel of Experts. Therefore the client's perspective related to the burden of administering the outcome measures, the meaningfulness of the outcome measures

and the impact of the outcome measure on their recovery was not taken into account during the development of the evidence-based recommendations.

5.6.3.2. Summary of the evidence

In order to identify potential functional capacity outcome measures for use by physiotherapists to assess post-operative cardiac surgery clients, a systematic review of the scientific literature was performed. The Cochrane Collaboration handbook for systematic reviews of interventions (45) was used to guide the systematic review process. One reviewer was involved in the screening, data extraction and quality assessment process. The involvement of only one reviewer for the identification of the outcome measures, the collection of data on their psychometric properties and the quality assessment of the outcome measures could have affected the quality and the comprehensiveness of the evidence tables that were created for the development of the evidence-based recommendations. In order to address this issue, two months before the CPG development meeting, the Panel of Experts members were sent the list of outcome measures being discussed at the consensus meeting, the list of references used to create the evidence tables, and the quality assessment criteria. They were required to review the lists provided to them and to make suggestions as to any additional outcome measures or references that should be included in the review. This process resulted in the addition of two functional capacity outcome measures and one category of outcome measures (vital signs).

5.6.3.3. Formation of recommendations

The evidence-based recommendations included in the CPG were based on pre-defined criteria which included: 1) the evaluation of the outcome measures psychometric properties; 2) the appropriateness for the client population; 3) the quality assessment of the outcome measure; and 4) the barrier level associated with its administration. The Panel of Experts members were required to provide an overall assessment of the outcome measures using a pre-defined assessment scale as well as to classify the outcome measures as having either a low or high barrier level. Both the barrier level classification and the overall assessment scale were subjective processes. The overall assessment scale was adapted from “Overall Judgment” component of the AGREE tool (107). The AGREE tool (107) is scale that is used

to assess the quality of CPG. Despite the subjectivity of both the overall assessment of the outcome measures as well as the barrier level, consensus was reached for each of the outcome measures discussed at the Panel of Experts consensus meeting.

5.6.3.4. Peer review process

The summary document containing the evidence-based recommendations included in the CPG that were developed by the Panel of Experts was distributed to all experts who participated in the development of the recommendations and to the twenty-three cardiac surgery sites who participated in the survey. Feedback was requested regarding both the format and the content of the recommendations. Clinicians were also requested to provide feedback regarding the feasibility of implementing the evidence-based recommendations in clinical practice. Six of the eleven Panel of Experts members responded to the feedback request. Five of the six experts recommended that pain be included as an additional outcome measure in the Inner Core category of recommended outcome measures. They also recommended that pain be measured using the Visual Analogue Pain Scale (VAS) (109).

No clinicians provided feedback as to the content, the format or the feasibility of implementing the recommendations. Therefore the impact of the evidence-based recommendations on clinical practice and would be difficult to assess due to the lack of feedback on the recommendations.

5.6.3.5. The inclusion of pain

Outcome measures were identified using several different methods including a systematic review of the literature, a prevalence study survey and in consultation with experts in the field of cardio-respiratory physiotherapy. A total of four categories of outcome measures were identified, discussed during a Panel of Experts meeting and recommended for use in clinical practice: dyspnea, health related quality of life, function and vital signs. Following the development of the recommendations, it was suggested by an expert in the field of physical rehabilitation outcome measures that pain be included in the recommendations.

The completed summary document with the recommended outcome measures, without the addition of pain, was sent to the Panel of Experts members and the cardiac surgery sites who

had participated in the initial prevalence study survey. Their opinion was requested regarding the addition of pain to the recommendations. Six Panel of Experts members responded to the feedback request and five of them agreed that pain should be included in the recommendations as an Inner Core outcome measure. Furthermore, all five Panel of Experts members who recommended that pain be included in the CPG also recommended that pain be measures using the VAS (109). The sixth Panel of Expert member did not agree with the inclusion pain as a recommended outcome measure. Consensus was not reached regarding the inclusion of pain as a recommended outcome measure and therefore it was not included in the recommendations.

In addition to the lack of consensus, the process used to present and discuss pain related outcome measures was not the same as the process used to discuss the other thirty-one outcome measures. The inclusion of pain did not follow the same methodological rigor as the other outcome measures. It was suggested as a potential outcome measure after the recommendations had been developed and it did not reach consensus among the Panel of Experts members. Therefore the role of pain in the assessment of the functional capacity of post-operative cardiac surgery clients requires further investigation and cannot be included in the recommendations.

One of the many challenges facing both researchers and clinicians is the integration of research findings into clinical practice. The complexity of integrating evidence into practical recommendations has limited its use in clinical practice (25).

6. Discussion

This chapter summarizes the results of the three phases of the study, discusses how the results compare to the recent literature on outcome measure use among physiotherapists, presents the limitations of the study related to the implementation of the evidence-based recommendations that were developed for the CPG, and puts forward recommendations and suggestions for areas of future research.

6.1. Summary of results

6.1.1. Phase I: systematic review of the literature

The first phase of the study consisted of a qualitative systematic review of the scientific literature. The objectives of the systematic review were to identify all functional capacity outcome measures available to physiotherapists to evaluate the functional capacity of post-operative cardiac surgery clients, and to identify and summarize their psychometric properties.

The outcome measures identified through the systematic review of the literature assisted in the development of the current practice question in the survey as well as in the creation of the evidence tables for the CPG recommendations.

Data was collected on eight psychometric properties for each of the identified outcome measures. The quality of the outcome measures was assessed using the “the “Quality criteria were proposed for measurement properties of health status questionnaires” by Terwee et al (26). A total of thirty-one functional capacity outcome measures were included in the review and summarized in the form of evidence tables.

6.1.2. Phase II: survey of outcome measure use in clinical practice

The second phase of the study consisted of a prevalence study survey of outcome measures used by Canadian physiotherapists working with post-operative cardiac surgery clients. The objective of the study was to determine the prevalence of functional capacity outcome measure use within this specific group of physiotherapists. Secondary objectives of the

survey were to identify outcome measures currently being used in practice, to determine the physiotherapist's knowledge of terminology specific to outcome measures and their psychometric properties, to identify barriers and facilitators to their use in clinical practice and to identify a gap between clinical practice and research.

The survey was developed with the assistance of experts in the field of survey methodology and outcome measures (GAW and LB). The survey was based on the Dillman format of total survey design (82,83). The framework of the survey was based on the revised Ottawa Model of Research Use (84). The revised Ottawa Model of Research Use was designed to guide and implement knowledge transfer activities (84). The survey was based on the Assess component of the model and consisted of the following three sections: demographic questions; practice environment; and physiotherapists.

A total of twenty-six cardiac surgery centers were recruited into the study of which twenty-three agreed to participate. The response rate for the survey was 41%. Responses were received from physiotherapists in every province except British-Columbia with the majority of respondents working in Ontario.

The sample of physiotherapists who responded to the survey were 76.9% female, had an average of 9.5 years of clinical experience and were an average age of 34.9 years. In terms of outcome measure use, 51.3% of respondent reported using outcome measures occasionally in their clinical practice (within the last 6 months) and approximately 56% of respondents stated that outcome measures were useful in clinical practice. The most common barriers to outcome measure use in clinical practice were resource, time and training related. In terms of facilitators, resources and training were the most common responses. Therefore resources and training were seen as both barriers and facilitators in terms either limiting or increasing the frequency of outcome measure use in clinical practice.

6.1.3. Phase III: CPG development

The third and final phase of the study consisted of the development of evidence-based recommendations, in the form of a CPG, regarding the use of outcome measures in clinical

practice among physiotherapists working with post-operative cardiac surgery clients. The evidence-based recommendations were developed using the SIGN methodology (14).

The guideline topic was chosen by the primary investigator (TM), in discussion with GAW and LB., and was based on clinical interest and the need to develop evidence-based recommendations regarding the use of standardized outcome measures in clinical practice. The guideline development group consisted of a total of fourteen Canadian experts in the field of cardio-respiratory physiotherapy and CPG development methodology.

A systematic review of the scientific literature was performed by the primary investigator in order to: identify all potential functional capacity outcome measures; and to summarize their psychometric properties. The data collected from the systematic review of the literature was summarized in the form of evidence tables. The evidence tables were distributed to the members of the Panel of Experts. The Panel of Experts members were responsible for the development of the evidence-based recommendations that were to be included in the CPG.

The evidence-based recommendations were developed during a consensus meeting that was held on June 6th, 2008 at the University of Ottawa Heart Institute. A total of thirty-one outcome measures were discussed at the consensus meeting. Nineteen of the outcome measures were determined to be inappropriate for post-operative cardiac surgery clients. Evidence-based recommendations were developed for the remaining twelve functional capacity outcome measures according to the following three categories: Inner Core outcome measures (recommended in clinical practice); Middle Core outcome measures (recommended with provisions); and Outer Core outcome measures (not recommended for clinical practice). The three outcome measures that were recommended for routine use in clinical practice to assess the functional capacity of post-operative cardiac surgery clients were the 6MWT (46), the modified Borg scale (69) and vital signs (as part of the physiotherapy assessment).

6.2. Current outcome measure use in clinical practice

Evidence-based practice has been identified as one of the Canadian Physiotherapy Association's (CPA) priorities since the move towards evidence-based practice began in the

1990's (104). The objective of the CPA new initiative, concerning evidence-based practice, was to provide physiotherapists with the necessary skills and tools to support the use of evidence-based knowledge in clinical practice (110). Six key areas were targeted in order to facilitate the acquisition of these skills. Outcome measures were identified as one of the targeted areas that would facilitate the use of evidence-based knowledge in clinical practice, along with entry level curriculum, continuing professional development, clinical practice guidelines, CPA accreditation program and the CPA data base program (110). The objective of the outcome measures initiative was ensure that Canadian physiotherapists consistently use standardized outcome measures in their clinical practice (110). This initiative resulted in the publication of the second edition of Physical Rehabilitation Outcome Measures (PROM II) (38) and resulted in a series of teleconferences on outcome measures through the CPA teleconference program.

Despite these new initiatives undertaken by the CPA, only 2.6% of respondents reported using outcome measures “almost always” and only 17.9% reported using them “most of the time”. The majority of respondents, 51.3%, reported using outcome measures “occasionally” which fails to meet the CPA outcome measure initiative objective. The results obtained by the survey of cardio-respiratory physiotherapists working with post-operative cardiac surgery clients, is consistent with the other surveys of physiotherapists that have been previously published in the literature.

Previous surveys of Canadian physiotherapists in 1992 (6) and 1999 (8) reported prevalence's of 41% and 42% of outcome measure use in clinical practice respectively (6,8). The investigators specifically asked physiotherapy departments whether or not they used outcome measures (yes or no question) in their clinical practice. The current survey questions were based on the physiotherapists use of outcome measures compared to the department's use and was based on frequency of use in clinical practice compared to use in the form of a yes or no question. Therefore it is difficult to compare the results as the questions were target to different populations (departments compared to clinicians) and the type of question pertaining to outcome measure use was different (use compared to frequency of use). However, if the frequency categories on the current survey were combined, the percentage of physiotherapists who use outcome measures in their clinical

practice would be approximately 71.8% (combination of occasionally, most of the time and almost always) which is an increase compared to the surveys conducted in 1992 (6) and 1999 (8). The results of the Canadian surveys conducted in 1992 (6) and 1999 (8) also found that the majority of physiotherapy departments were using their own department forms to evaluate and measure client progress. No respondents to the current survey listed their own department forms in the outcome measure question in the survey however this does not imply that they are not being used in clinical practice. In addition to the target population and the format of the questions, the characteristics of the survey respondents across all surveys are quite different which also limits the comparisons of the results. The survey done in 1992 was a random sample of all physiotherapy departments across Canada, the survey done in 1999 was of 5 health care facilities in the Toronto area and the current survey was a census of all physiotherapists working with post-operative cardiac surgery clients. Cardio-respiratory physiotherapy is relative young in terms of research and use of outcome measures compared to other areas practice such as orthopedics and neurosciences and therefore it is difficult to make comparisons between the different groups. Furthermore, the issues that are being addressed by the physiotherapists working with these different client populations are also quite different and therefore the outcomes that are being measured to evaluate progress are quite different as well.

Surveys conducted in Scotland and Nigeria also reported similar results in terms of outcome measure use among physiotherapists. A prevalence of 39% was reported by a survey of occupational and physiotherapists in Scotland (7) and only 10% of surveyed Nigerian physiotherapists reported using outcome measures “often” in clinical practice (9). The survey that was conducted in Scotland was also targeting physiotherapy and occupational therapy departments compared to the clinicians themselves and therefore not comparable to the results obtained by the current survey among cardio-respiratory physiotherapists.

The only evidence of 100% outcome measure use was reported by a group of researchers in Ireland (111). They surveyed physiotherapists working in a rehabilitation setting with geriatric clients in 1998 and in 2003. The 1998 survey obtained an outcome measure use of 30-50%, which is consistent with the Canadian and Scottish surveys (prevalence of 41% and 42% for the Canadian surveys and 39% for the Scotland survey). The follow-up survey done

in 2003 obtained an outcome measure use of 100% for the assessment of mobility and balance (111). The results from the 2003 survey (111) highlights the differences in outcome measure use between different areas of practice of physiotherapy and is reflective of the amount of research that is currently available to clinicians on the assessment of mobility and balance in a rehabilitation setting with geriatric clients. Despite the high prevalence of outcome measure use for the assessment of mobility and balance disorders, only 66% of physiotherapists reported using standardized outcome measures when assessing clients with Parkinson's disease, stroke, gait disorders and decreased exercise tolerance (111).

6.3. Usefulness and benefits of outcome measures in clinical practice

The results of the prevalence survey found that 56.4% of physiotherapists reported that outcome measures are useful in clinical practice and that 7.7% find them very useful. A large percentage of physiotherapists find them only somewhat useful (17.9%) and not very useful (7.7%). Despite the fact that 56.4% of physiotherapists find them useful, only 17.9% of clinicians are using them most of the time in clinical practice with the majority of respondents using them on an occasional basis. This discrepancy in the results is indicative of the lack of knowledge regarding both the benefits of the outcome measures and their interpretation, as well as institutional barriers that currently exist regarding their consistent use in clinical practice. The average number of years of clinical experience of the survey respondents was 9.5 years. Therefore the integration of outcome measure education into the physiotherapy curriculum would not have taken place when they went through the program. This would result in a lack of knowledge as to their benefits in clinical practice for objectively evaluating client progress as well as the interpretation of the results obtained from the outcome measure. In addition to the knowledge barriers, this limited use of consistent outcome measure use in clinical practice despite their perceived usefulness is also reflective of the health care context and the time and resource restraints that are currently being imposed on clinician. The average length of stay of a surgical patient is currently 5 days (13) and therefore provides a very short time frame for the physiotherapists to integrate outcome measures into their daily clinical practice.

6.4. Confidence in using outcome measures outcome measures

A limited number of respondents reported being confident when using outcome measures in clinical practice (33.3%). The majority of respondents (43.6%) stated that they were only somewhat confident when using outcome measures in clinical practice. These results conflict with the results obtained in the question pertaining to barriers to outcome measure use in clinical practice. Only 23.1% of respondents reported that lack of confidence was a barrier to outcome measure use. Furthermore, 87.1% of respondents reported that training would facilitate outcome measure use in clinical practice. Training would consequently also increase confidence in using the outcome measure therefore there are some discrepancies in terms of the responses to the questions pertaining to confidence, barriers and facilitators. Lastly, only 10.3% of respondent agreed that they were leaders in outcome measure use in their clinical practice which is reflective of both the confidence of the physiotherapists in using outcome measures as well as their training in outcome measure use. The results obtained in this survey are consistent with results from a survey of Irish physiotherapists (111).

6.5. Knowledge of psychometric terminology

In addition to discrepancies in terms of usefulness, benefits of outcome measures and confidence in using outcome measures in clinical practice, huge gaps were also identified in terms of the physiotherapist's knowledge of terminology. Only 35% of physiotherapists could explain the following terminology to others: validity, reliability and sensitivity to change and only 41% could explain inter-rater reliability and intra-rater reliability. If a clinician has limited understanding of the concepts underlying the outcome measure they would also fail to use them in clinical practice (in a consistent manner), would have difficulty interpreting the results and would fail to understand the benefits of using outcome measures in clinical practice. Therefore this gap in knowledge is a direct effect of the training of physiotherapists and ultimately has an impact on the use of outcome measures in clinical practice. This gap in knowledge is supported by the results of a study by physiotherapists working in Ireland (111). The physiotherapists were confident in the administration of the outcome measure however they were less confident about: 1) their

knowledge of reliability and validity when choosing the best measure; 2) knowledge about scale development; and 3) knowledge about the interpretation of the score obtained by the outcome measure (111). Physiotherapists were confident in their skills in terms of administering the outcome measures however their knowledge of the different terminology used to describe the psychometric properties of the outcome measures was lacking.

6.6. Barriers to outcome measure use in clinical practice

The reported barriers and facilitators to outcome measure use are consistent across all studies investigating the use of outcome measures in clinical practice by physiotherapists. In the present survey of physiotherapists in the field of cardio-respiratory the most commonly reported barriers were time, lack of resources and limited training. The Canadian surveys (6,8) reported lack of time, limited knowledge about the outcome measure, and limited knowledge about outcome measure development as the most common barriers. The most commonly reported barriers in the survey of Irish physiotherapists (111) were time and lack of resources, which are consistent with those reported by the current prevalence study survey. The reported barriers found in both the Canadian study and the Irish study support the notion that the knowledge and confidence of physiotherapists when using and choosing outcome measures is directly related to their frequency of use of the outcome measure in clinical practice. These results emphasize the importance of including outcome measure training and education about the psychometric properties of outcome measures in order to increase confidence, knowledge and ultimately use of outcome measures in clinical practice.

6.7. Quantity of existing outcome measures and quality assurance

A total of 45 physiotherapy functional capacity outcome measures for evaluating post-operative cardiac surgery clients were identified through the systematic review of the literature. This is a huge task to sort through for a clinician who has both time restraints and lack of knowledge in terms of outcome measures and their psychometric properties. When selecting outcome measures to use in clinical practice, the clinician must consider the client and their needs, what aspect of the client's progress that needs to be evaluated, the time and resources required to administer the outcome measure, the clinician's familiarity

with the outcome measure and the quality of the outcome measure based on the evaluation of its psychometric properties. The clinician's knowledge of psychometric properties and the statistical tests required to evaluate them will have an impact on their ability to assess the quality of the outcome measure. These two challenges, selecting an appropriate outcome measure from the literature and assessing the quality of the outcome measure further support the development of the evidence-based recommendations and highlight the importance of using an objective scale, such as the Terwee scale (26), when assessing the methodological quality of the outcome measures.

6.8. Limitations

CPG are systematically developed recommendations that assist health care practitioners in the clinical decision making process with regards to the most appropriate interventions for a specific health care problem (99). The objective of the CPG is to improve quality of care by encouraging the adoption of interventions that have proven to be effective and by discouraging those that are ineffective (99,101).

Despite the abundance of evidence-based resources, such as CPG, a gap continues to exist between research findings and their adoption into clinical practice (112). This knowledge gap, between research findings and clinical practice, can be attributed to many different reasons. The adoption of research findings into clinical practice is often a slow process resulting in a time lag between the dissemination of the research findings and their implementation into clinical practice (112). Furthermore, the rate at which evidence is accumulating is surpassing the health care professional's ability to keep up to date (112). Several factors are known to have an impact on the uptake of evidence (such as CPG): the characteristics of the research evidence, the quality of the evidence supporting the recommendations, the compatibility of the recommendations with the practitioners beliefs, a concrete description of the action to be taken to change patterns of care, the need to develop fewer skills, and less organizational change required (98).

Knowledge translation is defined as the "exchange, synthesis, and ethically sound application of knowledge-within a complex system of interactions among researchers and users" (<http://www.cihr-irsc.gc.ca/e/8505.html>). The goal of knowledge translation is to address the

gap between research and knowledge synthesis and the implementation of this knowledge in order to improve health outcomes (112). Several different interventions aimed at implementing this knowledge have been developed and evaluated in terms of their effectiveness at bridging the gap between knowledge synthesis and implementation of this knowledge in clinical practice. However the evidence base that currently exists to guide the selection of the most effective guideline dissemination and implementation strategy remains incomplete (113,98,101).

6.8.1. Knowledge to action process

The knowledge-to-action process consists of two concepts: knowledge creation and action (112) (Figure 6). The knowledge creation phase is represented by a funnel and consists of knowledge inquiry, knowledge synthesis and knowledge tools/products. The knowledge action phase represents the cycle that leads to the implementation of the knowledge that has been created (112). It is a dynamic cycle that can be influenced by all phases of the action cycle or the knowledge creation phase. The phases of the action cycle consist of the identification of an issue, the critical appraisal of the evidence, the adaptation of the knowledge to the setting, the assessment of barriers to the utilization of the knowledge, the development of tailored interventions to address the identified barriers, the monitoring of the utilization of the knowledge, the evaluation of the impact of the knowledge and the maintenance of the utilization of the knowledge in clinical practice (112). The implementation of evidence into practice is a dynamic process that is influenced by the characteristics of the evidence that has been created, the existing barriers to the implementation of the evidence into practice and the method used to implement the evidence into practice (98).

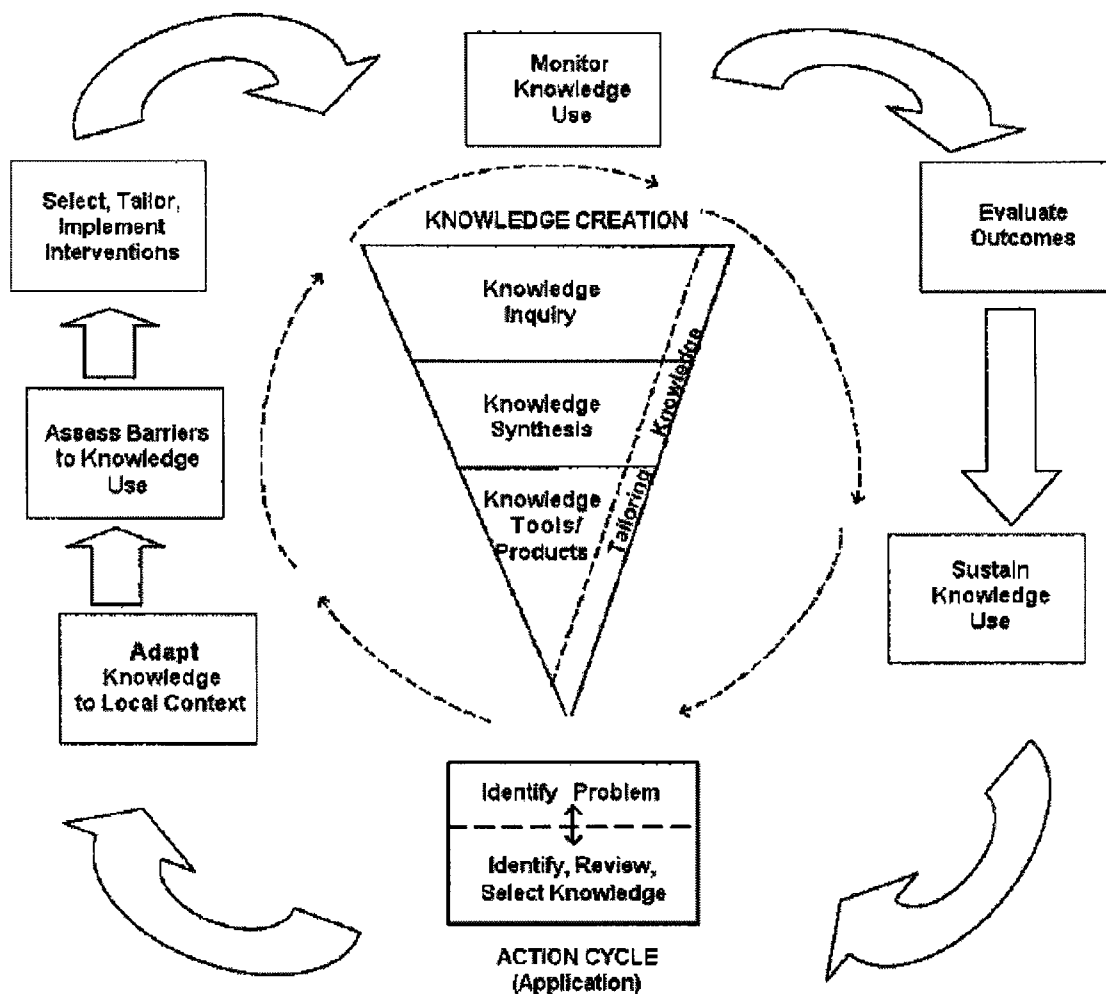
6.8.2. Knowledge translation methods

CPG are becoming increasingly common in the health care literature (101). Due to the cost of developing, disseminating and implementing CPG into clinical practice, it is important to select the most effective strategy to ensure improvements in health care professional performance and patient outcomes (101). Several different methods have been proposed for implementing evidence-based scientific knowledge into clinical practice such as printed

educational materials, workshops and conferences, educational outreach visits, opinion leaders, audit and feedback, tailored interventions, reminders and multi-faceted interventions.

Figure 6: Knowledge to action process

Graham ID, Logan J, Harrison MB, Straus SE, Tetroe J, Caswell W, Robinson N. Lost in knowledge translation: time for a map? *The Journal of Continuing Education in the Health Professions* 2006;26:13-24



Printed education materials, such as publications and CPG, are printed or published materials that have been developed in order to improve or change knowledge and/or practice (114). They are a passive method of dissemination of scientific evidence. The distribution of printed materials is one of the most frequently used methods of disseminating evidence as they are relatively low cost, familiar to health care professionals, easily accessible and a

convenient method for distributing evidence-based knowledge to health care professionals (114). A systematic review of the effects of printed educational materials on the performance of health care professionals found that printed education materials had limited effect on health care professionals in terms of changing clinical practice (114). A review of nine systematic reviews evaluating the effects of printed educational materials on professional practice also showed mixed effects (98). Finally, a systematic review of guideline dissemination and implementation strategies concluded that the distribution of educational materials had modest effects in terms of improving the process of care (101). Therefore printed education materials alone have limited effects in terms of changing clinical practice (98).

Continuing education, in the form of conferences and workshops, is another strategy that is currently being used to disseminate evidence-based knowledge. The objective of these conferences and workshops is to improve the health care professional knowledge and performance in clinical practice and to improve quality of care and patient outcomes (115). Conferences and workshops include passive or didactic presentations, interactive sessions, a combination of the two formats and may also include any of the following: meetings, lectures, seminars, symposia, rounds and courses (115,116). A systematic review of the effects of continued medical education in the form of workshops and conferences among physicians was done by Davis et al (115). Didactic sessions were found to have no effect on health care professional performance (115). Interactive sessions and mixed interventions of both didactic and interactive elements both resulted in positive effects on physician performance (115). Another systematic review done by the Cochrane Collaboration evaluated the effects of workshops and conferences (didactic, interactive and mixed sessions) on the following behaviors: management of a clinical problem, prescribing, prescribing counseling, preventative care, communication skills and specific targeted treatment interventions (116). Didactic sessions were found to have no significant effect on the targeted behaviors whereas both interactive sessions and mixed interventions resulted in moderate to large effects on health care professional behavior (116). In terms of CPG dissemination and implementation strategies, educational meetings were shown to have a very small effect on clinical uptake of the CPG (101). However the systematic review only included three comparisons. Therefore further research is required prior to making

recommendations regarding the effectiveness of educational meetings in disseminating and implementing CPG.

Educational outreach visits are defined as visits from external experts or trained facilitators to a specific health care setting. The objective of the outreach visit is to change the performance or behaviors of the health care professionals working in a targeted health care setting (98,117). The expert or trained facilitator provides information to the health care professionals in the form of performance related feedback (117). A systematic review evaluating the effects of educational outreach showed that educational outreach visits had a small to moderate effect on health care professional behavior, but that the effects were variable depending on the behavior being evaluated (117). A review of eight systematic reviews evaluating the effects of educational outreach visits found similar results. They found that educational outreach visits were especially effective for prescribing and preventive behaviors (98).

An opinion leader is an individual who is perceived to be influential (by his or her peers) and able to disseminate and implement evidence-based knowledge among health care professionals. According to the social learning theory, individuals who are credible, who can be trusted and who are liked by their peers have the ability to persuade others to change their clinical practice behaviors (118). Opinion leaders use the following educational strategies to disseminate and implement evidence-based information: informal teaching, community outreach sessions, small group teaching, preceptor, and formal lectures (119,120). In terms of the effectiveness of opinion leaders in changing health care professional practice, previous systematic reviews have found mixed results (98). A recent systematic review undertaken by Doumit et al (118) for the Cochrane Collaboration found that the use of opinion has a positive effect in disseminating and implementing evidence-based knowledge into clinical practice (118). When comparing the use of opinion leaders to no intervention, they found a 7% decrease in non-compliance with evidence-based knowledge (118).

Audit and feedback is the review of clinical performance, with or without recommendations for changing clinical practice, over a specific period of time. The feedback can either be passive or active and can be given in a verbal, written or electronic format (121). The objective of the audit and feedback strategy is to provide feedback to health care

professionals regarding their clinical practice behaviors when compared with that of their peers or with accepted CPG (121). The health care professional's ability to accept feedback, their willingness to change, the source of the feedback, the frequency of the feedback and the format in which the feedback is provided will have an impact on the effectiveness of the of the audit and feedback strategy (122,121). A review of sixteen reviews on the effectiveness of audit and feedback found mixed effects with regards to changing clinical practice (98). They found that audit and feedback was most effective in changing test ordering and preventive care behaviors. They also found that the effect size of the intervention was influenced by the type of feedback, the source of the feedback, the format and frequency of the feedback (98). A systematic review that examined the effectiveness of audit and feedback on professional practice and health care outcomes found small to moderate effects with regards to changing clinical practice (121). Finally, a systematic review of CPG dissemination and implementation strategies showed that audit and feedback had a modest effect on clinical practice and improved care (101).

Tailored intervention is a knowledge translation strategy that targets a specific barrier to change. It involves the identification of important barriers to change among the targeted health care professionals and the selection of the most effective strategy to change practice behaviors based on the barrier assessment (124). The goal of this knowledge translation strategy is to change clinical practice by overcoming the identified barriers (124). A systematic review investigating the effectiveness of tailored interventions on health care practice and patient outcomes was done by the EPOC group of the Cochrane Collaboration (124). The review showed mixed results with variation in the direction of the effect size (124). The authors of the review reported that the mixed effects were due to the poor reporting of how the barrier influenced the choice of the knowledge translation strategy as well as the poor reporting of the effectiveness of the intervention (124). Studies that used multi-faceted interventions with an active component showed larger effects than the two studies that used passive methods of knowledge translation. Therefore, tailored interventions may have an impact on health care practice and patient outcomes however its effect remains uncertain.

Reminders consist of providing patient or behavior specific information, verbally, on paper or on a computer, to a health care professional. The goal of the reminder is to prompt the health care professional to recall information regarding a behavior that is either to be performed or avoided (101). The reminder can be delivered through the health care professional's general education, through medical records or by interacting with peers. A systematic review of CPG dissemination and implementation strategies studied the effectiveness of reminders compared to no intervention or usual care (101). The targeted behaviors were prevention, general management, prescribing, discharge planning and financial procedures (101). Reminders were found to have a moderate effect on CPG implementation with a median effect of 14.1% improvement in health care professional performance. Comparable results were reported in a systematic review of reviews on the effectiveness of reminders in changing health care professional's performance (98). They found that reminders were mostly effective in changing health care professional behavior, especially in terms of prevention.

Finally, multi-faceted interventions are the use of several strategies to achieve changes in health care professional behaviors and client outcomes. The most frequently reported multi-faceted interventions are combinations of the following: educational materials, educational meetings, reminders and audit and feedback (101). When comparing multiple educational outreach sessions to no intervention the majority of the studies resulted in improvements in performance of care. The studies also found that a combination of educational materials and educational outreach was relatively ineffective in disseminating and implementing CPG (101). The combination of educational materials, educational meetings and educational outreach as well as the combination of educational materials and audit and feedback both resulted in modest improvements (median improvement of 7.4%) in process of care (101). The combination of reminders and patient directed interventions, in terms of CPG dissemination and implementation, was evaluated and showed modest improvements in performance (101). Finally, the combination of educational materials, educational meetings and organizational interventions resulted in small effects on guideline dissemination and implementation (101). Therefore, in terms of the most effective combinations of strategies for disseminating and implementing CPG (compared to no intervention), educational

materials in combination with audit and feedback and reminders in combination with patient directed interventions had the greatest effects (modest effects) (101).

Comparisons were also made between multi-faceted interventions and other interventions. The multi-faceted interventions consisted of the following: 1) educational outreach strategies compared to other interventions; 2) the combination of educational materials and reminders compared to educational materials alone; 3) educational meetings and reminders compared to educational meetings alone; and 4) the combination of educational materials, educational meetings and reminders compared to educational materials and educational meetings. When comparing multiple educational outreach strategies to other interventions the majority of the studies demonstrated improvement in performance with modest effects. However the effects were less than those obtained when comparing multiple interventions that included educational outreach to no intervention (101). Educational materials and reminders compared to educational materials alone found that the combination of educational materials and reminders was more effective than educational materials alone in the dissemination and implementation of CPG (101). The combination of educational meetings and reminders compared to educational meetings alone was also found to be more effective than educational meetings alone (101). Finally, the combination of educational materials, educational meetings, and reminders was more effective in disseminating and implementing CPG than educational materials and educational meetings alone (101).

A single most effective knowledge translation strategy, with regards to the dissemination and implementation of CPG into clinical practice, has yet to be determined. However, based on the results from several different systematic reviews, different strategies have been shown to be more effective than others (115,119,116,98,101,124,121,118,117,114). The most effective knowledge translation strategies in terms of impact on health care professional's behaviors and patient outcomes were audit and feedback and educational outreach sessions that involved an interactive component. In terms of single intervention strategies regarding the effectiveness of guideline dissemination and implementation, it was found that patient directed measures and reminders were the most effective intervention strategies (101). In terms of the most effective combinations of strategies for disseminating and implementing CPG (compared to no intervention), educational materials in combination with audit and

feedback and reminders in combination with patient directed interventions had the greatest effects (modest effects).

Clinicians continue to engage in passive methods of knowledge dissemination, such as courses, conferences, meetings and educational rounds/in-services. Despite the lack of evidence regarding the effectiveness of knowledge and guideline dissemination strategies, passive interventions have been shown to be relatively ineffective and results in small changes in clinical practice (113). Therefore there is a need to change the way that health care professionals learn new skills and expand their knowledge base.

6.9. Recommendations

- 1) Based on the responses to the survey, there needs to be more opportunities for physiotherapists to acquire new skills related to outcome measures administration in clinical practice in order to increase both their knowledge base as well as their confidence level.
- 2) Based on the responses to the survey, there needs to be more opportunities for physiotherapists to acquire new skills related to the knowledge of the terminology involved in the development and evaluation of outcome measures.
- 3) There needs to be improved education regarding the quality assessment of physical rehabilitation outcome measures in order to provide physiotherapists with a framework when choosing outcome measures in clinical practice.
- 4) In order to ensure that all physiotherapists are consistently using outcome measures in clinical practice, each site should consider including outcome measures as integral components of their charting.

6.10. Future research

6.10.1. Role of pain in the evaluation of post-operative clients by physiotherapists

The Panel of Experts members were not able to reach consensus regarding the addition of pain as an outcome when evaluating or assessing the functional capacity of post-operative

cardiac surgery clients. The addition of pain as a recommended inner core outcome measure was suggested by five of the six Panel of Experts members who participated in the development of the guidelines. Therefore, further research is required regarding the role of pain as outcome.

6.10.2. Feasibility of implementing recommendations into clinical practice

The evidence-based recommendations developed for the CPG recommends that the 6MWT (46) be used routinely in clinical practice to assess the functional capacity of post-operative cardiac surgery clients. During the Panel of Experts meeting, the barrier level of performing the 6MWT (46) with each post-operative cardiac surgery client was discussed. Despite its strong psychometric properties, clinicians felt that the barrier level may be too high. Clinician feedback was requested regarding the feasibility of implementing the proposed guidelines. However no clinicians responded to the feedback request therefore the feasibility of implementing the recommendations in clinical practice is unknown.

6.10.3. Knowledge translation strategy to disseminate and implement recommendations among physiotherapists

Research has shown that passive dissemination of information is relatively ineffective in changing health care practitioner's behaviors (113). However, physiotherapists continue to engage in and participate in passive methods of disseminating scientific information such as conferences, rounds and didactic courses. Several different strategies were discussed in chapter IV of the thesis, however their effectiveness remains uncertain. Furthermore, none of the studies specifically targeted physiotherapists. Therefore there is a need to determine the most effective knowledge translation strategy to disseminate and implement recommendations among physiotherapists.

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APPENDIX A: SEARCH STRATEGY

The following search strategy was used in CINAHL and modified for searching EMBASE and MEDLINE:

- 1 "Outcome Assessment (Health Care)"/ (0)
- 2 Questionnaires/ (76538)
- 3 Questionnaires/ or Self Concept/ (82053)
- 4 or/1-3 (82053)
- 5 Aptitude/ (164)
- 6 "Recovery of Function"/ (0)
- 7 capacity.mp. (9646)
- 8 life habits.mp. (258)
- 9 "Activities of Daily Living"/ (7817)
- 10 Walking/ (4079)
- 11 Physical Endurance/ or Exertion/ (3137)
- 12 impairment.mp. (11186)
- 13 "Activities of Daily Living"/ or Disability Evaluation/ (9815)
- 14 [Disability Evaluation/mt, cl, st, sn [Methods, Classification, Standards, Statistics & Numerical Data]] (0)
- 15 "Quality of Life"/ (16127)
- 16 Health Status Indicators/ (3951)
- 17 or/5-16 (52513)
- 18 4 and 17 (9696)
- 19 thoracic surgery.mp. [mp=title, subject heading word, abstract, instrumentation] (561)
- 20 exp thoracic surgery/ (11250)
- 21 cardiac surgery.mp. [mp=title, subject heading word, abstract, instrumentation] (1913)
- 22 heart surgery.mp. [mp=title, subject heading word, abstract, instrumentation] (2721)
- 23 cardiovascular surgery.mp. [mp=title, subject heading word, abstract, instrumentation] (635)
- 24 exp cardiovascular diseases/su (5225)
- 25 exp cardiovascular surgical procedures/ (0)
- 26 or/19-25 (16053)
- 27 18 and 26 (219)
- 28 limit 27 to english language (215)
- 29 [from 28 keep 1-614] (0)
- 30 from 28 keep 1-215 (215)

***APPENDIX B: DATA COLLECTION AND QUALITY ASSESSMENT
SCALE***

Table 1
Quality criteria for measurement properties of health status questionnaires

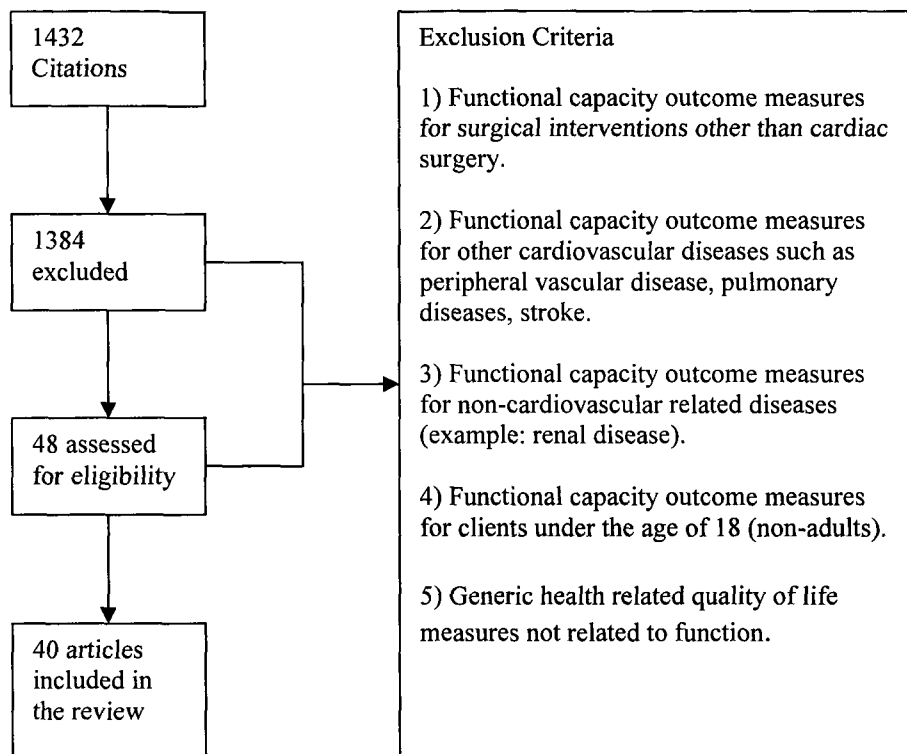
Property	Definition	Quality criteria ^{a,b}
1. Content validity	The extent to which the domain of interest is comprehensively sampled by the items in the questionnaire	+A clear description is provided of the measurement aim, the target population, the concepts that are being measured, and the item selection AND target population and (investigators OR experts) were involved in item selection; ?A clear description of above-mentioned aspects is lacking OR only target population involved OR doubtful design or method; –No target population involvement; 0No information found on target population involvement.
2. Internal consistency	The extent to which items in a (sub)scale are intercorrelated, thus measuring the same construct	+Factor analyses performed on adequate sample size (7 * # items and ≥ 100) AND Cronbach's alpha(s) calculated per dimension AND Cronbach's alpha(s) between 0.70 and 0.95; ?No factor analysis OR doubtful design or method; –Cronbach's alpha(s) <0.70 or >0.95, despite adequate design and method; 0No information found on internal consistency.
3. Criterion validity	The extent to which scores on a particular questionnaire relate to a gold standard	+Convincing arguments that gold standard is "gold" AND correlation with gold standard ≥ 0.70 ; ?No convincing arguments that gold standard is "gold" OR doubtful design or method; –Correlation with gold standard <0.70, despite adequate design and method; 0No information found on criterion validity.
4. Construct validity	The extent to which scores on a particular questionnaire relate to other measures in a manner that is consistent with theoretically derived hypotheses concerning the concepts that are being measured	+Specific hypotheses were formulated AND at least 75% of the results are in accordance with these hypotheses; ?Doubtful design or method (e.g., no hypotheses); –Less than 75% of hypotheses were confirmed, despite adequate design and methods; 0No information found on construct validity.
5. Reproducibility		
5.1. Agreement	The extent to which the scores on repeated measures are close to each other (absolute measurement error)	+MIC < SDC OR MIC outside the LOA OR convincing arguments that agreement is acceptable; ?Doubtful design or method OR (MIC not defined AND no convincing arguments that agreement is acceptable); –MIC $\geq$ SDC OR MIC equals or inside LOA, despite adequate design and method; 0No information found on agreement.
5.2. Reliability	The extent to which patients can be distinguished from each other, despite measurement errors (relative measurement error)	+ICC or weighted Kappa ≥ 0.70 ; ?Doubtful design or method (e.g., time interval not mentioned); –ICC or weighted Kappa < 0.70, despite adequate design and method; 0No information found on reliability.
6. Responsiveness	The ability of a questionnaire to detect clinically important changes over time	+SDC or SDC < MIC OR MIC outside the LOA OR RR > 1.96 OR AUC ≥ 0.70 ; ?Doubtful design or method; –SDC or SDC $\geq$ MIC OR MIC equals or inside LOA OR RR ≤ 1.96 OR AUC < 0.70, despite adequate design and methods; 0No information found on responsiveness.
7. Floor and ceiling effects	The number of respondents who achieved the lowest or highest possible score	+ $\leq 15\%$ of the respondents achieved the highest or lowest possible scores; ?Doubtful design or method; –> 15% of the respondents achieved the highest or lowest possible scores, despite adequate design and methods; 0No information found on interpretation.
8. Interpretability	The degree to which one can assign qualitative meaning to quantitative scores	+Mean and SD scores presented of at least four relevant subgroups of patients and MIC defined; ?Doubtful design or method OR less than four subgroups OR no MIC defined; 0No information found on interpretation.

MIC = minimal important change; SDC = smallest detectable change; LOA = limits of agreement; ICC = Intraclass correlation; SD, standard deviation.

^a + = positive rating; ? = indeterminate rating; – = negative rating; 0 = no information available.

^b Doubtful design or method = lacking of a clear description of the design or methods of the study, sample size smaller than 50 subjects (should be at least 50 in every (subgroup) analysis), or any important methodological weakness in the design or execution of the study.

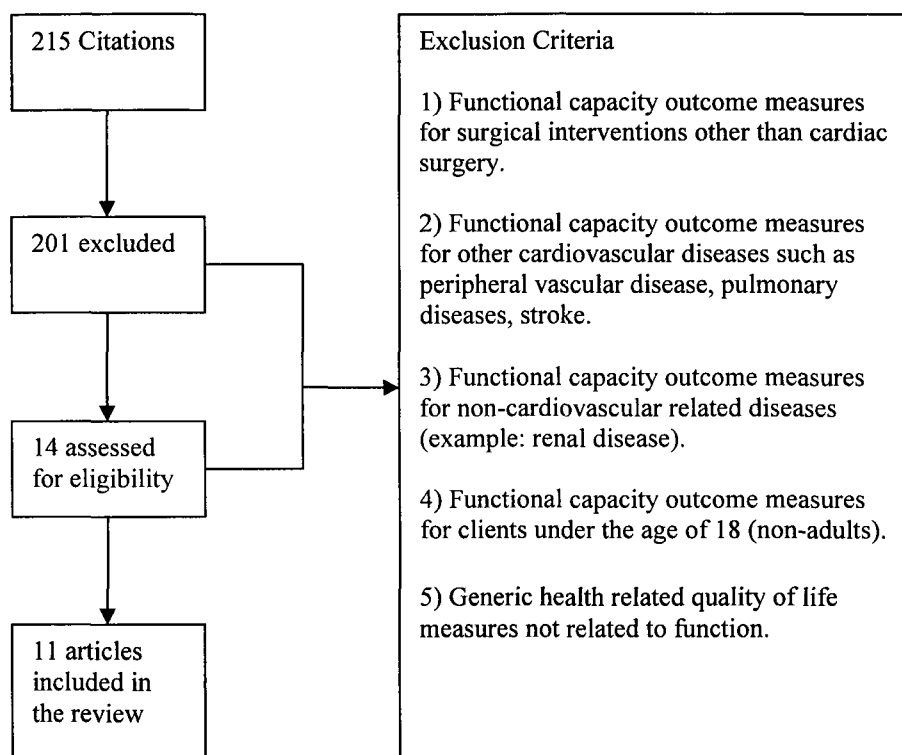
APPENDIX C: GENERAL DATABASE SEARCHES RESULTS



Functional capacity outcome measures identified from database searches and number of articles included in the review:

University of California San Diego Shortness of Breath Questionnaire (SOBQ) (1)
 Veteran's Specific Activity Questionnaire (VSAQ) (1)
 Heart Surgery Symptom Inventory (HSSI) (4)
 The Medical Outcomes Study Short Form 36 (SF-36) (17)
 Minnesota Living with Heart Failure Questionnaire (MLWHFQ) (3)
 A Global Measure of Physical Functioning (AGMPF) (1)
 Duke Activity Status Index (DASI) (2)
 The Two Minute Walk Test (2MWT) (3)
 The Six Minute Walk Test (6MWT) (1)
 Coronary Revascularization Questionnaire (CROQ) (2)
 Seattle Angina Questionnaire (2)
 Quality of Life after Myocardial Infarction/ MacNew Heart Disease Health Related Quality of Life Instrument (2)
 The Reduced Duke Activity Status Index (1)

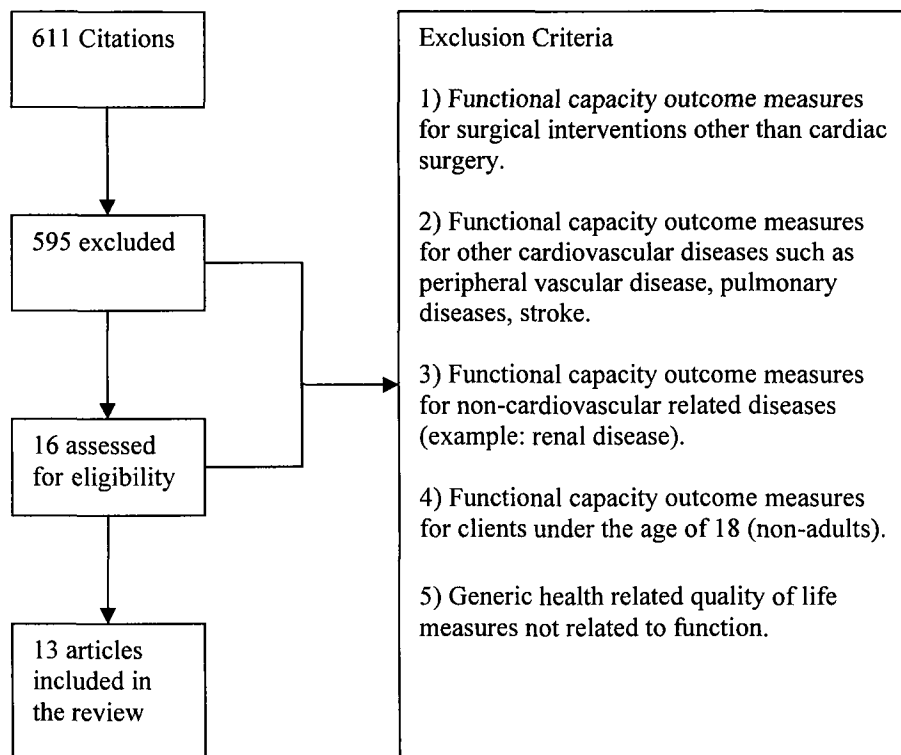
APPENDIX D: CINAHL SEARCH RESULTS



Functional capacity outcome measures identified from CINAHL search and number of articles included in the review:

University of California San Diego Shortness of Breath Questionnaire (SOBQ) (1)
 Veteran's Specific Activity Questionnaire (VSAQ) (1)
 Heart Surgery Symptom Inventory (HSSI) (3)
 The Medical Outcomes Study Short-Form 36 (SF-36) (2)
 Minnesota Living with Heart Failure Questionnaire (MLWHFQ) (1)
 Coronary Revascularization Questionnaire (CROQ) (1)
 Two Minute Walk Test (2MWT) (1)
 Quality of Life after Myocardial Infarction/MacNew Heart Disease Health Related Quality of Life Instrument (QLMI) (1)

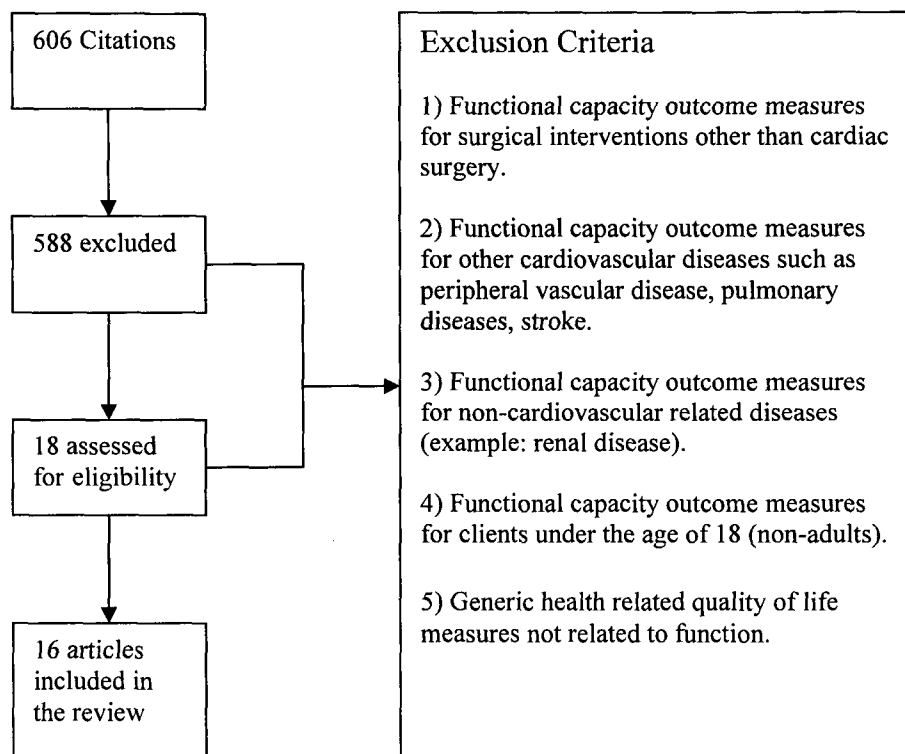
APPENDIX E: EMBASE SEARCH RESULTS



Functional capacity outcome measures identified from EMBASE search and number of articles included in the review:

The Six Minute Walk Test (6MWT) (1)
 The Medical Outcomes Study Short-Form 36 (SF-36) (5)
 Minnesota Living with Heart Failure Questionnaire (MLWHFQ) (1)
 Coronary Revascularization Questionnaire (CROQ) (1)
 Seattle Angina Questionnaire (2)
 The Two Minute Walk Test (2MWT) (1)
 Quality of Life after Myocardial Infarction/ MacNew Heart Disease Health Related Quality of Life Instrument (QLMI) (1)
 The Reduced Duke Activity Status Index (1)

APPENDIX F: MEDLINE SEARCH RESULTS



Functional capacity outcome measures identified from Medline search and number of articles included in the review:

Heart Surgery Symptom Inventory (HSSI) (1)
 The Medical Outcomes Study Short-Form 36 (SF-36) (10)
 Minnesota Living with Heart Failure Questionnaire (MLWHFQ) (1)
 A Global Measure of Physical Functioning (AGMPF) (1)
 Duke Activity Status Index (DASI) (2)
 The Two Minute Walk Test (2MWT) (1)

APPENDIX G: INCLUDED OUTCOME MEASURES

Outcome Measures
1. Baseline and Transitional Dyspnea Index (BDI and TDI)
2. Borg Rating Scale of Perceived Exertion (Borg)
3. The Medical Research Council Dyspnea Scale (MRC dyspnea)
4. Numerical Rating Scale as a measure of Dyspnea (NRS)
5. University of California San Diego Shortness of Breath Questionnaire (SOBQ)
6. Visual Analog Dyspnea Scale (VAS)
7. Coronary Revascularization Questionnaire (CROQ)
8. Heart Surgery Symptom Inventory (HSSI)
9. Medical Outcomes Study Short-Form 36 (SF-36)
10. Quality of life after Myocardial Infarction Questionnaire (QLMI)/ MacNew Heart Disease Quality of Life Instrument
11. The Two Minute Walk Test (2MWT)
12. The Six Minute Walk Test (6MWT)
13. The Berg Balance Scale (Berg)
14. The Physiotherapy Clinical Outcome Variables (COVS)
15. Duke Activity Status Index (DASI)
16. Reduced Version of the Duke Status Activity Index
17. The Elderly Mobility Scale (EMS)
18. The Functional Independence Measure System (FIM)
19. A Global Measure of Physical Functioning (Global Assessment of Physical Functioning) (AGMPF)
20. The Lower Extremity Functional Scale (LEFS)
21. The Physiotherapy Functional Mobility Profile (PFMP)
22. Seattle Angina Questionnaire
23. Specific Activity Scale (SAS)
24. Specific Activity Questionnaire (SAQ)
25. Timed Stand Tests (TST)
26. The Timed-Up and GO (TUG)
27. Post-Operative Discharge Scoring Tool (POP-DST)
28. Veteran's Specific Activity Questionnaire (VSAQ)
29. Quality of Life Index-Cardiac version III or IV
30. Minnesota Living with Heart Failure Questionnaire (MLWHFQ)
31. Vital Signs (hear rate, respiratory rate, blood pressure and oxygen saturation)

***APPENDIX H: QUALITY ASSESSMENT RESULTS FOR DYSPNEA
OUTCOME MEASURES***

Outcome Measure	Content Validity	Internal Consistency	Criterion Validity	Construct Validity	Reproducibility: Agreement	Reproducibility: Reliability	Responsiveness	Floor/Ceiling Effects	Interpretability
Baseline and Transitional Dyspnea Index	+	+	0	?	0	+	0	0	?
Borg Rating Scale of Perceived Exertion	+	0	+	-/?	?	+	?	?	0
The Medical Research Council Dyspnea Scale	?	0	0	?	0	+	0	0	?
Numerical Rating Scale as a measure of Dyspnea	+	0	+	+	0	+	0	0	0
University of California San Diego Shortness of Breath Questionnaire	?	-	+	+	0	?	+	+	+
Visual Analog Dyspnea Scale	+	0	+	?	?	+	0	-	?

**APPENDIX I: QUALITY ASSESSMENT RESULTS FOR HEALTH
RELATED QUALITY OF LIFE OUTCOME
MEASURES**

Outcome Measure	Content Validity	Internal Consistency	Criterion Validity	Construct Validity	Reproducibility: Agreement	Reproducibility: Reliability	Responsiveness	Floor/Ceiling Effects	Interpretability
Coronary Revascularization Questionnaire	+	+	0	?	0	?	?	-	?
Heart Surgery Symptom Inventory	+	?	0	?	0	-	0	0	0
The Medical Outcomes Study Short-Form 36	+	+	?	?	0	?	?	-	?
Quality of Life after Myocardial Infarction Questionnaire	+	+	0	-	0	0	+	+	+

**APPENDIX J: QUALITY ASSESSMENT RESULTS FOR FUNCTION
OUTCOME MEASURES**

Outcome Measure	Content Validity	Internal Consistency	Criterion Validity	Construct Validity	Reproducibility: Agreement	Reproducibility: Reliability	Responsiveness	Floor/Ceiling Effects	Interpretability
The Two Minute Walk Test	+	0	+	-	0	?	?	0	?
The Six Minute Walk Test	+	0	+	+	+	+	+	0	+
The Berg Balance Scale	+	-	+	+	0	+	+	0	+
The Physiotherapy Clinical Outcomes Variables	+	+	0	?	0	+	0	0	?
Duke Activity Status Index	+	0	+/-	0	0	0	0	0	+
Reduced Version of the Duke Activity Status Index	+	+	0	?	0	?	?	-	?
The Elderly Mobility Scale	+	0	0	?	0	?	0	0	?
The Functional Independence Measure	+	+	0	?	0	+	+	0	?
A Global Measure of Physical Functioning	?	0	0	?	0	?	?	+	?
The Lower Extremity Functional Scale	+	-	0	-	+	?	?	+	+
The Physiotherapy Functional Mobility Profile	+	-	0	0	0	+	?	0	?
Seattle Angina Questionnaire	+	0	0	+	0	+	?	0	+
Specific Activity Scale	+	0	+	+	0	+/-	0	0	?
Specific Activity Questionnaire	?	0	+/-	0	0	0	0	0	0
Timed Stand Test	+	0	+	?	0	?	0	0	?
The Timed-Up and Go	+	0	0	+	0	+	0	0	+
Post-Operative Discharge Scoring Tool	+	0	0	+	0	+	0	0	?
Veteran's Specific Activity Questionnaire	?	0	+	?	0	0	0	0	?
Quality of Life Index Cardiac Version	+	+	?	?	0	+	?	0	?
Minnesota Living with Heart Failure Questionnaire	+/0	+	?	+	0	+	+/-	+/-	+

APPENDIX K: FINAL VERSION OF QUESTIONNAIRE



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Prevalence of Standardized Functional Capacity Outcome Measures in Post-Operative Cardiac Surgery: a Survey of Current Clinical Practice and Development of a Clinical Practice Guideline (CPG)

The following is a survey regarding the knowledge and utilization of functional capacity outcome measures amongst physiotherapists working with post-operative cardiac surgery patients across Canada. The goal of the survey is to assist in determining whether a gap exists between the availability of evidence-based functional capacity outcome measures and their utilization in clinical practice. The survey will also provide a framework for the development of a clinical practice guideline to assist physiotherapists in selecting validated functional capacity outcome measures in their clinical practice. The survey is based on the Ottawa Model of Research Use (Graham, I, Logan, J, 2004).

The present document consists of the consent form and the survey. The survey is divided into three major sections. The first section consists of demographic questions. The second section consists of questions related to your practice environment and is divided into two sub-sections: structural aspects and patient aspects. The final section consists of questions related to you as a physiotherapist (clinician) and is divided into 5 sub-sections: awareness, attitudes, knowledge and skills, concerns and current practice.

A second survey, which will include the newly developed CPG and three reality based cases, will be sent out in approximately 6 months, in order to evaluate the CPG.

The present survey will take you approximately 20 minutes to complete. Please be sure to answer all questions. Once you have completed the survey, click on the send "button" and your survey will be submitted to the primary research investigator.

Please complete and return the survey by February 1st, 2008.

I thank you in advance for your participation.

Tanya Mac Donald, M.Sc. candidate, B.Sc. PT; tmacd096@uottawa.ca
Dr. George A. Wells, PhD; gawells@ottawaheart.ca
Dr. Lucie Brosseau, PhD; Lucie.Brosseau@uottawa.ca

Prevalence of Standardized Functional Capacity Outcome Measures in Post-Operative Cardiac Surgery: a survey of current clinical practice and development of a clinical practice guideline (CPG)

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Consent

My participation in this research project entails the completion of the initial prevalence study survey. I have 6 weeks to complete the survey.

I have been informed by the researchers who are conducting the present study that my responses to the survey will remain confidential.

I have also been informed that the responses from the survey will be summarized and presented to a Panel of Experts in order to develop the CPG. The members of the Panel of Experts will be required to sign a confidentiality agreement prior to having access to the summary of the responses to the survey.

It is understood that my participation in this study is on a voluntary basis, and I can withdraw from the research project at any time. It is also understood that my withdrawal from the research project will not affect my relationship with the University of Ottawa.

I am accepting to participate in the research project that is being undertaken by Tanya Mac Donald, a student enrolled in the master's of Epidemiology and Community Medicine program at the University of Ottawa, under the supervision of Dr. George A. Wells and Dr. Lucie Brosseau.

☐ YES, I consent to participate in the study.

Section I: Demographics Questions:

1. In which Canadian Province or Territory do you practice cardio-respiratory physiotherapy?

2. Your age (*please write*) _____ years.
3. Your Gender:
☐ Male ☐ Female
4. At which school did you study physiotherapy? _____
5. How many years of clinical practice do you have as a physiotherapist? ____ years
6. What is your highest level of degree obtained?
☐ Diploma ☐ Bachelor ☐ Master's ☐ PhD

Section II- Practice Environment:

A) Structural

The following section consists of questions related to the structure of your practice environment.

1. In your daily practice setting are you:
☐ The sole physiotherapist
☐ One of several physiotherapists
☐ Other: _____
2. What is the average number of post-operative cardiac surgery clients that you see in a typical day? _____ clients.

For the next 6 questions, please check (✓) the appropriate answer

- | | YES | NO |
|---|--------------------------|--------------------------|
| 3. Do you work with a physiotherapy assistant? | ☐ | ☐ |
| 4. Is your hospital affiliated with a University? | ☐ | ☐ |
| 5. Do you have access to computers in your facility? | ☐ | ☐ |
| 6. Do you have access to the Internet in your facility? | ☐ | ☐ |
| 7. Do you have access to a medical library? | ☐ | ☐ |
| 8. Do you have access to a medical librarian? | ☐ | ☐ |

B) Patients

The following section consists of questions related to the types of patients treated in your practice environment.

1. What types of surgical procedures are performed at your facility (*Please check (✓) all appropriate responses*)

	YES	NO
Coronary Artery Bypass Surgery	☐	☐
Valve Replacements/Repairs	☐	☐
Heart Transplants	☐	☐
Minimally Invasive Coronary Artery Bypass Surgery	☐	☐
Off Pump Coronary Artery Bypass Surgery	☐	☐
Other: _____		
Other: _____		

2. Do you assess all elective cardiac surgery clients in the Surgical Pre-assessment Clinic?

☐ Yes ☐ No

IF No ⇒ Reasons: _____

3. To your knowledge, is the assessment of all cardiac surgery clients in the Surgical Pre-Assessment Clinic evidence-based?

☐ Yes ☐ No ☐ Don't Know

4. Are all cardiac surgery clients at your facility assessed by physiotherapists post-operatively?

☐ Yes ☐ No

IF No ⇒ Specify why: _____

5. Are all cardiac surgery clients at your facility treated by physiotherapists post-operatively?

☐ Yes ☐ No

IF No ⇒ Specify why: _____

6. What is the referral process for the treatment (physiotherapy) of post-operative cardiac surgery clients at your facility (*please check (✓) the appropriate method*)

	YES	NO
Doctor referral in orders	☐	☐
Standing orders	☐	☐
Other: _____		

7. What is the average length of stay for clients after the following procedures at your facility?

Coronary Artery Bypass Surgery:	_____	Days
Valve Replacement/Repair Surgery:	_____	Days
Heart Transplants:	_____	Days
Minimally Invasive Bypass Surgery:	_____	Days
Off Pump Coronary Artery Bypass Surgery:	_____	Days
Other Procedure: _____	_____	Days
Other Procedure: _____	_____	Days

Section III-Physiotherapists

The following section contains questions related to you as a physiotherapist in terms of your awareness, attitudes, knowledge and skills, concerns and current practice regarding outcome measure utilization and evidence-based practice.

Evidence-based practice (**EBP**) uses the best available scientific evidence in clinical decision-making and standardized outcome measures to evaluate the care provided to a patient.

Outcome measure is defined as a measurement tool (instrument, questionnaire, rating form, etc) used to document change in one or more patient characteristics over time.

A) Awareness

- Was evidence-based practice (EBP) discussed during your training as a physiotherapist?
☐ Yes ☐ No
- Were validated outcome measures discussed during your training as a physiotherapist?
☐ Yes ☐ No
- In the last year, what types of activities have you engaged in as a professional?
(Please check (✓) all appropriate responses)

	YES	NO
Conference(s)	☐	☐
Educational Round(s)	☐	☐
Educational In-service(s)	☐	☐
Courses (clinical skills)	☐	☐
Journal Club(s)	☐	☐
Research	☐	☐
Other: _____		
Other: _____		

4. At your facility, do you use any of the following resources to guide clinical practice?
(please check (✓) all appropriate responses)

	YES	NO
Surgical Protocols:	☐	☐
Clinical Practice Guidelines:	☐	☐
Care maps/clinical pathways:	☐	☐
Set Discharge Criteria:	☐	☐

IF yes explain discharge criteria: _____

Other Evidence-based resources: ☐ ☐

If yes explain resource: _____

5. Are you aware of the following resources related to validated outcome measures:

	YES	NO
a) Physical Rehabilitation Outcome Measures (CPA) ¹	☐	☐
b) Physical Rehabilitation Outcome Measures: A guide to enhanced clinical decision making ²	☐	☐
c) Répertoire des outils d'évaluation en Français pour la réadaptation ³	☐	☐
d) Measuring Health: A Guide to Rating Scales and Questionnaires ⁴	☐	☐
e) Other: _____		
f) Other: _____		
g) Other: _____		

- Cole B, Finch E, Gowland C, Mayo N. Physical Rehabilitation Outcome Measures. (Ed J. Basmajian). Toronto: Canadian Physiotherapy Association 1994.
- Finch E, Brooks D, Stratfor P, Mayo N. Physical Rehabilitation Outcome Measures: a guide to enhanced clinical decision making 2nd edition. Canadian Physiotherapy Association 2002.
- LE Tremblay, Savard J, Casimiro L, Tremblay M. Répertoire des outils d'évaluation en Français pour la réadaptation. CFORP 2004.
- McDowell I, Newell C. Measuring Health: a guide to rating scales and questionnaires 2nd edition. Oxford University Press 1996.

B) Attitudes

1. How would you describe your feelings towards the current move towards Evidence-Based Practice?

Very negative	Negative	Neither negative nor positive	Positive	Very Positive
☐	☐	☐	☐	☐

2. What percentage of your clinical practice do you consider is currently evidence based? _____ %

3. In your opinion is the percentage of your clinical practice that you consider to be evidence-based sufficient?

☐ Yes ☐ No

If you responded No to question #3: Do you plan on increasing the percentage of you clinical practice that is currently evidence-based?

☐ Yes ☐ No

If you responded YES to question #4: How you plan on increasing the percentage of your practice that is evidence-based?

4. How often do you use validated outcome measures in your daily clinical practice?
(please check (✓) the response that applies to your practice)

Never	Rarely	Occasionally	Most of the time	Almost always
☐	☐	☐	☐	☐

5. In your opinion, how useful are outcome measures in guiding your clinical decisions?
(please (✓) the appropriate response)

Not at all Useful	Not very Useful	Somewhat Useful	Useful	Very Useful
☐	☐	☐	☐	☐

6. Do you agree with the following statement: I consider myself to be a leader in terms of standardized outcome measure utilization in my clinical practice?

Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
☐	☐	☐	☐	☐

7. Do you agree with the following statement: I consider myself to be a leader in terms of Evidence-Based Practice in your current clinical practice?

Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
☐	☐	☐	☐	☐

8. How confident are you when using standardized outcome measures in clinical practice?

Not at all Confident	Not very Confident	Somewhat Confident	Confident	Very Confident
☐	☐	☐	☐	☐

1. Please check (✓) the most appropriate response for each of the following terms, with regards to your knowledge of the terminology to describe the psychometric properties of outcome measure instruments.

	Never heard of the term	Don't understand the term	Have some under- standing of the term	Understand the term	Could explain the term to others
1. Validity:	☐	☐	☐	☐	☐
2. Content Validity:	☐	☐	☐	☐	☐
3. Criterion Validity:	☐	☐	☐	☐	☐
4. Construct validity:	☐	☐	☐	☐	☐
5. Reliability:	☐	☐	☐	☐	☐
6. Inter-rater reliability:	☐	☐	☐	☐	☐
7. Intra-rater reliability:	☐	☐	☐	☐	☐
8. Test-retest reliability:	☐	☐	☐	☐	☐
9. Internal consistency:	☐	☐	☐	☐	☐
10. Cronbach's alpha:	☐	☐	☐	☐	☐
11. Intra-Class Correlation coefficient:	☐	☐	☐	☐	☐
12. Kappa statistic:	☐	☐	☐	☐	☐
13. Pearson Correlation coefficient:	☐	☐	☐	☐	☐

C) Concerns

1. Is the utilization of outcome measures encouraged by your facility?

☐ Yes ☐ No

If No⇒ Specify why: _____

2. Why would you choose to use a particular outcome measure in clinical practice?
(please check (✓) either "yes" or "no" to all responses that apply)

	YES	NO
Imposed by setting:	☐	☐
Knowledge of outcome measure:	☐	☐
Experience using the measure:	☐	☐
Meets client's needs:	☐	☐
Ease of use:	☐	☐
Valid:	☐	☐
Reliable:	☐	☐
Sensitive to change:	☐	☐
Other: _____	☐	☐

3. What do you perceive as barriers to using outcome measures in clinical practice?
(please check (✓) either "yes" or "no" to all responses that apply)

	YES	NO
Limited training with instrument:	☐	☐
Lack of interaction with colleagues:	☐	☐
Limited experience with instrument:	☐	☐
Unfamiliar with required equipment:	☐	☐
Lack of resources:	☐	☐
Time consuming:	☐	☐
Not appropriate for setting:	☐	☐
Lack of confidence in my abilities:	☐	☐
Overwhelmed by scientific information:	☐	☐
Training (beliefs):	☐	☐
Patient preferences:	☐	☐
Other: _____	☐	☐

4. What do you perceive as facilitators to using outcome measures in clinical practice?
(please check (✓) either "yes" or "no" to all the responses that apply)

	YES	NO
Opportunity to interact with colleagues:	☐	☐
Training:	☐	☐
Participation in research projects:	☐	☐
Experience:	☐	☐
Availability of resources:	☐	☐
Time:	☐	☐
Accessible experience colleagues:	☐	☐
Supportive clinical environment:	☐	☐
Motivation and encouragement:	☐	☐
Other: _____	☐	☐

D) Current Practice

The following section consists of questions related to your current practice in terms of functional capacity outcome measure utilization in your daily clinical practice.

1. The following is a list of validated functional capacity outcome measures. The list is not representative of all possible functional capacity outcome measures available to physiotherapists. A section has been provided, at the end of the list, for you to include any additional functional capacity outcome measures that you use in your daily clinical practice.

Please check (✓) off all outcome measures that you have used in clinical practice in the last 6 months to measure the functional capacity of your post-operative cardiac surgery clients:

	YES	NO
The Physiotherapy Functional Mobility Profile Questionnaire:	☐	☐
The 6 Minute Walk Test:	☐	☐ The
Medical Outcomes Study Short Form-36 (SF-36):	☐	☐
Functional Independence Measure (FIM):	☐	☐
Sickness Impact Profile (SIP):	☐	☐
The Nottingham Health Profile (NHP):	☐	☐
The Two Minute Walk Test:	☐	☐
Nottingham Extended Activity of Daily Living:	☐	☐
Duke Activity Status Index (DASI):	☐	☐
Duke Activity Status Index – Reduced Version:	☐	☐
Specific Activity Questionnaire (SAQ):	☐	☐
EuroQuol:	☐	☐
The 12 Minute Walk Test:	☐	☐
The Shuttle Walk Test:	☐	☐
Specific Distance Walk Test:	☐	☐
Lower Extremity Functional Scale (LEFS):	☐	☐
Clinical Outcome Variables Scale (COVS):	☐	☐
Medical Research Council Dyspnea Scale:	☐	☐
The Borg Scale of Perceived Exertion:	☐	☐
Other: 1. _____	☐	☐
2. _____	☐	☐
3. _____	☐	☐
4. _____	☐	☐
5. _____	☐	☐
6. _____	☐	☐
7. _____	☐	☐
8. _____	☐	☐

Thank you for your participation!

I would also like to take this opportunity to remind you that you will be receiving another survey in approximately 6 months. The survey will consist of the CPG developed by a Panel of Experts based on your response to this survey as well as three reality based cases in order to evaluate the CPG.

APPENDIX L: ETHICS APPROVAL



Université d'Ottawa University of Ottawa

Service de subventions de recherche et d'éthologie Research Grants and Ethics Services

November 7, 2007

Dr. George A. Wells
Epidemiology and Community Medicine
Faculty of Medicine
University of Ottawa
H 1 – 140 Ruskin Street
Ottawa

Tanya MacDonald
2-240 Guay Street
Gatineau, QC J8P 3C7

RE: Prevalence of Standardized Functional Capacity Outcome Measures in Post-Operative Cardiac Surgery: A Survey of Current Clinical Practice and Development of a Clinical Practice Guideline (CPG) (H 09-07-04)

Dear Dr. Wells and Miss MacDonald,

You will find enclosed the Health Sciences and Science REB ethical clearance for the abovementioned study.

During the course of the study, any modifications to the protocol or forms may not be initiated without prior written approval from the REB. You must also promptly notify the REB of any adverse events that may occur.

This certificate of ethical clearance is valid until November 7, 2008. Please submit an annual status report to the Protocol Officer in November 2008 to either close the file or request a renewal of ethics approval. This document can be found at:

http://web9.uottawa.ca/services/research/ethics/application_dwn.asp

A copy of this approval will be sent to research services, if necessary.

If you have any questions, you may contact the undersigned at the number (613) 562-5387.

Sincerely yours,

Germain Zongo
Protocol Officer for Ethics in Research
For Dr. Daniel Lagarec, Chair of the Health Sciences and Science REB

550, rue Cumberland 550 Cumberland Street
Ottawa (Ontario) K1N 6N5 Canada Ottawa, Ontario K1N 6N5 Canada
(613) 562-5841 • Téléc./Fax (613) 562-5388
<http://www.uottawa.ca/services/research/ethics/index.html>



Université d'Ottawa University of Ottawa

Service de subventions de recherche et d'éthologie Research Grants and Ethics Services

HEALTH SCIENCES AND SCIENCE RESEARCH ETHICS BOARD

CERTIFICATE OF ETHICAL APPROVAL

This is to certify that the University of Ottawa Health Sciences and Science Research Ethics Board has examined the application for ethical approval of the research project entitled **Prevalence of Standardized Functional Capacity Outcome Measures in Post-Operative Cardiac Surgery: A Survey of Current Clinical Practice and Development of a Clinical Practice Guideline (CPG) (H 09-07-04)** submitted by Dr. Dr. George A. Wells of the Department of Epidemiology and Community Medicine at the University of Ottawa and his master's student Ms. Tanya MacDonald.

The Board found that this research project met appropriate ethical standards as outlined in the Tri-Council Policy Statement and in the Procedures of the University of Ottawa Research Ethics Boards, and accordingly gave it a Category 1a (approval). This certification is valid one year from the date indicated below.

Germain Zongo
Protocol Officer for Ethics in Research
For Dr. Daniel Lagarec, Chair of the
Health Sciences and Science REB

November 7, 2007
Date

550, rue Cumberland 550 Cumberland Street
Ottawa (Ontario) K1N 6N5 Canada Ottawa, Ontario K1N 6N5 Canada
(613) 562-5841 • Téléc. Fax (613) 562-5338
<http://www.uottawa.ca/services/research/ebg/index.html>

APPENDIX M: LIST OF CARDIAC SURGERY CENTERS

Participating sites:

1. St-Paul's Hospital, Vancouver, British Columbia
2. St-Boniface General Hospital, Winnipeg Manitoba
3. Kingston General Hospital, Kingston, Ontario
4. University of Alberta Hospital, Edmonton, Alberta
5. St-Michaels Hospital, Toronto, Ontario
6. Trillium Health Center, Mississauga, Ontario
7. Toronto General Hospital (University Health Network), Toronto, Ontario
8. London Health Sciences Center, London, Ontario
9. St-Mary's General Hospital, Kitchener, Ontario
10. Southlake Regional Hospital, Newmarket, Ontario
11. Saint-John Regional Hospital, Saint-John New Brunswick
12. University of Ottawa Heart Institute, Ottawa, Ontario
13. Queen Elizabeth II Health Science Center, Halifax, Nova Scotia
14. Regina General Hospital, Regina, Saskatchewan
15. Hamilton Health Sciences, Hamilton, Ontario
16. St-John's General Hospital Health Sciences Center, St-John, Newfoundland and Labrador
17. McGill University Health Center, Montreal, Quebec
18. Institut de Cardiologie de Montréal, Québec
19. Centre Hospitalier de l'Université de Montréal, Pavillon Hôtel-Dieu, Montréal, Québec ; Pavillon St-Luc, Montréal, Québec ; Pavillon Notre-Dame, Montréal, Québec
20. Centre Hospitalier Sacré-Coeur, Montréal, Québec
21. Centre Hospitalier Université du Québec Hôpital- de l'Enfant-Jésus, Québec, Québec
22. Centre Hospitalier Université du Québec- Hôpital de l'Hôtel-Dieu , Québec, Québec
23. Centre Hospitalier Régional de Trois-Rivières- Pavillon Saint-Joseph, Trois-Rivières, Québec
24. Canadian Physiotherapy Association, cardio-respiratory division, Canada

Non-participating sites:

25. Vancouver General Hospital, Vancouver, British Columbia
 26. Royal University Hospital, Saskatoon, Saskatchewan
 27. Sudbury Regional Hospital, Sudbury, Ontario
-

APPENDIX N: INVITATION LETTER TO CLINICAL MANAGERS



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Prevalence of Standardized Functional Capacity Outcome Measures in Post-Operative Cardiac Surgery: a survey of current clinical practice and development of a clinical practice guideline (CPG)

Invitation Letter for Physiotherapy Clinical Leaders

The following letter is an invitation to participate in a research project that is being conducted by a student researcher in the master's of Epidemiology and Community Medicine program, at the University of Ottawa. The primary investigator of the research project is Tanya Mac Donald (M.Sc. Student) under the supervision of Dr. G.A. Wells (supervisor) and Dr. L. Brosseau (co-supervisor).

The goal of the study is to establish the prevalence of utilization of standardized functional capacity outcome measures by physiotherapists working with post-operative cardiac surgery patients across Canada and to develop a clinical practice guideline related to their utilization in clinical practice. The study will be conducted by means of a cross-sectional survey. The target population for the survey is all physiotherapists working with post-operative cardiac surgery clients.

The study consists of four different phases, in which you are asked to participate in the second phase. The first phase of the study consists of a systematic review of the literature with regards to the different outcome measures used by physiotherapists to assess the functional capacity of post-operative cardiac surgery patients and their psychometric properties. The second phase, as mentioned above, is the development of a cross-sectional survey to assess outcome measure utilization amongst physiotherapists working with this patient population. The third phase consists of the development of a Clinical Practice

Guideline (CPG) related to the selection of evidence-based functional capacity outcome measures and the fourth phase consists of an evaluation of the CPG by means of a case-based survey.

Your involvement as a Physiotherapy Clinical Leader at one of the many sites that offers these services across Canada is to present this research participation opportunity to your clinicians. If you agree to present this opportunity to the physiotherapists who are involved in the assessment and treatment of post-cardiac surgery clients and currently employed at your facility, you will be asked to contact the student investigator (TM) responsible for the study at the email address listed below.

All physiotherapists who are currently involved in the assessment and treatment of this particular patient population, both on a part-time and/or full-time manner, are invited to participate in the research project. The student investigator (TM) will then forward you the link for the web-survey, an information letter for the clinicians as well as a consent form for those who agree to participate. The research participants will be assigned a research participant number in order to maintain the confidentiality of their responses to the survey. All research participants will then be required to complete the web-based survey through the link that will be provided to them if they agree to participate in the research project. Due to the web-based nature of the survey, participants will not be required to return any documents to the primary investigator (TM). Once the survey is completed it will automatically be sent to the primary investigator (TM).

You are invited to carefully read through the attached consent form, which contains further information related to the research project. Any questions that you may have concerning the present research project are welcomed and will be answered in a timely manner by the primary investigator. In order to confirm your participation in the research project, please contact the primary investigator at the email address listed below.

Thank you for your collaboration;

Tanya Mac Donald (M.Sc. Student, B.Sc, Physiotherapy),
University of Ottawa, Faculty of Medicine,
Epidemiology and Community Medicine,
451 Smyth Road, Ottawa, Ontario, K1M 8M5
tmacd096@uottawa.ca

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APPENDIX O: INVITATION LETTER TO CLINICIANS



Prevalence of Standardized Functional Capacity Outcome Measures in Post-Operative Cardiac Surgery: a survey of current clinical practice and development of a clinical practice guideline (CPG)

Information Letter for Clinicians

The following letter is an invitation to participate in a research project that is being conducted by a student researcher in the master's of Epidemiology and Community Medicine program, at the University of Ottawa. The primary investigator of the research project is Tanya Mac Donald (MSc Student) under the supervision of Dr. G.A. Wells and Dr. L. Brosseau (co-supervisor).

The goal of the study is to establish the prevalence of utilization of standardized functional capacity outcome measures by physiotherapists working with post-operative cardiac surgery patients across Canada and to develop a clinical practice guideline related to their utilization in clinical practice.

If you agree to participate, your involvement as a clinician will be to complete two surveys approximately 6 months apart from one another. Each survey will take approximately 30 minutes to complete. The surveys will be sent out electronically using the surveymonkey.com website. You will be given approximately 6 weeks to complete the two different surveys. You will also be assigned a research participant number in order to ensure that your identity remains anonymous and that your responses to the surveys remain confidential.

In terms of potential benefits, your participation in this research project will assist in identifying any potential gaps that may exist between the evidence and clinical practice in terms of outcome measure utilization. Your participation will also provide the framework for the development of a clinical practice guideline regarding the selection of evidence-based outcome measures.

You are invited to carefully read through the attached consent form, which contains further information related to the research project. Any questions that you may have concerning the

present research project are welcomed and will be answered in a timely manner by the primary student investigator (TM). In order to confirm your participation in the research project, please complete the survey provided by the link in the email sent to you by your clinical leader. The survey includes a question regarding your consent to participate in the research project. Due to the web-based nature of the survey, you are not required to return any documents (either survey or consent form) to the primary investigator. Once the survey is completed it will automatically be sent to the primary student investigator (TM). This process will ensure the confidentiality of your responses.

Thank you for your collaboration;

Tanya Mac Donald (MSc Student, B.Sc, Physiotherapy)
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APPENDIX P: CLINICIAN CONSENT FORM



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Prevalence of Standardized Functional Capacity Outcome Measures in Post-Operative Cardiac Surgery: a survey of current clinical practice and development of a clinical practice guideline (CPG)

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(613) 562-5800 extension 8015
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Consent Form

I, (name of the participant), am accepting to participate in the research project that is being undertaken by Tanya Mac Donald, a student enrolled in the master's of Epidemiology and Community Medicine program at the University of Ottawa, under the supervision of Dr. George A. Wells and Dr. Lucie Brosseau.

The goal of the research project is to establish the prevalence of utilization of standardized functional capacity outcome measures by physiotherapists working with post-operative

cardiac surgery patients across Canada and to develop a clinical practice guideline related to their utilization.

In order to meet the goals of the research project, the study will be conducted in four different phases. The first phase of the research project will consist of a systematic review of the literature. The goal of the systematic review is to identify all standardized functional capacity outcome measures that are currently available for use by physiotherapists working with post-operative cardiac surgery patients. Studies related to their psychometric properties will also be retrieved in order to establish the evidence base for their utilization in clinical practice. The systematic review of the literature will serve as the framework upon which the second and third phases of the research project will be based.

The second phase of the research project consists of the development and distribution of a cross-sectional survey related to the utilization of standardized functional capacity outcome measures amongst physiotherapists working with post-operative cardiac surgery patients. The goal of the survey is to determine the prevalence of standardized functional capacity outcome measure utilization by physiotherapists working with a post-operative cardiac surgery patient population. The prevalence component consists of a cross-sectional survey regarding the knowledge and utilization of physiotherapists working with this particular patient population. The survey will be conducted using surveymonkey.com, and consists of six major sections. The first four sections of the survey consist of questions related to the demographics of the research participants. The final two sections of the survey consist of questions related to the utilization of functional capacity outcome measures, in clinical practice, the knowledge of the terminology used to describe their psychometric properties, as well as three high functioning reality based case studies.

The third phase of the research project consists of the development of a clinical practice guideline (CPG) to assist physiotherapists working with post-operative cardiac surgery patients in selecting evidence-based functional capacity outcome measures. The CPG will be based on the systematic review of the literature, the responses to the cross-sectional survey and the consensus of a Panel of Experts in the field of outcome measures and cardio-respiratory physiotherapy. Therefore, the Panel of Experts that will be recruited to develop the CPG will have access to the responses from the cross-sectional survey. The Panel of Experts will be required to sign a confidentiality agreement prior to accessing the data collected from the survey.

The fourth and final phase of the research project consists of an evaluation of the CPG by means of a survey using a case-based intervention. Case-based intervention is a type of interactive teaching method that is based on the adult learning theory and principles by means of a second cross-sectional survey (White et al, 2004).

The second survey consists of the CPG, a summary of the evidence, the selected standardized functional capacity outcome measures as discussed by the Panel of Experts, and the same case studies that were included in the initial cross-sectional survey.

Therefore, my participation in this research project entails the completion of both the initial prevalence study cross-sectional survey as well as evaluation component of the CPG by

means of a case-based intervention. The evaluation component of the CPG is based on the initial survey results, the systematic review and the Panel of Experts. The survey will be developed using the surveymonkey.com website. The survey will be internet based and sent to the participants email address. Participants will be given six weeks to complete both the initial prevalence study cross-sectional survey and the CPG evaluation survey. Demographic information will also be collected in order to describe the participants in the research project.

Confidentiality

I have been informed by the researchers who are conducting the present study that my responses to both the prevalence study survey and the CPG evaluation survey will remain confidential. The primary investigator will be sending the links for the survey to the participant's clinical leaders, who will then be responsible for forwarding the links to the research participants. Therefore the research participant's identity will remain confidential and their responses to the two surveys will remain anonymous. Therefore, the researchers will be unable to determine which participants responded to the surveys. Furthermore, each research participant will be designated a research participant number for identification purposes in order to maintain the confidentiality of the research participants.

All responses to the surveys will be stored on the primary student investigators computer (TM), which will be kept in a locked and secure area. Only the primary student investigator, the student's supervisor and the student's co-supervisor will have access to the information collected by the two surveys. The information will be kept for a period of five years and then it will be destroyed.

As mentioned above, the responses from the prevalence surveys will be summarized and presented to the Panel of Experts in order to develop the CPG. The members of the Panel of Experts will be required to sign a confidentiality agreement prior to having access to the summary of the responses to the survey.

Risk associated with participating in the research project

There are no harms or risks associated with participating in the present research project. Participation in this research project will require participants to reflect on their current clinical practice and will require that they complete two different surveys approximately six months apart. Therefore, the risks associated with the present research project relate to the time that is required to complete the two surveys and the emotional impact of reflecting on ones clinical practice.

Furthermore, the current evaluation of prevalence of utilization of outcome measures is an independent study being conducted by a student researcher at the University of Ottawa. The clinical leaders at each of the different facilities, and the facilities themselves are not involved in the research project and will not have access to any of the data.

Benefits of participating in the research project

As a participant, there are no tangible benefits associated with my participation in the research project. However, my participation in this research project will contribute to the

identification of gaps between the evidence and clinical practice in terms of outcome measure utilization, as well as to the effectiveness of case-based interventions in evaluating CPG.

Therefore, my participation in this research project will assist in increasing the knowledge base of the prevalence of utilization of functional capacity outcome measures in the post-operative management of cardiac surgery patients.

Voluntary Participation

It is understood that my participation in this study is on a voluntary basis, and I can withdraw from the research project at any time. It is also understood that my withdrawal from the research project will not affect my relationship with the University of Ottawa.

Information regarding my rights as a participant in a research project conducted at the University of Ottawa can be obtained by contacting the “Protocol Officer for Ethics in Research”, 550 Cumberland street, Room 159, Ottawa, Ontario, K1N 6N5, (613) 562-5841 or at ethics@uottawa.ca. This study has received ethics approval.

For additional information regarding the research project, the primary investigator as well as the supervisor and co-supervisor can be contacted:

Tanya Mac Donald: tmac096@uottawa.ca

Dr. George A. Wells: gawells@ottawaheart.ca/ agray@ottawaheart.ca

Dr. Lucie Brosseau: Lucie.brosseau@uottawa.ca

Participant’s Signature:

Witness’ Signature:

APPENDIX Q: GUIDELINE DEVELOPMENT GROUP MEMBERS

Evidence-Based Clinical Practice Guideline for Physiotherapy Standardized Functional Capacity Outcome Measures in Post- Operative Cardiac Surgery

Ottawa Standardized Outcome Measures Development Group:

George A. Wells, PhD^{1,2}, Lucie Brosseau, PhD^{1,3}, Tanya Mac Donald, M.Sc. candidate^{1,4}.

1. Department of Epidemiology and Community Medicine, University of Ottawa, Ontario, Canada.
2. Cardiovascular Research Methods Centre, University of Ottawa Heart Institute, Ontario, Canada
3. Physiotherapy Program, School of Rehabilitation Sciences, Faculty of Health Sciences, University of Ottawa, Ontario, Canada.
4. Prevention and Rehabilitation, University of Ottawa Heart Institute, Ontario, Canada.

Ottawa Group Panel of Experts:

Bob Reid, Ph.D, Prevention and Rehabilitation, University of Ottawa Heart Institute, Ontario, Canada.

Dina Brooks, Ph.D, (Assistant Professor), Physical Department, University of Toronto, Ontario, Canada.

Judy King, PhD, (Part-time Professor) Physiotherapy Program, University of Ottawa, Ontario, Canada.

Stéphane Poitras, PhD, (Assistant Professor) Physiotherapy Program, University of Ottawa, Ontario, Canada.

Rachel Brosseau, M.Sc. (Professeure adjointe de clinique) Programme de Physiothérapie, Université de Montréal, Québec.

Alain Mayhew, M.Sc. (EPOC Review Group Coordinator), Institute of Population Health, University of Ottawa, Ontario, Canada.

Lucie Laferrière, MHA. (Injury Prevention) Directorate Forces Health Protection, Ottawa, Ontario, Canada.

Frederick Beauchemin, MBA. (Chief of Physiotherapy) Ottawa Hospital, Ontario, Canada.

Guy-Anne Proulx, PT (Prevention and Rehabilitation) University of Ottawa Heart Institute, Ontario, Canada.

Lynn Sawyer, PT (Prevention and Rehabilitation) University of Ottawa Heart Institute, Ontario, Canada.

Marc Laflamme PT (Project Coordinator FrancoForme Prevention and Rehabilitation) University of Ottawa Heart Institute, Ontario, Canada.

APPENDIX R: EXAMPLE OF EVIDENCE TABLE

The 6 Minute Walk Test (6MWT)

The 6MWT is a practical simple test that requires patients to walk as far as they can in 6 minutes. It requires a 100 foot hallway and the distance that the patient can quickly walk on a flat hard surface in a period of 6 minutes. No training is required. Patients are allowed to stop and rest during the test. Only standardized phrasing of encouragement can be used during the test.

Criteria	Evaluation	Score
1. Content validity	<u>Objectives</u>: Measure response to medical interventions, as a one time measure in functional status of patients as well as a predictor of morbidity and mortality (12). <u>Target population</u>: patients with moderate to severe heart or lung disease (12). <u>Concepts</u>: measures sub-maximal level of functional capacity (12). <u>Item selection and reduction</u>: The 6MWT test is an adaptation of the 12MWT in order to accommodate patients with respiratory diseases who could not tolerate walking for 12 minutes (12). <u>Interpretability of the items</u>: Practical simple test requiring no training (12).	+
2. Internal consistency	No information provided.	0
3. Criterion Validity	Correlation between 6MWT, 2MWT and 12MWT based on the hypothesis that shorter tests would be as good as the 12MWT (1): 6MWT and 12 r=0.955; 6MWT and 2 r=0.892. Correlation between 6MWT and 12MWT in patients with COPD (2): r=0.97.	+

Criteria	Evaluation	Score
4. Construct Validity	Correlation between 6MWT and cycle ergometer exercise test and 4 functional status questionnaires in patients with chronic airflow limitations (n=25) and chronic heart failure (n=18) (4): 6MWT and Rand Instrument r=0.589; 6MWT and Oxygen cost diagram (OCD) r=0.495; 6MWT and Baseline Dyspnea Index (BDI) r=0.59; 6MWT and Specific Activity Scale (SAS) r=0.473; 6MWT and cycle ergometer r=0.579. Correlation between 6MWT and age, gender, left ventricular ejection fraction (LVEF) and presence/absence of co-morbidities in post-cardiac surgery patients (5): 6MWT and age r= -0.35; LVEF and 6MWT in men r=0.11; gender and presence of at least one co-morbidity (significant but data not presented). Correlation between 6MWT and other tests in older adults (n=86) (13) based on hypothesis that the 6MWT would be moderately correlated with all other tests: 6MWT and chair stands r=0.67; 6MWT and tandem balance r=0.52; 6MWT and gait speed r=0.73. Correlation between 6MWT and BMI based on hypothesis that they would be negatively and moderately correlated (13): a low correlation was found between the two (not consistent with hypothesis). Correlation between 6MWT and general health perceptions and self-report physical functioning (SF-36 physical functioning subscale) based on the hypothesis that they would be moderately correlated (13): 6MWT and physical functioning subscale r=0.55; 6MWT and general health perceptions r=0.39. Correlation between 6 minute walk distance (6MWD) and other measures in heart failure (HF) and respiratory patients (7): 6MWD and NYHA r=-0.45 (HF patients); 6MWD and SAS r=0.37 (HF) and r=-0.52 (respiratory) and r=-0.47 total; 6MWD and cycle ergometer r=0.42 (HF) and r=0.57 (respiratory) and 0.58 total. Correlation between maximal oxygen consumption and 6MWD in normal and class II and III heart failure subjects (8): there was a curvilinear relationship between the two. Relationship between 6MWT (distance ambulated) and peak V02 and peak %VO2 by univariate analysis (9): 6MWT and peak V02 r=0.64 and 6MWT and peak %V02 r=0.58. Correlation between 6MWT and different test scores in patients with heart failure based on the hypothesis that there would be a reasonably close relationship (r >or equal to 0.5) at baseline assessment between 6MWT and total quality of life (Chronic Heart Failure questionnaire (CHQ) and dyspnea quality of life (10): 6MWD and global rating of change r=0.78; 6MWD and dyspnea QOL r=0.60; 6MWD and fatigue QOL r=0.58; 6MWD and emotion QOL r=0.47 and 6MWD and total QOL r=0.70). Correlation between 6MWT and V02 max and V02/kg in patients with COPD (2): r=0.51 for 6MWT and V02 max and r=0.67 for V02/kg.	+

Criteria	Evaluation	Score
5.1. Reproducibility Agreement	Reproducibility as measured by within-person standard deviations (WPSD) (4): WPSD=29.8 and coefficient of variation=0.07. WPSD in patients with heart failure and respiratory disease (7): subjects walking scores were within 6% of their mean 65% of the time and within 12% 95% of the time.	+
5.2 Reproducibility Reliability	Reliability using ICC for multiple visits (testing) (4): ICC=0.909 for visits 3 to 6; ICC=0.921 for all six visits. Test re-test reliability (1 week interval) in 86 older adults (13): $r=0.95$ for total group; retirement home group $r=0.91$; community center group $r=0.87$. Reliability of the 6MWT in 20 patients (test-retest) repeated on the same day (9): ICC=0.96. Test-retest reliability in heart failure patients who reported no major overall change in cardiac status between 2 visits (3 to 8 weeks apart) ($n=24$) (10): ICC=0.91. Test-retest reliability in patients 1 week post myocardial infarction (11): ICC=0.879.	+
6. Responsiveness	Responsiveness of 6MWT to change was assessed using three different approaches: 1) observed change in test scores according to the results of the global rating of change assessment (much worse to much better); 2) effect size (ES) and 3) responsiveness coefficient (10): 1) changes in 6MWD at follow-up (compared to baseline) were in the direction and magnitude expected according to the global rating of change $p<0.01$; 2) ES for improvements was 0.85 and for deterioration was 2.13; 3) responsiveness coefficient was 1.73.	+
7. Floor and Ceiling Effects	No information provided.	0

Criteria	Evaluation	Score
8. Interpretability	Data on 6MWT results in patient's post-cardiac surgery admitted to an in-hospital rehabilitation unit along with reference tables based on age, LVEF and presence of co-morbidities in male subjects and based on age and presence of co-morbidities in females (5). Development of reference equations for men and women in healthy individuals (6): equation for men explained 42% of the variance in the 6MWD and 38% in women. Men: $(7.57 \times \text{height (cm)}) - (5.02 \times \text{age}) - (1.76 \times \text{weight (kg)}) - 309$ meters (and subtract 153 for lower limit of normal); Women: $(2.11 \times \text{height (cm)}) - (5.78 \times \text{age}) - (2.29 \times \text{weight (kg)}) + 667$ meters (and subtract 139 for lower limit of normal). Known group validity tested by comparing 6MWD between more and less active older adults ($n=86$) (13): more active adults (from community centers) covered greater distances than less active adults (retirement homes) $t=10.1$, $p<0.0001$. Comparison of 6MWD in normal and class II and III heart failure subjects (8): significant difference between distance walked between the two groups ($p<0.003$). Prediction of peak V02 using multivariate analysis (9): the model including variables recorded during 6MWT had an r^2 value of 0.65 (distance walked, maximal heart rate, maximal mean systolic blood pressure, maximal rate-pressure product and maximal rating of perceived exertion). Prediction of peak %V02 using multivariate analysis (9): the model including variables recorded during 6MWT had an r^2 value of 0.71 (distance walked, maximal heart rate, maximal mean systolic blood pressure, maximal rate-pressure product and maximal rating of perceived exertion). Survival analysis in reaching the combined endpoint of death or hospital admission for inotropes or mechanical ventilation in heart failure patients (9): the 6MWT was predictive in reaching the endpoint in the short term but was not predictive of long term survival and a greater proportion of patients who had a 6MWD < than 300 meters reached the combined end-point within 6 months compared to those who had a 6MWD > 300 meters (40% compared to 12%). Data presented for patients 1 week post myocardial infarction (means and standard deviations) (11).	+

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***APPENDIX S: GUIDELINE DEVELOPMENT GROUP
METHODOLOGY***



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Evidence-Based Clinical Practice Guideline for Physiotherapy Standardized Functional Capacity Outcome Measures in Post- Operative Cardiac Surgery

Methodology:

The Ottawa Group composed of Dr. George A. Wells (Ph.D.), Dr. Lucie Brosseau (Ph. D.), and Tanya Mac Donald (M.Sc. candidate, B.Sc. PT) of the University of Ottawa and of the University of Ottawa Heart Institute has identified a list of validated cardio-respiratory physiotherapy outcome measures for measuring functional capacity in post-operative cardiac surgery clients.

The objectives of this project were: 1) To conduct a qualitative systematic reviews of the literature to identify all standardized functional capacity outcome measures, and their psychometric properties, in the field of post-operative cardiac surgery; 2) To conduct a cross-sectional survey of physiotherapists across Canada regarding their utilization of functional capacity outcome measures in post-operative cardiac surgery; and 3) To develop a clinical practice guideline, through a meeting of Experts in the field of cardio-respiratory physiotherapy and clinical practice guideline development, to assist physiotherapists working with post-operative cardiac surgery clients in selecting evidence-based functional capacity outcome measures in their clinical practice.

The outcome measures under review were identified using several different methods: 1) a literature search of the following databases: EMBASE, CINAHL, and MedLine were conducted to identify validated outcome measures and studies evaluating their psychometric properties, 2) hand searching of relevant articles identified by the literature review for additional outcome measures, 3) consultation with the website proqolid.org (a website that lists both generic and disease specific outcomes measures for measuring health status), 4) consultation with the Physical Rehabilitation Outcome Measures: a Guide to Enhanced Clinical Decision Making (2nd edition, 2002), 5) consultation with physiotherapists across Canada, currently working in a post-operative cardiac surgery setting, by means of a cross-sectional survey and 5) consultation with members of the Panel of Experts.

The following information package includes a list of the outcome measures, a copy of each of the outcome measures, a description of each of the instruments, a quality assessment of each of the outcome measures using the proposed quality criteria for measurement properties of health status questionnaires by Terwee et al (2007) as well as a copy of the quality assessment tool. The distribution of the copies of the outcome measures is strictly for the purposes of the clinical practice guideline development process.

Panel Of Experts Involvement:

As a member of the Panel of Experts, your task is to review each of the identified standardized outcome measures based on the following criteria: 1) the concepts that the instrument is intended to be measuring, 2) the instrument's psychometric properties (content validity, face validity, criterion validity, construct validity, reliability, responsiveness and interpretability), 3) the instruments applicability for use in clinical practice based on time, efficiency and resources required to utilize the instrument in clinical practice and 4) the quality assessment. Following the review of the identified instruments you will be required to provide an overall assessment of the outcome measures based on the Overall Judgement component of the AGREE tool (AGREE collaboration, 2003).

During the Panel of Experts meeting, the standardized outcome measures will be reviewed by category which will allow the Panel of Experts to decide which outcome measure (s) is (are) most appropriate for use in clinical practice for that particular category. The outcome measures were divided into the following categories: dyspnea measures, health related quality of life measures and functional measures. The objective of the consensus meeting of Experts is to review the standardized outcome measures, to provide an overall impression of the outcome measure and to determine their appropriateness for use in clinical practice.

Please note the following change in location for the June 6th meeting. The Panel of Experts meeting will be held on June 6th, 2008 in the East Foustenella Conference Room (2nd floor) at the University of Ottawa Heart Institute, 40 Ruskin Dr., Ottawa, Ontario from 9:00 am to 15:00 pm.

Thank you for your acceptance in taking part in the Panel of Experts meeting. It will be a pleasure for me to meet you at this consensus meeting. If you have any questions or comments regarding your participation or the material, do not hesitate to contact any of the investigators by email or by phone. The contact information is listed below.

Sincerely,

Tanya Mac Donald

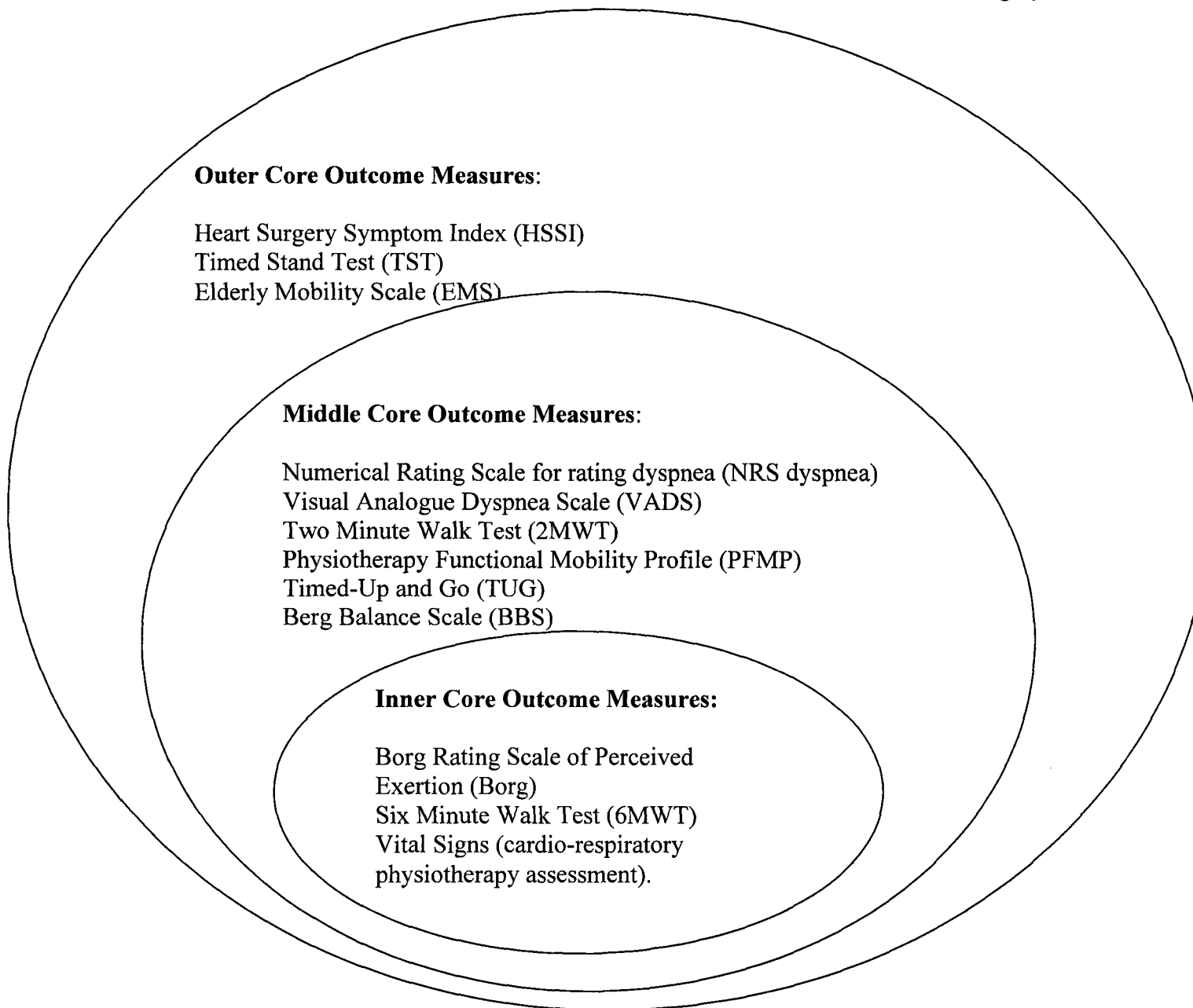
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Director Cardiovascular Research
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Dr. Lucie Brosseau, Ph.D
Full-Time Professor
Physiotherapy Program
School of Rehabilitation Sciences

***APPENDIX T: SUMMARY DOCUMENT OF RECOMMENDATIONS
AND FEEDBACK QUESTIONNAIRE***

Standardized Functional Capacity Outcome Measures in Post-Operative Cardiac Surgery



Inner Core outcome measures: Recommended outcome measures for routine use in clinical practice to assess the functional capacity of all post-operative cardiac surgery clients.

Middle Core outcome measures: Recommended outcome measures for use in clinical practice for specific post-operative cardiac surgery clients based on the physiotherapist's assessment.

Outer Core outcome measures: Standardized outcome measures that require further research prior to their adoption in clinical practice.

Description of Inner Core Outcome Measures:

Outcome Measures	Description
Borg Rating Scale of Perceived Exertion (Borg)	The Borg scale consists of an 11 point rating scale (on a vertical line) ranging from 0 (none) to 10 (severe) on which patients are asked to rate their level of breathlessness. Written descriptors are placed at fixed points on the scale so that a doubling of the numerical rating corresponds to a two-fold increase in sensation intensity. It is recommended that dyspnea be assessed in association with exercise only and that dyspnea should not be assessed at rest.
Six Minute Walk Test (6MWT)	The 6MWT requires patients to walk as far as they can in 6 minutes. It requires a 100 foot hallway and the distance that the patient can quickly walk on a flat hard surface in a period of 6 minutes is recorded. Patients are allowed to stop and rest during the test. Only standardized phrasing of encouragement can be used during the test. Rating of perceived exertion (Borg scale), heart rate, respiratory rate and oxygen saturation are to be measured before and after the test.
Vital Signs	Heart Rate (HR): A measure of the number of heart beats per minute. It can be measured by electrocardiogram, by an auditory method, by a palpation method or by a portable heart rate monitor. The most common sites for palpating the heart rate are the radial and carotid arteries. Respiratory Rate (RR): Respiratory rate is a measure of the number of breaths per minute taken by an individual. It is used by physiotherapists as a response to physical exertion. Oxygen Saturation (SP02): Oxygen saturation is the percent saturation of available blood haemoglobin. It is used by physiotherapists to monitor oxygen prescription and as a response to physical exertion. Blood Pressure (BP): Blood pressure is a measure of the pressure exerted within the arterial walls during the systolic and diastolic phases of the cardiac cycle. It is used in physiotherapy as a response to physical exertion

Description of Middle Core Outcome Measures:

Outcome Measures	Description
Numerical Rating Scale as a measure of Dyspnea (NRS)	Dyspnea is rated on a numeric rating scale from 0-10 where 0 is no shortness of breath and 10 is shortness of breath as bad as it can be. Patients are required to rate their SOB by circling the appropriate number in the written format. The NRS can also be administered verbal.
Visual Analog Dyspnea Scale (VADS)	The VADS is a 1 item scale designed to measure shortness of breath. The scale consists of a 100 mm line placed vertically or horizontally on a page. The vertical line is anchored by “no SOB” at one end and “SOB as bad as it can be at the other. Subjects are required to indicate the intensity of their dyspnea by marking across the line. The scoring is done by measuring the distance from the bottom of the scale to the level indicated by the patient. VADS can be either horizontal or vertical. The VAS has only been used to assess task specific breathlessness
The Two Minute Walk Test (2MWT)	The 2MWT is a modification of the Cooper 12 minute running test. Its goal is to decrease the duration of the test in order to decrease the time to exhaustion of the participants. The test requires standardized wording, encouragement and 2 practice walks. Subjects are asked to cover as much distance as possible during the test. The test was an attempt to explore the possibility of using walking tests of shorter duration to assess exercise tolerance.
Physiotherapy Functional Mobility Profile (PFMP)	The goal of the measure is to assess and measure changes in functional mobility of adult chronic care patients and to evaluate their basic skills. It consist of nine items (bed mobility, supine to sit, sitting balance, sit to stand, standing balance, transfers, wheel chair mobility, ambulation indoors and stairs) using a 7 point scoring system that corresponds to the degree of assistance required by the subject to perform the task. The scoring scheme ranges from 7 (total independence) to 1 (complete dependence). The maximum score is 63 and the minimum is 9. The profile is observation based (physiotherapist). A questionnaire version has also been validated.
The Timed-Up and Go (TUG)	The TUG is based on the Get-Up and Go test by Mathias et al that was developed to assess disturbances of balance in elderly people. The test consists of observing the subject rising from a standard arm chair, walking three meters, turning and returning to sit down on the chair. The score is the time that it takes to complete the test as measured in seconds. Subjects are permitted to use their gait aid if necessary. The subject walks through the test once to familiarised themselves with the test requirements.
The Berg Balance Scale (Berg)	The Berg balance scale is a performance based measure of balance consisting of 14 items. Each item is scored on a 5 point scale (from 0 to 4). The scale is observation based. The maximum score on that can be obtained on the scale is 56 with higher scores indicating higher levels of independence and that the performance on the timed items met the specific time criteria. The Berg Balance Scale takes approximately 15 minutes to administer.

Description of Outer Core Outcome Measures:

Outcome Measures	Description
Heart Surgery Symptom Inventory (HSSI)	The HSSI was designed to provide a disease specific outcome measure for patients following coronary bypass surgery with an emphasis on the impact of disease specific symptoms. The instrument contains 76 items divided into 5 subcategories (general, cardiac, trunk, lower extremity and upper extremity). All statements are worded negatively and the scale consists of a 5 point Likert-scale with higher scores indicating greater severity of symptoms. It is self-report, self-administered (written) or interview based. Scores from each item are summed to generate subcategory and total scores. The scores can be divided by the number of items to give a relative score.
Timed Stand Tests (TST)	The timed stand test is a simple, reproducible method for quantifying lower extremity muscle strength. The subject sits on a chair 44.5 cm high, 38cm deep and performs 10 full stands from the sitting position. The test is time based (in terms of scoring) and the subject is allowed one practice stand for positioning and leaning the task. The subject is asked to complete the test as quickly as possible and the use of the upper extremities is not permitted
The Elderly Mobility Scale (EMS)	The EMS was developed in response to a recommendation by the Royal College of Physicians and British Geriatric Society regarding the need for a multi-disciplinary geriatric assessment package. The package originally included the Barthel Index as the functional measure however physiotherapists felt that it was too broad and not sensitive enough to change. The EMS is a scale that reflects the physiotherapy assessment of a geriatric population and represents the minimum (in terms of standards) that is required when assessing this patient population. The scale consists of the following components: lying to sitting, sitting to lying, sit to stand, stand, gait, timed walk (in 6 meters) and functional reach. The maximum possible score is 20, which represents independent mobility and the minimum is 0.

Methodology: Development of Recommendations:

Why were the recommendations developed?

The recommendations were developed to assist physiotherapists working with post-operative cardiac surgery clients in selecting evidence-based functional capacity outcome measures in their clinical practice.

What was the process that led to the development of the recommendations?

The process that led to the development of the recommendations consisted of the following: 1) a systematic review of the literature in order to identify all published standardized outcome measures available for use by physiotherapists to assess the functional capacity of post-operative cardiac surgery clients; 2) a survey of all physiotherapists working with post-operative cardiac surgery clients in order to identify outcome measures that may not have been captured by the literature search; 3) the quality assessment of each identified outcome measure using the “Quality criteria were proposed for measurement properties of health status questionnaires” by Terwee et al, 2007; 4) development of evidence (summary) tables for each of the identified outcome measures; 5) presentation of the evidence tables to a Panel of Experts; and 6) meeting of the Panel of Experts members in order to develop the recommendations.

Who participated in the survey involved in the second step of the development process?

The survey was distributed to Canadian physiotherapists with expertise and experience in the assessment and treatment of post-operative cardiac surgery clients.

How were the recommendations developed?

The members of the Panel of Experts were given a binder containing the evidence tables for each of the identified standardized functional capacity outcome measures two weeks prior to the scheduled meeting. The recommendations were then developed through discussions held at the June 6th, 2008 meeting. Each outcome measure was reviewed and recommendations with regards to their use in clinical practice were made based on pre-defined criteria.

What were the pre-defined criteria upon which the recommendations were based?

The overall assessment of each of the identified standardized functional capacity outcome measures was based on the following criteria: 1) the concepts that the instrument is intended to be measuring; 2) the instrument’s psychometric properties (content validity, face validity, criterion validity, construct validity, reliability, responsiveness and interpretability); 3) the instruments applicability for use in clinical practice based on time, efficiency and resources required to administer the instrument in clinical practice; and 4) the quality assessment of the outcome measures.

Who were the members of the Panel of Experts?

The members of the Panel of Experts consisted of experts in the field of cardio-respiratory physiotherapy as well as experts in the field of clinical practice guideline development. There was also clinician representation on the Panel of Experts in order to ensure that the recommendations were relevant to clinical practice.

Feedback on recommendations for use of standardized functional capacity outcome measures in post-operative cardiac surgery

- 1) Do you have any feedback about the recommendations regarding the utilization of “Standardized Functional Capacity Outcome Measures in Post-Operative Cardiac Surgery” ?**
- 2) Do you have any feedback regarding the feasibility of implementing these recommendations in clinical practice?**
- 3) Can you identify any potential facilitators that could assist the implementation of these recommendations in clinical practice?**
- 4) Can you identify any potential barriers that could make the implementation of the recommendations in clinical practice more difficult?**
- 5) Apart from function, dyspnea and quality of life, what else would you measure?**
- 6) Do you have any other suggestions or comments regarding these recommendations**

APPENDIX U: REFERENCE LIST FOR EVIDENCE TABLES

1. Post-Operative Discharge Scoring Tool (POP-DST)

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