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This project, written under the direction of the candidate's faculty advisor and approved by the chair of the Master's program, has been presented to and accepted by the Faculty of the Occupational Therapy department in partial fulfillment of the requirements for the degree of Master of Science in Occupational Therapy. The content, project, and research methodologies presented in this work represent the work of the candidates alone.

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Abstract

In recent years, the number of inpatient cardiovascular surgeries has significantly increased in hospitals around America. Occupational therapists in the intensive care unit (ICU) at Mills-Peninsula Medical Center (Burlingame, California) lack a standard protocol for addressing physical, cognitive, and psychosocial factors in patients post cardiac surgery. Furthermore, individuals' experience and clinical reasoning frequently guides interventions rather than current evidence. The American Occupational Therapy Association's Centennial Vision encourages occupational therapists to pursue science-driven practices and provide evidence-based interventions. In response to this Vision, an evidence-based clinical pathway was developed for the occupational therapists at Mills-Peninsula Medical Center. The clinical pathway facilitates patients' return to their highest level of function during post cardiac surgery rehabilitation. The proposed clinical pathway includes physical recovery, early detection of cognitive impairment, and psychosocial health for patients post cardiac surgery. The final clinical pathway was compiled into a clinical manual, entitled *Clinical Pathway for Post Cardiac Surgery – Progression of Occupational Therapy in Intensive Care Unit*, and adapted into a pocket guide.

Introduction

Hospitals in America are seeing a rise in the number of inpatient cardiac surgeries, increasing from 5,939,000 in 2000 to 7,588,000 in 2010 (Mozaffarian et al., 2015). As more patients require cardiac surgery, occupational therapy services are needed in the intensive care unit (ICU) to facilitate patients' return to their daily lives. Occupational therapists use a holistic approach to healthcare by addressing the entire person. This includes assessing and providing interventions for physical, cognitive and psychosocial aspects of the recovery process with the goal of promoting health and well-being, while simultaneously increasing participation in meaningful occupations (American Occupational Therapy Association, 2014).

In the ICU, the main focus is to medically stabilize patients before relocating patients to a lower level of care or discharging to an appropriate setting according to their health status. Occupational therapists working with patients following cardiac surgery often focus on addressing patients' physical factors, such as sternal precautions and safety, while improving patients' occupational engagement in activities of daily living (ADL). However, due to the nature of cardiac conditions and cardiac surgery, patients are also at an increased risk of developing cognitive and psychosocial symptoms (Davydow, Zatzick, Hough, & Katon, 2013; Gao et al., 2005). Despite the array of potential complications faced by patients who have had cardiac surgery, not all of these concerns are consistently addressed in the ICU at Mills- Peninsula Medical Center (MPMC). Yet, the ICU setting may present an opportunity for occupational therapists to address patients holistically. Therefore, occupational therapists should not only address physical factors,

but also attend to cognitive and psychosocial domains, in order to facilitate patients' return to their previous level of functioning in daily occupations and roles.

The American Occupational Therapy Association (AOTA) envisions "that occupational therapy is a powerful, widely recognized, science-driven, and evidence-based profession with a globally connected and diverse workforce meeting society's occupational needs," (AOTA, p.1, 2006). Evidence-based practice is a process in which evidence from research is combined with clinical knowledge and reasoning to provide interventions that are effective for a specific client (Law & Baum, 1998). As an evidence-based profession, a clinical pathway provides a guide to intervention that is supported by research and best practice. A clinical pathway is a plan of care that is based on the best and most current clinical practices (I., S., A., S.M., I., M., & ... H., 2016). First developed in the United States in the 1980s, the purpose of a clinical pathway is to reduce variability of clinical practice, streamline efficiency of treatment, and maximize quality of care (Di, XuPing, Jinhui, Qi, & Kehu, 2015). Studies demonstrate that using clinical pathways can improve patient outcomes, increase quality of care, reduce length of stay, and decrease hospitalization costs (Di et al., 2015; Xiao Yan et al., 2015). Furthermore, an evidence-based clinical pathway ensures the most appropriate and effective assessments and interventions are implemented to create consistent and unbiased care to facilitate patients' return to their highest level of functioning and improve their overall quality of life. Therefore, the goal of this project was to develop a clinical pathway for the occupational therapy department at MPMC. The clinical pathway developed for MPMC addresses common physical, cognitive, and psychosocial factors that may arise in patients post cardiac surgery during their stay in the ICU and acute care.

Literature Review

Hospitals continue to see a rise in the number of invasive cardiac surgeries due to the increased rate of cardiac conditions, some of which require open-heart surgery. Some common cardiac conditions that result in open-heart surgery are coronary heart disease (CHD), congestive heart failure (CHF), and valve stenosis. In 2006, there were 448,000 documented coronary artery bypass grafting (CABG) surgeries to treat severe CHD in America (Cahalin, LaPier & Shaw, 2011). Depending on the severity of the condition, some patients may have elective open-heart surgery while others may require emergency open-heart surgery. After cardiac surgery, patients initially receive care in the ICU for medical stabilization as they begin their recovery. Due to the nature of cardiac surgery, patients' physical, cognitive, and psychosocial well-being may be affected during their recovery in the ICU.

Occupational therapists view health from a holistic standpoint to address the entire person, including their physical and cognitive abilities, personal values, concerns, and goals to improve their overall quality of life. Therefore, occupational therapists are in a unique position to identify and address not only physical factors in the ICU but also pre-existing or new cognitive and psychosocial concerns. Early identification of physical impairments, cognitive concerns, and impairments in psychosocial functioning in patients post cardiac surgery may result in earlier and more successful discharges, which may, decrease the length of stay in the ICU (Eltheni et al., 2012). In addition, decreased length of stay and successful discharges will allow for efficient allocation of ICU resources, reduce healthcare costs, and improve patient outcomes (Eltheni et al., 2012). This literature review will address physical, cognitive, and psychosocial aspects of recovery

following cardiac surgery. In addition, the literature review will explore the most appropriate guidelines, assessments, and interventions occupational therapists may use to guide a patient's return to participation in daily occupations and life roles after cardiac surgery.

Physical Factors

Due to medical instability following cardiac surgeries, all patients begin their recovery in the ICU. Patients are initially on temporary bed rest, which can result in physiological changes including disuse muscle atrophy and ICU acquired weakness (Fan, 2012). Sternal instability may occur as a result of the median sternotomy, which is the surgical separation of the sternum bone into halves to allow the surgeon access to the heart to perform the cardiac surgery. Other common physical symptoms after cardiac surgery include respiratory difficulties, trouble with sleeping, improper wound care, difficulties with eating, and thoracic, shoulder, and back pain (Cahalin et al., 2011).

To facilitate a patient's return to their highest level of function, all of these symptoms following cardiac surgery should be addressed during cardiac rehabilitation (Nguyen, Thoa-Houane, & Warren, 2014). Cardiac rehabilitation is needed to address disuse muscle atrophy by implementing early mobilization post-cardiac surgery. Some of the identified factors from the literature that guide early mobilization are the Metabolic Equivalent of Task (MET), vital signs, and Rating of Perceived Exertion (RPE). Additionally, variations of sternal precautions are implemented to address the potential for sternal instability.

Disuse muscle atrophy. Disuse muscle atrophy is a common condition that occurs as a result of decline in muscle mass. Just four hours of immobility and disuse can

initiate the process of decline in cell diameter, number of muscle fibers, muscle mass, and endurance, particularly in the lower extremities (Fan, 2012; Kasper, Talbot, & Gaines, 2002; Nordon-Craft, Moss, Quan, & Schenkman, 2012). Appleton and Kinsella (2012) found that muscle cross-sectional area can decrease at a rate of 3-4% per day due to protein breakdown, reduced protein synthesis, and increased cell death during critical illness. Bloomfield conducted a literature review to assess musculoskeletal changes associated with disuse during prolonged bed rest and found that within four to six weeks of immobilization, a patient may experience as much as 40% loss of muscle strength (as cited in Cameron et al., 2015).

Disuse muscle atrophy is a concern for patients following cardiac surgery as the patients begin to recuperate from surgery after an initial period of bed rest. Disuse muscle atrophy and the resulting weakness can lengthen patients' ICU hospital stay and can significantly limit independent participation in basic activities such as bed mobility (Citerio et al., 2015; Nordon-Craft et al., 2012). In order to facilitate patients' return to their daily functional activities, early mobilization interventions are recommended to address disuse muscle atrophy.

Early mobilization. Early mobilization is the active participation in functional mobility and activity by patients immediately following medical stabilization in the ICU (Fan, 2012; Kalisch, Lee, & Dabney 2014; Lipshutz & Gropper, 2013). Functional mobility is defined as "moving from one position or place to another" (AOTA, p.S19, 2014). Examples of early mobilization activities include sitting at the edge of the bed with no back support, sitting in a chair after being transferred from the bed, and ambulating (Bailey et al., 2007; Lipshutz & Gropper, 2013). By participating in early

mobilization, functional mobility, endurance, and muscle strength can be maintained or improved (Fan, 2012; Needham, 2008).

Wahab et al. (2015) implemented a one-year program in five medical, cardiac, and surgical ICUs to determine the effects and benefits of an early mobilization rehabilitation program has on patients' ICU and hospital length of stay. Physical and occupational therapists evaluated and treated patients six days a week. While physical therapy focused on passive range of motion (ROM), transfers, and ambulation, occupational therapy provided intervention regarding ADL such as feeding, personal grooming, and dressing. By retrospectively comparing statistics from the year prior to the early mobilization rehabilitation program and the year after it was implemented, Wahab et al. (2015) found that when the early mobilization rehabilitation program was in place (a) the average of number of therapy treatments received by each patient per day increased from 0.16 to 0.72, (b) 35% more patients ambulated with physical therapy, and (c) the ICU length of stay decreased from an average of 14.7 days to 13.9 days. However, due to the lack of information regarding the baseline activity and mobility level of the patients before the ICU admissions, a change in the functional outcomes of the patients could not be assessed (Wahab et al., 2015). Nevertheless, this study supports the use of an early mobilization rehabilitation program as it may shorten patients' ICU length of stay.

Waugaman, VanNortwick, Dionne, Whitmore, and Bradley (2015), implemented early mobility in a study to explore the effects of early mobilization rehabilitation in postoperative protocol for patients following cardiac surgery. The researchers created clinical pathways specifically designed for each participant to emphasize increased

mobility starting with pre-admission testing and continuing throughout discharge from the ICU. Additionally, staff and family members were educated on the effects of early mobilization. Results of the study showed improvements in mobility and sleep quality, and reductions in postoperative complications, readmission rates, and average length of stay in the hospital (Waugaman et al., 2015). These findings have significant clinical implications as all of these factors may have a positive effect on the health and recovery of patients who have had cardiac surgery and may facilitate a resumption of normal activities and routines.

Although Kalisch, Lee, and Dabney (2014) did not focus exclusively on cardiac patients, their literature review evaluated 36 studies and concluded that there was substantial evidence supporting the use of early mobilization in rehabilitation. Kalisch et al. (2014) found that benefits of early inpatient mobilization were observed in adult patients within the acute care setting, which included patients post cardiac surgery as well as patients with stroke, patients post hip surgery, and patients with cancer. The benefits included reduction in pain, fatigue, pneumonia, as well as improved walking distance and a more rapid return of the ability to ambulate independently (Kalisch et al., 2014). The researchers also observed that patients who received less rehabilitation with early mobilization were more likely to experience physical and psychosocial complications, a slower recovery, more functional impairments, and a longer hospital stay when compared to their counterparts (Kalisch et al., 2014). The results of the literature review supported the important role of early mobilization rehabilitation in preventing negative outcomes that may impact recovery.

Review of the literature shows extensive evidence supporting the benefit of early immobilization. However, there is a gap in the literature pertaining to the progression of occupational therapy intervention in the ICU. The lack of clinical evidence to guide the progression of occupational therapy intervention is problematic because variations in treatment may occur between therapists or may occur at a rate without sound clinical guidance. A clinical pathway that incorporates a progression of early mobilization while accommodating patients' needs and capabilities is needed for rehabilitation in the ICU. Methods that may be used to guide progression of rehabilitation for patients post cardiac surgery include the MET, vital signs, and Borg's RPE scale.

Metabolic Equivalent of Task. MET is a commonly used physiological construct that describes the energy cost of various activities (Savage, Toth, & Ades, 2007). MET values are used to evaluate individuals' baseline of physical fitness, assess for changes in physical function, and prescribe activity to facilitate increased physical capacity for individuals with cardiac conditions such as CHD (Savage et al., 2007). *The Compendium of Physical Activities* was initially published in 1993 as a reference of energy requirements for various physical activities measured in MET for adults between ages 18 and 65 years of age, (Ainsworth et al., 2011). *The Compendium of Physical Activities* is organized according to estimated and measured level of energy requirements, ranging from 0.9 MET for low intensity activities such as sleeping to 23 MET for high intensity activities such as running at a pace of 14.0 miles per hour (Ainsworth et al., 2000; Ainsworth et al., 2011; Jetté, Sidney, & Blumchen, 1990). *The Compendium of Physical Activities* was recently updated in 2011 to include more precisely measured MET values

that were previously estimated and MET values for a larger variety of physical activities including ADL and instrumental activities of daily living (IADL) as shown in Table 1.

Table 1
MET Values for ADL, IADL, and Leisure activities

Activity	MET Value
Typing on computer	1.3
Eating while seated	1.5
Playing cards while seated	1.5
Toileting	1.8
Ironing	1.8
Washing dishes while standing	1.8
Hygiene and grooming while seated or standing	2.0
Folding laundry	2.0
Grocery shopping	2.3
Getting ready for bed	2.3
Dusting or polishing furniture	2.3
Dressing/undressing while seated or standing	2.5
Driving a car	2.5
General child care	2.5
Sweeping carpet or floors	3.3
Making a bed	3.3
Vacuuming	3.3
Cooking and food preparation, moderate effort	3.5
Walking for pleasure	3.5
Descending stairs	3.5
Mopping floors while standing	3.5
Mowing lawn	5.5
Moving Furniture	5.8
Alternate Jogging and walking	6.0
Climbing stairs quickly	8.8

Note. From Ainsworth et al., 2011, The Compendium of physical activities tracking guide.

The absolute value of one MET (1-MET) can be defined in two different ways. First, 1-MET can be defined in terms of energy expenditure at rest as the ratio of work metabolic rate to resting metabolic rate (RMR), which is 1 kilocalorie per kilogram per hour ($kcal \cdot kg^{-1} \cdot h^{-1}$) (Ainsworth et al., 2000; Ainsworth et al., 2011; Howley, 2000). RMR is the amount of energy a person expends during rest (Howley, 2000). Therefore, MET values may be used as an index, meaning that an activity that requires 2 MET, such as

showering and drying off while standing, requires twice as much energy as an activity that requires 1 MET, such as sitting quietly (Ainsworth et al., 2011). The second definition of 1-MET is derived from the maximum amount of oxygen consumed (VO_2) at rest for a 40-year old male that weighs 70 kilogram that weighs 70 kilograms, which is 3.5 milliliters of oxygen per kilogram of body weight per minute ($mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$) (Byrne, Hills, Hunter, Weinsier, & Schutz, 2005; Howley, 2000). However, resting VO_2 is highly influenced by age, gender, exercise routine, genetics, cardiovascular health, body mass, and body composition (Fletcher, Froelicher, Hartley, Haskell, & Pollock, 1990). Since there is high variability in body type, physical fitness, and anthropometric variables, the validity of the absolute value of the MET to prescribe physical activity is highly questionable.

Several studies have been conducted to assess the validity of the MET values. Byrne, Hills, Hunter, Weinsier, and Schutz (2005) found the absolute MET value overestimates the actual resting VO_2 by 27%. Participants of the study were 593 females and 78 males, who were generally healthy, ranging in age from 18 to 74 years old. Participants' skinfold thickness were measured and body bioelectrical impedance were assessed to calculate the percent of fat mass and fat-free mass. The researchers analyzed data from 78 female and 78 male participants with an average age of 38 years and an average body mass index (BMI) of 31 kg/m^2 to account for the major disparity in sample size among gender. In their study, Byrne et al. (2005) found the average resting VO_2 for this selection of participants was 2.56 ± 0.40 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$. The researchers further concluded that the absolute value of 1-MET is, therefore, mostly impacted by BMI (Byrne et al., 2005).

Cunha, Midgley, Montenegro, Oliveira, and Farinatti (2013) also calculated the individual resting VO_2 of 125 healthy male participants at an average age of 22 years. Resting VO_2 was measured while participants laid in a supine position in a thermoneutral and calm laboratory environment for 30 minutes. Body mass, height, skinfold thickness, body density, and percent body fat were collected from each participant to determine factors to explain the variance in resting VO_2. Through statistical analysis, Cunha et al. (2013) found the average amount of oxygen consumed at rest was 3.21 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$, with 70% of the participants demonstrating resting VO_2 values below the absolute 1-MET equivalent of 3.5 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$. Thus, due to individual variations that can affect VO_2, it should be noted that the absolute MET value may not accurately apply to everyone. Therefore, the researchers recommended using 3.0 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$ as the 1-MET equivalent may be a more accurate estimation of the amount of energy an individual spends at rest, and can be used to identify more appropriate levels of activity intensity (Cunha, Midgley, Montenegro, Oliveira, & Farinatti, 2013; Savage et al., 2007).

Furthermore, Savage, Toth, and Ades (2007) also calculated and assessed the resting VO_2 of individuals diagnosed with CHD. Of the 109 participants, 60 were male and 49 were female, the average age was 66 years old, and the average BMI was 31.8 kg/m^2. Resting VO_2 was calculated by assessing the participant's body weight and height, composition of body fat, and RMR. After statistical analysis, Savage et al. (2007) found the absolute value for one MET to be 2.58 ± 0.4 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$, which is 23% to 36% lower than the absolute value of 3.5 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$.

Overall, the researchers concluded that an estimated energy expenditure of 3.0 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$, rather than 3.5 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$, would be a more accurate estimate of

the absolute 1-MET value when prescribing exercise to cardiac patients returning to physical activity. The researchers noted that although the measurement of VO_2 and 1-MET may not be exact, MET values can still be used as a general guide to grade activities in relationship with the various levels of energy demands (Savage et al., 2007). These findings are very similar to the findings of Byrne et al. (2005). Therefore, the 1-MET value of 3.5 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$ is likely not an accurate value of energy spent at rest for every person, and the corresponding 1-MET value does not precisely describe the amount of energy each individual will need to exert to complete an activity. Since the difference between actual resting VO_2 and the standard 1-MET value could result in selecting imprecise exercise intensities based on an inaccurate estimation of energy expenditure for an individual (Cunha et al., 2013), perhaps MET values should be used as only a relative guide. Occupational therapists may utilize the relative MET values to determine the progression of physical activity for patients recovering from cardiac surgery in the hospital and while they continue to recover at home and slowly resume their typical daily routine to prevent overexertion. For example, patients post cardiac surgery should participate in light IADL physical tasks such as washing dishes (1.8 MET) before moving to slightly more demanding IADL such as standing to cook (3.3 MET) or washing the floor (3.5 MET) (Ainsworth et al., 2011; Jetté et al., 1990).

Vital signs. As best practice, vital signs are continuously monitored while patients are recovering in the ICU following cardiac surgery. Vital signs include heart rate, blood pressure, respiratory rate, oxygen saturation, and pain (Elliot & Coventry, 2012). Careful observation of these vital signs is especially crucial when occupational therapists begin to mobilize patients in the ICU. Patients are not necessarily medically stable following a

cardiac surgery. Any changes in heart rate, oxygen saturation levels, and blood pressure may indicate clinical deterioration and activity intolerance within patients following cardiac surgery (Preston & Flynn, 2010). As fluctuations in any one of the vital signs may suggest a change in medical status, the vital sign parameters that have been laid out by the patient's physician should be closely adhered to during exercise as patient's progress through their cardiac rehabilitation.

Heart rate (HR) variability is commonly used to assess cardiac autonomic nervous system functioning, which includes heart rate and electrical conduction within the structures of the heart (Shen & Zipes, 2014). Furthermore, cardiac autonomic regulation plays a significant role in hemodynamics, which includes the amount of force exerted by the heart in order to facilitate adequate blood circulation (Shen & Zipes, 2014). Cardiac autonomic regulation is often impaired following CABG surgery (Mendes et al., 2010). In a study by Mendes et al. (2010), 47 patients participated in a study to examine the efficacy of an early mobilization protocol consisting of short-term physiotherapy exercises following CABG surgery on improving cardiac autonomic regulation. The early mobilization protocol consisted of various exercises, beginning with active assistive ROM movements and progressing to climbing flights of stairs (Mendes et al., 2010). Vital signs were used to measure exercise intensity and HR was monitored to ensure the patient's exercising HR remained less than 20 beats per minute (BPM) above the patient's resting HR (RHR) (Mendes et al., 2010). The HR limit was adopted from Phase I of a cardiac rehabilitation program used in the Veterans General Hospital in Taipei for cardiac patients following CABG surgery (Ku, Ku, & Ma. 2002). The results of the study by Mendes et al. (2010) indicated that HR variability measurements were an accurate

way to assess cardiac autonomic function following a CABG. The study found early mobilization had positive effects on cardiac autonomic activity as evidenced by improved HR variability, demonstrating exercise following cardiac surgery is safe within the patient's HR guidelines (Mendes et al., 2010).

Blood pressure is a recorded measure of the pressure of blood flow when the heart is in contraction (systole) and relaxation (diastole) (Elliot & Coventry, 2012). Average blood pressure is 120 millimeters of mercury (mmHg) systole and 80 mmHg diastole. Hypertensive crisis is apparent when the blood pressure exceeds 180-mmHg systolic and 110 mmHg diastolic; however, each patient may have different blood pressure parameters set by his or her physician (American Heart Association, 2014). Blood pressure may elevate during exercise and may fluctuate during positional changes. When changing positions, for example from sit to stand, blood pressure can become significantly lower and cause patients to become light headed or dizzy. Fluctuation in blood pressure can become a safety risk and decrease participation in daily occupations (Eser, Khorshid, Yapucu Günes, & Demir, 2007). Therefore, occupational therapists should exercise caution with cardiac patients, particularly when mobilizing them into different positions following periods of bed rest.

Respiratory rate (RR) has been shown to be a good indicator of declining medical status in patients in acute care. An increased RR that is over 20 breaths per minute at rest can be considered abnormal and may indicate a serious decline in medical status (Preston & Flynn, 2010). Respiratory dysfunction, as measured by RR, has also been identified as a symptom prior to adverse events, such as a cardiac arrest (Considine & Botti, 2004; Preston & Flynn, 2010). With regards to patients who have undergone cardiac surgery,

respiratory volumes can be significantly reduced following CABG surgery due to changes in pulmonary functioning and limited mobilization of the sternum (Cahalin et al., 2011). A reduction in respiratory volume, and consequently a reduced intake of oxygen, could lead to a decreased blood oxygen saturation level. Therefore, therapists should monitor RR during interventions in the ICU because decreased blood oxygen saturation can negatively impact respiratory control and brain function.

Pulse oximetry is often used to monitor patient's blood oxygen saturation level. Hypoxemia is an abnormally low concentration of oxygen in the blood, and is classified as a blood oxygen saturation level below 90% as measured by pulse oximetry (McMullan et al., 2013). Low oxygen levels can result in a decreased partial pressure of oxygen in the blood, which affects physiological processes like respiratory control (Kapur et al., 2013). In the elderly, a decrease in blood oxygen saturation can impact the body’s ability to deliver adequate levels of oxygen to organs such as the brain and interrupt its functioning. This demonstrates the need for pulse oximetry to be carefully monitored throughout occupational therapy sessions with patients, regardless of their condition (Kapur et al., 2013).

Pain is considered by some as a vital sign in itself (Elliott & Coventry, 2012; Karabulut, Aktaş, Gürçayır, Yilmaz, & Gökmen, 2015), and is frequently experienced by patients in acute care post-cardiac surgery. During their hospitalization, patients were most likely to report pain as interrupting daily activities during the first week after cardiac surgery (Sethares, Chin, & Costa, 2013). As occupational therapists work with patients to enable them to perform their daily tasks, untreated pain may negatively impact patients' willingness and ability to participate in early mobilization. Untreated pain can

also trigger a response from the sympathetic nervous system. The pain response can lead to an increase in heart rate and blood pressure, as well as a reduction in ventricular filling time and cardiac output (Sethares, Chin, & Costa, 2013). Excess stress on the heart after cardiac surgery may increase medical complications, therefore it is vital that pain is monitored during occupational therapy interventions.

Rating of perceived exertion scale. Borg's RPE scale is a subjective rating scale commonly used with cardiac patients. It is based on patients' perception of the amount of energy they are exerting at any given time (Borg, 1982). RPE is based on a number of factors, including feedback from the central nervous system, the cardiopulmonary system, joints, and muscles (Borg, 1982). The assumption behind RPE is that exertion is linearly correlated with oxygen expenditure and an increase in HR, therefore making it a suitable tool for gauging the perceived level of intensity during physical activity (Borg, 1982). When the RPE was created, the scale was arranged from 6 to 20 to correlate with HR values varying from 60 to 200 BPM. For example, RPE of 10 represents an average HR of 100 BPM (Borg, 1982). Hence, RPE of 6 to 11 indicates very light to fairly light exertion during a task, RPE of 12 to 16 indicates hard to somewhat hard exertion, and RPE of 17 to 20 indicates very hard to maximum exertion (Borg, 1982). However, many factors can affect HR, such as the environment, comorbid conditions, and the intensity and type of exercise (Borg, 1982). Moreover, since RPE is a subjective scale, the correlation between RPE and HR should not be strictly adhered to and RPE should not be used as a measure on its own.

Joo et al. (2004) conducted a single-group crossover study to determine if participants with cardiac conditions were able to use RPE or 20 BPM higher than their

individual resting heart rate (RHR+20) to guide exercise intensity within the limit of 40 and 60 percent of VO_2 during a two-part field test. Participants of the study included 11 overweight or obese participants between the ages of 43 and 63 who had either been diagnosed with cardiac conditions or had recently undergone a cardiac procedure. In the first part of the study, the participants were told to use a RPE of 11 through 13 to guide their exercise intensity while walking in a gymnasium for 10-minutes. After a 10-minute rest period to allow each participant's heart rate to return to his or her baseline, the participants were then asked to walk another 10-minutes to reach a target intensity of RHR+20 in the second part of the study. Heart rate and VO_2 data were recorded in two-minute intervals for both parts of the study. After data analysis, the results of the first part of the study found that when participants were told to walk at a RPE between 11 and 13, one participant expended less than 40 percent VO_2, one participant expended between 40 percent and 60 percent VO_2, and nine participants exceeded the recommended expenditure of 60 percent VO_2. In other words, 82 percent of the participants' VO_2 measured above the recommended 40 to 60 percent peak oxygen uptake for cardiac patients, demonstrating overexertion beyond safe limits (Joo et al., 2004). The results of the second part of the study showed that when participants used RHR+20, four participants expended less than 40 percent VO_2, six participants expended between 40 percent and 60 percent VO_2, and one participants exceeded the recommended expenditure of 60 percent VO_2. Since a significant number of patients overestimated how much energy they were exerting, this study indicates that RPE may be an unsafe method of determining physiological effort in patients following cardiac surgery who had been classified as high risk. The researchers concluded that RPE would be a more appropriate

measure for low risk cardiac patients, while the RHR + 20 may be more appropriate for guiding exercise intensity in high risk cardiac patients (Joo et al., 2004).

A non-randomized, single-group, crossover study by Aamot, Forbord, Karlsen, and Støylen (2014) examined the use of RPE as a valid guide for determining exercise intensity during cardiac rehabilitation exercises which included high-intensity interval training (HIT). The ten participants in Aamot et al.'s (2014) study were adults who had all been enrolled in an outpatient cardiac rehabilitation program and each participant was instructed to reach 85 to 95 percent of their individual peak HR during the exercise program to demonstrate that they had reached the target intensity. The 24 HIT sessions were led by a physiotherapist who began each session with a 15-minute warm-up exercise during which the participants performed low intensity workouts of up to RPE of 12 to 13. The warm-up was followed by high-intensity exercise during which the participants were instructed to work up to RPE of 17 within one to two minutes by using either a treadmill or a stationary bicycle. Of the 24 HIT sessions, four sessions required participants to rely only on RPE as a guide for reaching their target exercise intensity. Four other sessions were performed during which the participants used HR monitors to guide them in reaching their target heart rate limit (Aamot, Forbord, Karlsen, & Støylen, 2014).

A comparison of Aamot et al. (2014) results from the RPE guided HIT sessions and the HR monitor guided HIT sessions revealed that participants were less likely to reach their target exercise intensity when relying solely on RPE as a guide to rate the intensity of their exercise. When using RPE as a guide, participants were not able to reach their individual target peak HR, while participants reached the target peak HR

when using HR monitors as a guide. Based on the results found by Aamot et al. (2014), it appears that HR monitors may be more effective at guiding patients in meeting their target exercise intensity. However, it should be noted that 85 percent is the lower limit of the target peak HR, and participants using RPE were able to reach 82 percent (Aamot et al., 2014). This demonstrates that while RPE appears to be correlated with a lower peak HR and intensity than is desired in a cardiac rehabilitation program, it may still be an effective tool for determining exercise intensity when coupled with HR measurements.

Based on the results of Joo et al. (2004) and Aamot et al. (2014), it appears that RPE may not be a reliable tool for patients to use alone to interpret the exact amount of energy being exerted. For instance, the study by Joo et al. (2004) assessed the VO_2 of cardiac patients when exercising at a RPE between 11 and 13, 82 percent of the study participants exceeded the 40 to 60 percent VO_2 limit. As demonstrated above, the participants' efforts in excess of the recommended limit for patients who have undergone cardiac surgery may signify a safety concern since the patients may not be able to independently determine how hard to work in order to remain within the recommended limit (Joo et al., 2004). Similarly, in the study comparing the use of RPE and HR monitors in guiding patients to meet their target exercise intensity, RPE was found to be too subjective and the participants were not able to reach their target when relying solely on RPE (Aamot et al., 2014).

Although the RPE is based on individual and subjective ratings, and is therefore susceptible to inconsistencies, it still has clinical merit as a tool in cardiac rehabilitation. It is recommended that RPE be used in conjunction with vital signs, specifically HR and RR, because although it is a subjective measure it could serve as a means of monitoring

how the patient is feeling throughout the therapy session (Scherr et al., 2013). For example, if a patient reports a high RPE but his or her HR is well below the lowest limit of a safe HR, the occupational therapist will feel supported in their decision to encourage the patient to continue to participate in therapy. Based on the study results from Joo et al. (2004), research supports that RHR+20 may be a safer and more reliable objective measure to use with high risk cardiac patients, while RPE can still be used as supplemental feedback to the clinicians.

Sternal instability. A median sternotomy consists of the complete division of the sternum and separation of the two halves with retractors to allow access to the heart during the surgery before being reattached with stainless steel sutures (Kun & Xiubin, 2009; Tuyl, Mackney, & Johnston, 2012). A median sternotomy is the most common incision in cardiac surgeries, including CABG and valve replacements (Tuyl et al., 2012). The incidence of sternal complications following cardiac surgery ranges from 1% to 5%, with one of the major complications being sternal instability, a condition where the incised sternum fails to heal properly (Olbrecht et al., 2006).

Since the sternum is no longer properly fused as a single bone after a sternotomy, the trunk may become unstable during movement, particularly in the upper body (El-Ansary, Waddington, & Adams, 2007). A randomized crossover study by El-Ansary, Waddington, and Adams (2007) examined the effects of trunk stabilization exercises on sternal separation and pain in nine participants who reported having chronic sternal instability for four years after the surgery. Sternal pain and instability had interfered with daily tasks that required limb and trunk movement, such as lying supine, transitioning from sitting to standing, reaching above shoulder height, and driving (El-Ansary et al.,

2007). To address the impact of sternal instability on daily life, El-Ansary et al. (2007) implemented a six-week trunk stabilization exercise program, which included contractions of the abdominal muscles while in various positions. The results showed a 35% decrease in sternal separation and a decrease in pain assessed using a visual analog scale, particularly in the seated and supine positions (El-Ansary et al., 2007). Since sternal instability and pain can negatively impact an individual's participation in sleep, as well as their ability to drive and dress independently, the reduction of sternal instability and pain could have important implications for improving health-related quality of life.

El-Ansary, Adams, and Waddington (2009) further supported the need to address sternal instability in a case study that assessed upper limb elevation. The participant was a 55-year-old male who had been diagnosed with sternal instability following CABG surgery that occurred five years prior. During rest, the participant's sternal displacement in the transverse plane measured 10mm and ranged between 11mm to 17.5mm during upper limb movement. In the sagittal plane, the participant had sternal displacement of 3.5 mm that ranged between 4.5 mm to 18.2 mm during movement. The change in sternal measurements during rest and movement in the transverse and sagittal planes demonstrate that sternal instability can result in subluxation or partial dislocation of the sternal halves. Subluxation may result in nonunion or malunion of the sternum, which may negatively impact function (El-Ansary, Adams, & Waddington, 2009). The results of the study illustrate the importance of adhering to sternal precautions in order to prevent subluxation during movement of the upper limbs and ensure proper healing of the sternum.

Thoracic exercises may reduce postoperative pain and sternal instability in cardiac patients. A randomized pilot study by Sturgess, Denehy, Tully, and El-Ansary (2014) examined the effects of early mobilization on pain, ROM, and health-related quality of life in 38 patients who had recently undergone open-heart surgery. While all participants in this study were assessed preoperatively, received education on early mobility following their operation, and received the standard protocol for postoperative care in the ICU, the experimental group received additional intervention in the form of a thoracic exercise program. The exercises were graded up or down by changing the level of intensity and frequency of the exercises and were individually tailored according to each patient's reported level of fatigue, pain, and ease of movement. Participants of the thoracic exercise program reported a statistically significant reduction in sternal pain during the first six weeks following the surgery using a visual analog scale (Sturgess, Denehy, Tully, & El-Ansary, 2014). This finding supports the inclusion of thoracic exercises in postoperative rehabilitation to decrease patients' pain. Pain reduction during movement may further allow patients who have undergone cardiac surgery to resume participation in ADL and meaningful occupations earlier in their recovery.

Sternal precautions. Sternal precautions are physical restrictions given to patients following cardiac surgery after a median sternotomy to promote proper healing of the sternum and prevent sternal instability. These restrictions include limiting ROM of the arms and the amount of weight that can be carried, pushed, or pulled. Therefore, sternal precautions can affect the performance of driving, exercising, and engaging in activities of daily living that involve reaching, lifting, and transporting objects (Cahalin et al., 2011). Theoretically, these precautions are in place to prevent excessive stress on the

surgical site and the sternum that has been halved. Precautions also aim to decrease risk for nonunion or malunion as the sternum heals (Brocki, Thorup, & Andreasen, 2010).

Currently, sternal precautions are based on clinical reasoning or expert opinions and are not supported by research (Cahalin et al., 2011). The lack of literature results in inconsistencies regarding what sternal precautions should be. Kelly and Kizhakkemuri (2012) investigated a case study of a 41-year old female and examined the patient's chest wall for shearing movements during manual muscle testing of the upper extremities. It was determined that sternal precautions could allow for 20 pounds of symmetrical, bilateral force during lifting, pushing, and pulling without increasing the risk of postoperative complications. The authors suggested that this sternal precaution would allow for increased participation in activities and functional mobility, which in turn would increase independence (Kelly & Kizhakkemuri, 2012). Similarly, Brocki, Thorup, and Andreasen (2010) found no reason to enforce weight restrictions during physical activities if there is no pain, on the condition that the elbows must be kept close to the body during the first eight weeks. However, these adjusted protocols greatly exceed the most commonly recommended standards for sternal precautions, which include limitations on arm movements above shoulder level, scapular adduction, lifting beyond 10 pounds, weight bearing on the upper extremities, and unilateral reaching (Cahalin et al., 2011).

Due to inconsistent recommendations for sternal precautions regarding weight limitations, ROM restrictions, and pain, Cahalin, LaPier, and Shaw (2011) suggested a progressive sternal precaution algorithm be implemented to better fit individual patient's needs. This proposed sternal precaution algorithm guides medical professionals to

prescribe less restrictive sternal precautions according to how well the patient is healing. In summary, the literature points to a precautionary approach rather than a restrictive approach to sternal precautions in order to reduce the restriction of participation in daily occupations while still promoting safe healing of the sternum (Cahalin et al., 2011).

Disuse muscle atrophy and sternal instability are two physical concerns of patients post cardiac surgery in the ICU. To address disuse muscle atrophy, occupational therapists may provide interventions consisting of early mobilization rehabilitation guided by MET, vital signs, and RHR+20 to keep patients active during their recovery. To address sternal instability, occupational therapists may educate patients who have had cardiac surgery on sternal precautions to avoid movements that may prevent the sternum bone from healing properly. Other than physical recovery, cognitive decline is another important concern to address following cardiac surgery. Cognitive decline may impact a patient's ability to recover and return to daily occupations following discharge. For example, cognitive decline in memory or attention may reduce a patient's ability to follow sternal precautions, thereby increasing the risk for nonunion and malunion of the sternal halves. Therefore, occupational therapists should also identify and address cognitive concerns in the ICU.

Cognitive Factors

Cognition consists of processes such as orientation, attention, perception, problem solving, memory, judgement, language, reasoning, and planning (Cheney & Rivera-Finnen, 2011). Processes of cognition are essential for participation in valued occupations and roles. Cognition is also required to maintain an independent and safe involvement in the community. Therefore, any impairments in cognition may significantly impact an

individual's participation in meaningful occupations which will ultimately impact the individual's quality of life. The incidence of cognitive impairments are on the rise as people live longer and as demographics shift toward an aging population (Cheney & Rivera-Finnen, 2011). Additionally, more elderly patients with multiple diagnoses, who are at a higher risk than other groups for developing cognitive impairments, are now able to undergo invasive surgical procedures such as cardiac surgery, later in life (Newman et al., 2001).

Cognitive impairments is a complication that many individuals encounter following cardiac surgery (Rosengart et al., 2005). In a longitudinal study that followed 261 patients after CABG, the incidence of cognitive decline was 53% at discharge, 36% at six weeks after surgery, 24 % at six months after surgery, and 42% at five years after surgery (Newman et al., 2001). The patients that continued to experience cognitive decline after five years were older in age, less educated, and had experienced cognitive decline at the time of discharge. Since the results of this study demonstrated a high prevalence of cognitive impairment immediately after cardiac surgery, it is important that changes in cognition be detected prior to discharge so that patients may receive appropriate care. In addition to the long-term impacts cognitive impairments may have on function and safety, cognitive decline has also been associated with a 10% increase in hospital mortality, increase lengths of stay, and prolonged expensive rehabilitation (Rosengart et al., 2005). Thus, understanding the risk factors that may contribute to developing cognitive impairments following cardiac surgery is important to consider when addressing treatment and discharge in the ICU setting.

The exact causes for developing cognitive impairments following cardiac surgery are unknown and may often be the result of many factors (Newman et al., 2001). Factors that may contribute to the prevalence of cognitive impairments following cardiac surgery include previous cerebrovascular disease, undetected cognitive impairment prior to surgery, and cardiovascular risk factors such as hypertension, diabetes, and peripheral vascular disease (Newman et al., 2001). Other factors contributing to cognitive impairments may also be the result of the nature of the surgical procedure such as the duration of the CABG surgery, hypotension, manipulation of the diseased aorta, general anesthesia, and hypothermia (Newman et al., 2001).

The goals of occupational therapy in the ICU are to assess ADL, provide education, and formulate a discharge plan. However, all of these goals can be impacted if the patient is experiencing cognitive impairments. Patients with cognitive impairments may have difficulty understanding sternal precautions and may face challenges with performing ADL safely at home. Therefore, cognitive impairments that are not identified and addressed prior to discharge may present challenges in function as well as a safety concern.

Cognitive impairments after cardiac surgery may significantly limit a patient's ability to complete ADL and IADL. IADL are activities that allow an individual to be independent at home or in the community such as shopping, medication management, home management, and driving (Jekel et al., 2015). Ahlgren, Lundqvvist, Nordlund, Aren and Rutberg (2003) found that the IADL of driving may be significantly impacted by cognitive impairments following CABG. In this study, 27 patients underwent CABG and 20 patients underwent percutaneous coronary intervention (PCI) under local anesthesia

were administered a battery of 12 neuropsychological tests, a driving test in a driving simulator, and an on the road driving test in real traffic with a certified driving inspector one to three days before and four to six days after the intervention of either PCI or CABG. Results showed that 11 patients who underwent CABG experienced impairments in the cognitive demanding components such as traffic behavior and attention in the on-the-road driving test (Ahlgren et al., 2003). The results of the study indicated that cognitive functions important for safe driving may be influenced after cardiac surgery and should be considered when patients resume driving after cardiac surgery. Unless screened for, mild and subtle forms of cognitive impairment are hidden and may explain why many patients returning home exhibit functional impairments in their daily routine. Therefore, cognition should be detected early so that cognitive impairments resulting in decreased IADL performance and safety may be addressed.

Conditions. Two common cognitive conditions following cardiac surgery include postoperative cognitive dysfunction (POCD) and mild cognitive impairment (MCI) (Gao et al., 2005). POCD is a mild form of perioperative ischemic brain injury which emerges as decreased memory, attention, language comprehension and concentration during several months, or even years, after surgery (Polunina, Golukhova, Guekht, Lefterova, & Bokeria, 2014). In a review of the literature, Gao et al. (2005) indicated that POCD has been seen in 40% of patients several months after cardiac surgery.

Mild cognitive impairment (MCI) is described as a deterioration in cognitive functioning greater than expected for a person's age and education level (McLennan, Mathias, Brennan, & Stewart, 2010). The criteria for MCI includes all of the following; 1) change in cognition recognized by the affected individual or observers; 2) objective

impairment in one or more cognitive domains; 3) independence in functional activities; and 4) absence of dementia (Morris, 2011). Although occupational therapists do not diagnose, it is important to consider the criteria for MCI and how might the symptoms impact functional performance. Jekel et al. (2015) conducted a systematic review to identify functional deficits, specifically in the domains of IADL, in patients with MCI. Results from 35 studies showed that IADL deficits, such as problems with medication management, telephone use, keeping appointments, locating items at home, and using everyday technology were documented in patients with MCI.

Both POCD and MCI are cognitive conditions that may exhibit similar deficits in daily functioning following cardiac surgery. However, POCD is the result of surgery whereas MCI can occur with or without surgery. POCD is diagnosed by comparing preoperative and postoperative findings of cognitive assessments whereas MCI can be detected through the use of cognitive screening either preoperatively or postoperatively. Overall, POCD and MCI are both subtle forms of cognitive impairments that can affect functional recovery. Therefore, it is the occupational therapist role to utilize assessments that are sensitive to detecting cognitive impairments following cardiac surgery.

Assessments. Early detection of cognitive impairments can be addressed in the ICU through assessment and observation. Identification of the patient's cognitive functioning is the key to preventing long-term negative implications that may impede a patient's quality of life (Newman et al., 2001). Therefore, it is vital that cognitive deficits are identified within the ICU. Several cognitive assessments may be used by a variety of health professionals in the ICU team for patients prior to and after cardiac surgery. Given the fast paced nature of the ICU, occupational therapists should select cognitive

assessments based on the ease of administration, interpretation of results, duration of administering the assessment, and the environment in which the assessment is being administered. An additional consideration would be to examine the evidence for cognitive assessments that are sensitive in detecting mild cognitive impairments specifically with patients following cardiac surgery.

The current assessments being utilized to assess cognitive impairments in patients with cardiac conditions include the Montreal Cognitive Assessment (MoCA©) and the Mini Mental State Exam (MMSE) (Cameron, Carter, Page, Stewart, & Ski, 2013). The MoCA© is a brief 10-minute screening tool that can detect the severity of cognitive impairments and is most appropriate in the ICU given the fast paced environment (Cameron et al., 2013). The MoCA© was designed as a rapid screening instrument to assess patients for MCI. The MoCA© assesses 8 different cognitive domains that include attention and concentration, executive function, memory, language, visual/constructional skills, conceptual thinking, calculations, and orientation (Harkness, Demers, Heckman, & McKelvie, 2011).The total possible points an individual may score on the MoCA© is 30. Individuals are considered to have MCI if they score between 18 and 26 on the MoCA©. Similarly, the MMSE assesses the cognitive domains of visuospatial skills, language, concentration, working memory, memory recall, and orientation. The maximum score on the MMSE is 30 and scores between 21 and 26 are classified as MCI (Cameron et al., 2013).

It is important to consider the evidence regarding each assessment's sensitivity in detecting cognitive impairments in cardiac patients in the ICU. For instance, the MMSE was utilized in a study conducted by Ziyaeifard et al. (2016) that evaluated the prevalence

and risk factors of cognitive dysfunction in the ICU after cardiac surgery. In this study the cognitive status of 99 patients was assessed using the MMSE scale 2-3 days after cardiac surgery in the ICU. Results indicated that 55% had no cognitive impairment, while 39.4 % had MCI and 5.1% had moderate cognitive impairment. In addition, researchers found that cognitive dysfunction had a significant relationship with the following factors: age, cardiopulmonary bypass time, aortic cross- clamp time, and literacy. The results also showed that cognitive dysfunction had no significant relationship with sex, previous history of surgery, preoperative and postoperative hemoglobin, blood glucose, diabetes, type of operation, and duration of operation (Ziyaeifard et al., 2016). This study supports the need to examine MCI in patients in the ICU environment. However, it is important to consider how might the MMSE compare with the MoCA© in detecting MCI.

Cameron, Carter, Page, Stewart, and Ski (2013) compared both the MMSE and the MoCA© in screening for mild cognitive impairment in 93 hospitalized CHF. The patients included in this study were over 70 years old and had no previous history of neurocognitive impairments, which include cerebral vascular accident, transitional ischemic attack, short term memory loss, confusion, delirium and dementia. Results showed that statistically more participants were identified as having MCI on the MoCA© in comparison to the MMSE (71% vs. 32%, p=.02). The MoCA© classified 38 (41%) patients as cognitively impaired that were not classified as having MCI by the MMSE. The Kappa measure of agreement indicated a significantly low level of agreement between MoCA© and MMSE to classify participants as having MCI, .25 (p =.001).

Additionally in the 68% of patients with low cognitive assessment scores, visuospatial task errors were observed when using the MoCA© compared to 22% when using the MMSE (Cameron et al., 2013). The MoCA© uses two tasks to assess visuospatial functioning which involve drawing a clock and copying a 3- dimensional cube. Whereas the MMSE uses only one task to assess visuospatial functioning which involves copying intersecting pentagons. Sixty-six participants (96%) with MoCA© scores <26 had errors on delayed memory recall compared with 75% on the equivalent memory recall task of the MMSE. Fifty-five participants (81%) with scores <26 on the MoCA©, had task errors on three executive functioning items. Therefore, the results of this study support that the MoCA© can identify clinically relevant cognitive dysfunctions in domains such as visuospatial function and delayed memory recall with greater frequency than MMSE. Another important finding was that the MoCA© assessed executive functioning and was able to find significant impairments in executive functioning whereas the MMSE does not assess executive functioning. Executive functioning is an important component of cognition that is responsible for problem solving, attention, planning, decision making, and assessing dangerous situations. Overall, this study showed that the MoCA© was more sensitive in detecting mild cognitive impairment in CHF patients than the MMSE and also highlights a crucial component of cognition, executive functioning, which is only specifically assessed in the MoCA© (Cameron et al., 2013).

In a study conducted by Harkness, Demers, Heckman, and McKelvie (2011), occupational therapists administered the MoCA© to 44 heart failure patients in outpatient heart function clinics and found that 70% of patients scored below the MoCA© cutoff

score of 26, suggesting the presence of MCI (Harkness et al., 2011). Cognitive domains on the MoCA© that showed significant differences in subscores were short term memory, visuospatial ability, executive function, and language. Impairments in the aforementioned cognitive domains may be impacting the patient's ability to function independently at home or in the community as well as managing their heart. Additionally, in the group with scores indicative of MCI, 50% were hospitalized in the previous six months (Harkness et al., 2011). This may suggest the importance of administering a cognitive assessment such as the MoCA© since the patients with MCI experience difficulty in managing their heart and are more likely to be readmitted to a hospital.

Aykut, Albayrak, Guzeloglu, Baysak, and Hazan (2013) similarly found that patients with MCI also had difficulty managing their symptoms following cardiac surgery. Specifically, the 25 out of 48 patients with MCI were noncompliant with respiratory exercises, experienced ineffective coughs, and had difficulty learning the use of drugs such as inhalers following cardiac surgery. This resulted in patients with MCI experiencing more pulmonary complications such as atelectasis, which is partial or complete collapse of the lung, than patients that were not detected as having MCI prior to cardiac surgery. The preoperative mean MoCA© scores was 19.25 in group A and 27.16 in group B (p=.036) which is indicative of MCI. The rate of postoperative atelectasis detected on postoperative day 3 was 84% in the group with preoperative MCI (group A) and 17% in control group. The difference between the groups was statistically significant (p<.001). The rate of prolonged mechanical ventilation in the group with MCI was determined to be 24%, whereas in the control group it was 0%. The difference between the groups was statistically significant (p< .5).

This study shows that MCI could be associated with pulmonary complications after CABG. It also suggests the need to consider MCI prior to CABG to predict the recovery or the need for specialized attention to patients with MCI that may be experiencing pulmonary complications post cardiac surgery. Pulmonary complications after cardiac surgery prolong hospital stays and increase healthcare costs. Aykut et al. (2013) only administered the MoCA© prior to cardiac surgery and therefore, it is important for occupational therapists working in the ICU is to identify cognitive impairments after cardiac surgery to determine how to best meet the needs of the patient and to determine appropriate discharge.

Ball, Carrington, and Stewart (2013) examined cognitive function in 260 hospitalized patients with chronic atrial fibrillation. Atrial Fibrillation is an abnormal heart rhythm characterized by fast and irregular heartbeats (Centers for Disease Control and Prevention, 2015). Cognitive function was assessed at baseline using the MoCA© and patients were classified as having MCI with a score below 26 on the MoCA©. Overall, 169 patients were found to have MCI at baseline. Multiple deficits in cognitive domains were identified, most notably in executive functioning, visuospatial abilities and short term memory. Predictors of MCI were lower education level (including less than eight years of education or trade qualifications) and in those with a higher CHA2ds-VASc score, which is the calculated risk for patients with atrial fibrillation, and prescribed digoxin, which is used to slow heart rate in patients with atrial fibrillation. The results of this study support the need to assess cognition using the MoCA© for patients with atrial fibrillation which is a common occurrence following cardiac surgery. Additionally, the study found that atrial fibrillation may be an independent predictor of

MCI. Therefore, even though this study specifically examines patients with atrial fibrillation, it is important for occupational therapists to be aware of the risk of MCI in patients with atrial fibrillation that is a common occurrence following cardiac surgery.

Cognitive impairments are common following cardiac surgery and may be the result of many complex factors such as the nature of the surgery or old age (Newman et al., 2001). Unless screened in the ICU, cognitive impairments are often unrecognized by health professionals and family members due to the mild and subtle nature of the condition (Cameron et al., 2013). Occupational therapists need to consider how cognitive impairments impact the patient's ability to participate in ADL and follow sternal precautions. A number of screening assessments are currently being utilized to detect POCD and MCI. The screening assessment that is most widely used and sensitive in detecting cognitive impairments in cardiac patients is the MoCA© (Harkness et al., 2011). However, evidence for using the MoCA© specifically with patients post cardiac surgery is limited.

Since cognitive impairments may significantly impact an individual's ability to return to their roles, desired occupations, ADL, and IADL, early detection of cognitive impairments is essential prior to being discharged from the ICU. The individual experiencing cognitive impairments may feel a sense of loss of control and decreased self-esteem if they are unable to carry out their daily routines or roles. Therefore, addressing psychosocial concerns that may arise in the ICU will help support the recovery process following cardiac surgery.

Psychosocial Factors

Major surgeries can be considered traumatic events because surgeries produce feelings of fear, anxiety, uncertainty, loss of control, and a decreased self-esteem (Asilioglu & Celik, 2004). Studies are showing that ICU patients are at a high risk of developing depression, anxiety, and posttraumatic stress disorder (PTSD) with long lasting symptoms that can negatively impact a patient's quality of life (as cited in Paparrigopoulos et al., 2013). In a longitudinal study of 308 adults admitted to the ICU with diagnoses of a surgical, medical, or multi-trauma nature, 40% showed depressive or PTSD symptoms 18 to 24 months after discharge (Paparrigopoulos et al., 2013).

As invasive heart surgeries require ICU stays, patients who have had cardiac surgery are becoming an at risk population for developing impairments in psychosocial functioning. Patient's quality of life may become even more jeopardized because many patients may leave the ICU with these psychosocial impairments not being identified or addressed (Paparrigopoulos et al., 2013). Furthermore, family members of patients who have had cardiac surgery are also at an increased risk for developing depression, PTSD, or anxiety (Bunzel, Roethy, Znoj, & Laederach-Hofmann, 2007; Young et al., 2005).

According to Davydow, Zatzick, Hough and Katon (2013), having therapists acknowledge that patients are at a heightened risk for impairments in psychosocial functioning can lead to an improvement in the transition from inpatient to outpatient care. Occupational therapists, who are trained to identify and assess psychosocial impairments, would be able to facilitate this transition by recommending an appropriate discharge plan for patients post cardiac surgery in the ICU. Furthermore, early identification of

impairments in psychosocial functioning can assist in decreasing medical complications, health care costs, and improving quality of life (Paparrigopoulos et al., 2013).

Conditions. Depression is a common condition that may arise after surgery. Depression manifests with symptoms of (a) depressed mood, (b) loss of interest and or pleasure, (c) fatigue or loss of energy, or (d) changes in sleep patterns (American Psychiatric Association, 2013). The main risk factor for depression in patients post cardiac surgery in the ICU is the occurrence of previous psychosocial comorbidity (Davydow et al., 2013; Paparrigopoulos et al., 2013; Pirraglia, Peterson, Williams-Russo, Gorkin, & Charlson, 1999). In a longitudinal study of 218 participants undergoing cardiac surgery, 43% of participants demonstrated significant depressive symptoms preoperatively (Pirraglia et al., 1999). Although many of these participants resolved their symptoms, 23% of patients were still dealing with depressive symptoms six months after surgery. This study demonstrated the significant prevalence of depression in patients post cardiac surgery and the need to address depression early and to decrease the negative impact depression may on a patient's life after surgery.

Tully, Baker, Turnbull, and Winefield (2008) found that postoperative depression was related to an increased risk for readmission of patients after their first time CABG surgery. In a longitudinal study, 222 patients were evaluated preoperatively and postoperatively and were then followed to see if they had an unplanned hospital readmission within six months (Tully, Baker, Turnbullm, & Winefield, 2008). The patients that were readmitted to the hospital had a significantly higher postoperative depression score than the patients who were not readmitted (Tully et al., 2008). This study highlighted the impact that postoperative depression has on the patient. Therefore,

by addressing depressive symptoms in the ICU and hospital stay, it may positively affect readmissions rates of patients who have had cardiac surgery.

The above research points to a significant prevalence of preoperative and postoperative depression in patients undergoing cardiac surgery. Furthermore, it indicates that postoperative depression can lead to longer ICU stays and hospital readmission rates (Tully et al., 2008). Occupational therapists should monitor patients post cardiac surgery due to their increased risk of depression to prevent more complications after discharge.

Another common concern faced by patients undergoing cardiac surgery is an increase in anxiety symptoms (Tully et al., 2008). Anxiety is the excessive worry or fear that is marked by symptoms of restlessness, difficulty concentrating, irritability, muscle tension, sleep disturbances, or excessive fatigue (American Psychiatric Association, 2013). Anxiety commonly occurs during periods of high stress, but can become a concern when it impairs functioning of daily life. In their study, Tully et al. (2008) also found a high prevalence of anxiety in first time CABG patients. Out of 222 participants, 31.4% demonstrated symptoms of anxiety preoperatively and 45.5% had mild anxiety symptoms postoperatively, a 14.1% increase after cardiac surgery. Similar to depression, the study found that preoperative anxiety symptoms also contributed to hospital readmission after undergoing first time CABG surgery (Tully et al., 2008).

In a different study, Tully et al. (2010) found that postoperative anxiety was associated with the increased risk for developing Atrial Fibrillation (AF) after surgery. The study further clarified that anxiety is not predictive of AF but rather is concurrent with the development of AF due to the increase of autonomic arousal symptoms anxiety can produce (Tully et al., 2010). Atrial Fibrillation is also known to be associated with

longer hospital stays after surgery and increased health complications such as heart attack, stroke, or mortality (Centers for Disease Control and Prevention, 2015). These findings highlight the effect anxiety can have on patients after CABG surgery in the ICU, while further reinforcing the need for occupational therapists to identify and monitor patients demonstrating higher levels of anxiety.

Heart-focused anxiety (HFA) is another condition commonly associated with patients after being diagnosed with a cardiac condition. Eifert's definition of HFA is the fear of cardiac-related stimuli and sensations due to the perceived negative consequences that are associated with cardiac conditions (as cited in Hoyer et al., 2008). This type of anxiety can be found in individuals with or without cardiac conditions and in individuals with or without preexisting anxiety (Hoyer et al., 2008). Hoyer et al. (2008) compared a group of 72 participants without cardiac conditions to 90 patients undergoing cardiac surgery. The patients undergoing cardiac surgery demonstrated significantly higher HFA scores than the non-cardiac group both preoperatively and postoperatively (Hoyer et al., 2008). Hoyer et al. (2008) also examined the presence of HFA in a longitudinal study of 90 patients undergoing elective cardiac surgery; HFA was assessed preoperatively and postoperatively using the Cardiac Anxiety Questionnaire. Thirty-one percent of cardiac patients exhibited HFA before cardiac surgery compared to 26% of patients six weeks after surgery and 20% patients of six months after surgery (Hoyer et al., 2008). Lastly, Hoyer et al. (2008) examined the correlation of HFA with depression and anxiety, finding a significant positive correlation between HFA scores and indicators of anxiety and depression. Hoyer's et al. (2008) study further signifies the prevalence of HFA in cardiac patients in which symptoms can persist up to six months after surgery, and the correlation

HFA has to anxiety and depression. Persistence of HFA symptoms in a patient may lead to negative implications in the patient's health. Therefore, monitoring HFA preoperatively and intervening when patients are at risk could lead to increased quality of care patients receive in the ICU.

A different form of anxiety that can occur after surgery is PTSD. Posttraumatic stress disorder is characterized by the "exposure to actual or threatened death, serious injury, or sexual violence" (APA, 2013, p. 143). These exposures can be experienced directly, in response to close family members experiencing the trauma, or through repeated exposure to extreme or aversive details (APA, 2013). To many cardiac patients, open-heart surgery can be considered a traumatic event, therefore cardiac patients may be considered at risk for developing PTSD symptoms after surgery. Stoll et al. (2000) found 15% of the 80 participants in their study demonstrated substantial symptoms of PTSD after cardiac surgery. However, Stoll et al. (2000) proposed that there were two possible reasons; PTSD is pre-existing rather than acquired during the ICU stay or a pre-existing mental illness can predispose patients to develop PTSD. Currently, there is a gap in the research correlating PTSD with patients post cardiac surgery, but there is sufficient evidence correlating PTSD with ICU patients in general (Paparrigopoulos et al., 2013).

Lastly, it is also important to understand the effects cardiac surgery has on family and caregivers, in addition to patients after cardiac surgery. Though cardiac surgeries are often lifesaving, the range of physical restrictions can lead to additional physical and emotional stress in patients, as well as the whole family (Bunzel et al., 2007; Young et al., 2005). In a study assessing the psychosocial consequences after life-saving cardiac surgery, 30 patients and 21 partners were examined for signs of depression, PTSD, and

anxiety (Bunzel et al., 2007). Statistical analysis yielded that 6% of patients and 29% of partners showed symptoms of mild to moderate depression (Bunzel et al., 2007). Furthermore, none of the patients met criteria for having PTSD symptoms compared to 23% of partners that did, while12% of patients and 35% of partners showed signs of mild to moderate anxiety (Bunzel et al., 2007). These differences in psychosocial effects between patients and their partners demonstrate the need to incorporate family and partners into both education and interventions during the cardiac surgery and recovery process.

The above summarizes the negative impact depression, anxiety, and PTSD can have on the patients' and their partners' quality of life. Due to the short length of stay for patients in the ICU, quick identification and effective treatment is essential for improving patient impairments in psychosocial functioning. By incorporating assessments to determine the mental health status of patients preoperatively, occupational therapist will be able to monitor at-risk patients throughout their recovery. Using assessments postoperatively will also allow occupational therapists to provide interventions or appropriately discharge patients who are showing symptoms of impairments in psychosocial functioning to follow-up services. By identifying and addressing these impairments, occupational therapists can decrease medical complications, such as AF, decrease hospital readmission, shorten ICU stay, and increase the quality of life for cardiac postoperative patients.

Assessments. Early detection of impairments in psychosocial functioning can be examined in one of two ways for patients in the ICU: comparing a patient's preoperative and postoperative status or identifying early signs of impairments in psychosocial

functioning postoperatively. However, there is no general consensus on how to measure psychosocial functioning in the ICU setting (Ullman et al., 2015). Though the gold standard for diagnosing psychosocial issues is a structured clinical interview, this is not necessarily feasible in the ICU. Occupational therapists working in the ICU need to focus on early identification of impairments in psychosocial functioning, therefore the assessments utilized to identify psychosocial impairments need to be considered carefully due to the nature of the ICU. The psychometric properties, ease of administration, and administration time are all factors that need to be considered as well as time. Since time is limited the ICU, every minute with a patient is valuable. Thus, the ICU needs quick and reliable assessments to screen patients for impairments in psychosocial functioning.

The Hospital Anxiety and Depression Scale (HADS) was developed to determine the possibility and probability of anxiety disorders and depression among patients within a hospital setting (Bjelland, Dahl, Haug, & Neckelmann, 2001). It is a self-administered measure that consists of 14 questions and takes less than ten minutes to complete (Bratas, Gronning, & Forbord, 2014). For each question, a score ranging from 0-3 is given, with a maximum score of 21 for both anxiety and depression (Bjelland et al., 2001). In a literature review of 747 studies, psychometric properties of HADS were examined (Bjelland et al., 2001). As a screening tool, a score of 8+ in either category for anxiety or depression suggests the possibility of the psychosocial impairment being present (Bjelland et al., 2001). When compared to the General Health Questionnaire (GHQ) and Beck Depression Inventory (BDI) for anxiety and depression, the HADS exhibited similar sensitivity and specificity despite its brevity. Overall, the study found the validity of HADS ranged from good to very good (Bjelland et al., 2001).

In a comparative study of 161 patients with chronic obstructive pulmonary disease (COPD), the psychometric properties between the HADS and GHQ were tested (Bratas et al., 2014). The GHQ is also a self-administered test aimed at detecting psychosocial impairments (Bratas et al., 2014). The GHQ incorporated 20 questions, using a four-point scale for each question (Bratas et al., 2014). The two questionnaires yielded no significant differences between average scores or prevalence in cases, thus providing minimal differences in the internal consistency (Bratas et al., 2014). However, the study highlighted that the HADS and the GHQ measure different concepts (Bratas et al., 2014). The HADS measures anxiety and depression symptoms, whereas the GHQ looks at factors of psychological stress (Bratas et al., 2014). Furthermore, there are different versions of the GHQ, making scoring methods and thresholds inconsistent and harder to compare (Bratas et al., 2014). In conclusion, although both the HADS and GHQ can be reliably used as screening tools, the specificity of the HADS is more appropriate when trying to determine if anxiety or depression symptoms are present.

Another assessment commonly used to measure impairments in psychosocial functioning is the Depression Anxiety Stress Scale (DASS). The DASS is a 42-item self-administered questionnaire that generates three scores pertaining to depression, anxiety, and stress (Page, Hooke, & Morrison, 2007). Each question uses a 0-3 scale, with a maximum of 42 points for each sub category. Page, Hooke, and Morrison (2007) examined the psychometric properties of the DASS in their longitudinal study of adult inpatient and day patients with a primary diagnosis of depressive disorder. The study validated that the DASS has excellent internal consistency and high temporal stability, but demonstrated a ceiling effect for the depression subgroup. This implies that the DASS

may be limited when depressive symptoms are high by having decreased sensitivity to high depressive symptomatology (Page et al., 2007).

The Beck Depression Inventory-II (BDI-II) also has the capacity to discriminate between depressed and nondepressed users (Wang & Gorenstein, 2013). It takes approximately 5-10 minutes for a patient to complete the 21 questions (Wang & Gorenstein, 2013). In a comprehensive review of 118 articles, the BDI-II showed high reliability, retest reliability, convergent validity, structural validity, and optimal sensitivity (Wang & Gorenstein, 2013). Furthermore, the BDI-II is different than the HADS because it offers wider coverage of symptoms that can determine the severity of depressive symptoms by using six different categories ranging from normal ups-and-downs to extreme depression (Wang & Gorenstein, 2013). However in the ICU environment, the BDI-II may not be an appropriate assessment. The in-depth examination of depressive symptoms in BDI-II may not be applicable because the experiences in the ICU may have a substantial impact on a patient's answers, leading to inaccurate assessment results. Furthermore, the questions posed by the assessment may not be relevant for patients while staying in the ICU setting. Lastly, it is not necessary to determine the severity of depression in the ICU, only the presence of symptoms needs to be identified.

When measuring PTSD, both the PTSD Checklist-Civilian (PCL-C) and the Impact of Event Scale-Revised (IES-R) are two commonly used self-report assessments (Creamer, Bell, & Failla, 2003; Cook, Elhai, & Areàn, 2005). Both assessments have been adapted from the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) and incorporated questions from all three clusters of PTSD: intrusion,

avoidance, and hyperarousal (Creamer et al., 2003; Cook et al., 2005). The PCL-C is self-administered questionnaire that uses a 5-point Likert scale to rate 17 items on how bothersome symptoms were in the previous month (Cook et al., 2005). Furthermore, the PCL-C uses questions that are closely tied to the three different clusters of PTSD symptoms that are associated with DSM-IV criteria. Though the PCL-C has established high reliability in older military samples, little information has been published on older civilian adults (Cook et al., 2005). To determine the psychometric properties of the PCL-C amongst civilians, the PCL-C was administered to 142 older patients in primary care who experienced trauma exposure (Cook et al., 2005). The PCL-C demonstrated adequate internal consistency, however needed a lower cut off score to achieve optimal sensitivity and specificity.

The IES-R is also a self-administered questionnaire that uses a 5-point Likert scale to rate the distress caused by 22 possible scenarios within the past seven days (Creamer et al., 2003). Unlike the PCL-C, the IES-R uses questions that are more generalized measures of each PTSD cluster (Creamer et al., 2003). In a comparative study using two samples of male Vietnam veterans, the IES-R demonstrated high internal consistency for the total score and for each three sub scales (Creamer et al., 2003). When comparing the IES-R to the PCL-C, the assessments were significantly correlated, demonstrating high construct validity to IES-R. Yet, the main limitation of the study was the specific sample being used in the study, which were male Vietnam veterans, therefore decreasing the generalizability (Creamer et al., 2003). Nevertheless, it is worth mentioning that assessing PTSD for patients after cardiac surgery may not be applicable while still in the ICU. The stage of recovery patients are in may be too acute to determine

if new symptoms present are related to PTSD. Yet, that does not mean that PTSD should not be assessed in other stages of recovery.

Due to time limitation of the ICU, in-depth clinical interviews are not feasible to determine if patients who underwent cardiac surgery are at risk for developing impairments in psychosocial functioning. For this environment, incorporating quick, reliable, and self-administered screening tools would be the most appropriate approach. In the ICU, using an instrument that screens for multiple conditions would be more efficient than using an assessment for each condition. The results of this literature review suggest the HADS fits into the above criteria as it measures both depression and anxiety, while displaying strong psychometric properties. Despite its strengths, the DASS should be used with caution due to the ceiling effect and reduced sensitivity (Page et al., 2007). By incorporating the HADS into the ICU, the results can guide potential interventions and discharge plans if further action should be taken to address the impairments in psychosocial functioning.

Interventions. According to Micik and Borbasi, the length of stay in hospitals is decreasing, requiring patients and families to manage a greater portion of the recovery process at home (as cited in Årgen, Berg, Svedjeholm, & Stromberg, 2015). The psychosocial consequences of cardiac surgery have been shown to be both prevalent and long lasting. The decreased length of hospital stay, combined with the prevalence of impairments in psychosocial functioning after cardiac surgery, highlight the need for occupational therapists to do more than just identifying risk factors and monitoring psychosocial health. In spite of the limited time in the ICU, there are numerous opportunities for the occupational therapist to educate and provide interventions that will

improve the psychosocial health of patients, their partners and family members. Implementing a clinical pathway that standardizes how and when patients can be assessed for impairments in psychosocial functioning will contribute to occupational therapists' ability to provide the appropriate interventions.

Literature shows that well-informed patients are less likely to experience anxiety and depressive symptoms and have an improved quality of life (Årgen et al., 2015; Asilioglu & Celik, 2004; Cheraghi, Toulabi, Baharyand, & Farhadi, 2015). In a randomized control trial, 100 patients preparing to undergo cardiac surgery were divided into a control group and an intervention group. The control group received information regarding preoperative and postoperative routines. The intervention group received preoperative education booklets and was educated on rules to follow before and after surgery. The booklet also provided patients the opportunity to participate in their own care and served as a resource guide. The results did not show a statistical difference between the intervention and control groups anxiety scores. However, the intervention group did have lower scores of anxiety than the control group. Furthermore, all of the patients in the intervention group reported high levels of satisfaction with the preoperative educational training (Asilioglu & Celik, 2004).

Årgen, Berg, Svedjeholm, and Stromberg (2015) aimed to examine psychoeducational support after cardiac surgery at 3-4 weeks, 10-12 weeks, and 22-24 week intervals in a randomized control trial of 42 patients coupled with their partners. The intervention group received three psychoeducational support sessions from an interdisciplinary team along with the conventional care, whereas the control group only received conventional care (Årgen et al., 2015). The psychoeducational support session

highlighted different situations that resulted in stress, included a discussion of solutions for increased stress, and examined the relationship between the partners (Årgen et al., 2015). Even though a significant difference was not found between the two groups in regards to scores on functional and well-being, both the patients and their partners in the intervention group had a significant improvement in their scores, as well as decreased symptoms of depression (Årgen et al., 2015).

Lastly, in a study by Cheraghi, Toulabi, Baharvand, and Farhadi (2015), 90 patients with acute coronary syndrome were randomly assigned to three different groups to examine the effect that educational programs and follow-up phone calls have on the quality of life. The education group received three 30-minute educational sessions during hospitalization, while the education plus phone calls group received the educational sessions and received ten phone calls after discharge, and the control group did not receive any form of intervention (Cheraghi et al., 2015). The results of the study indicated a significant difference in quality of life for both groups that received education intervention. However, there was not a significant difference between the two intervention groups. This study demonstrated that both postoperative educational programs and follow-up phone calls can be effective factors on improving quality of life (Cheraghi et al., 2015). In summary, Asilioglu and Celik (2004), Årgen et al. (2015) and Cheraghi et al. (2015) all demonstrated that preoperative and postoperative educational trainings have a positive impact on overall health and quality of life for patients, as well as their family or partners, recovering from cardiac surgery.

The use of diaries for both patients and their families is an intervention strategy that has been implemented in different ICU settings (Ullman et al., 2015). Diaries provide

accurate records of events and background information regarding ICU admission. Delusional memories have been associated with anxiety, depression, and PTSD symptoms (Ullman et al., 2015). Therefore, it can be assumed that diaries allow patients to refer to factual memories of their time in the ICU, while decreasing the development of negative symptomatology (Ullman et al., 2015). Ullman et al. (2015) conducted a systematic review examining the efficacy of ICU diaries in promoting recovery of patients after critical illness. After excluding 1,482 studies, three studies were reviewed. All three studies were randomized control trials that compared patients who used diaries with patients who did not use diaries. The results concluded that there was inadequate evidence to support the use of diaries in psychosocial recovery for patients and their families (Ullman et al., 2015).

While diaries writing do not have conclusive evidence, using cognitive-behavioral intervention has been a successful approach for pain management, anxiety reduction and improvement in quality of sleep (Halpin, Speir, CapoBianco, & Barnett, 2002; Sendelback, Halm, Doran, Miller, & Gaillard, 2006). Other interventions that have been studied also include relaxation, music therapy, and guided imagery (Sendelback et al., 2006). A randomized control trial by Sendelback, Halm, Doran, Miller, and Gaillard (2006) examined the effects of music therapy on 86 patients. In their study, 50 patients listened to music twice a day for 20 minutes compared to the control group of 36 patients who were advised to rest for 20 minutes daily (Sendelback et al., 2006). The music chosen to elicit relaxation did not have dramatic changes, had similar sounds, included instrumental music, and had between 60 and 70 BPM (Sendelback et al., 2006). The

researchers found that music therapy significantly reduced both pain and anxiety in patients undergoing cardiac surgery.

Heidari et al. (2015) further supported the use of music to treat anxiety in their randomized control trial of 60 patients hospitalized in the cardiac ICU. In their study, patients were randomized into two groups: an intervention group that received a 30-minute session of light music with sounds of nature and a control group that received 30-minutes of rest without distraction (Heidari et al., 2015). Heart rate, blood pressure, mean arterial pressure, and anxiety measurement were taken immediately before the 30-minute session, immediately after, and 30 minutes after termination of the intervention (Heidari et al., 2015). The results of the study demonstrated that mean anxiety scores were significantly lower in the intervention group immediately after and 30 minutes after listening to music when compared to the control group (Heidari et al., 2015). In summary, both Sendelback et al. (2006) and Heidari et al. (2015) found that implementing music during hospitalization can have a positive impact on decreasing anxiety levels, which may further impact their health upon discharge from the ICU.

Halpin, Speir, CapoBianco, and Barnett (2002) found improvement in anxiety symptoms in patients post cardiac surgery who participated in guided imagery. The guided imagery tapes guided patients to a place that allowed them to feel safe, protected, supported, and relaxed (Halpin et al., 2002). Seven hundred and eighty-nine patients were contacted to participate in the guided imagery study. One hundred and thirty-four patients completed guided imagery activities the week before surgery, the day of surgery, and for two weeks after surgery (Halpin et al., 2002). The anxiety of patients who elected to participate in guided imagery improved an average of 43.1% two weeks after surgery

compared to participants who declined participation. In summary, music therapy and guided imagery can be easily implemented with minimal time and effort (Halpin et al., 2002). These two studies provide opportunities for early intervention to address anxiety in an ICU environment.

Summary and Conclusion

As one of the members of the rehabilitation team, occupational therapists offer a unique contribution by identifying and addressing patients' physical, cognitive, and psychosocial concerns. When addressing physical impairments in patients post cardiac surgery in the ICU, occupational therapists use a variety of methods to guide their interventions. Occupational therapists should take MET, RHR+20, and vital signs into consideration when planning interventions to address physical recovery of patients following cardiac surgery. When accurately monitored, these measures can improve patient safety during early mobilization throughout recovery in the ICU and acute care. A median sternotomy is a common incision in many cardiac surgeries. Therefore, occupational therapists will need to address sternal instability as patients resume their daily activities by providing education on how to follow sternal precautions and instruction in abdominal and thoracic exercises to allow the bone to heal properly.

Furthermore, cognitive and psychosocial concerns are prevalent in patients following cardiac surgery. Due to the nature of cardiac surgery, patients are at a high risk of developing mild cognitive impairments, postoperative cognitive dysfunction, depression, anxiety, and PTSD. These cognitive and psychosocial concerns can significantly affect an individual's ability to perform ADL and IADL. Hence, early

identification of cognitive decline and impairments in psychosocial functioning should be incorporated in a clinical pathway.

Currently, the profession lacks a standardized and evidence-based clinical pathway to guide the progression of effective interventions in the ICU setting for patients who have had cardiac surgery. Due to the presence of physical limitations and the prevalence of cognitive and psychosocial concerns in patients post cardiac surgery, an evidence-based approach to treatment is needed for occupational therapists to utilize in the ICU. By implementing an evidence-based clinical pathway that guides intervention for physical impairments, and monitors for cognitive and psychosocial concerns, occupational therapists would be able to provide a standard of care, facilitating the return to participation in occupations for patients following cardiac surgery.

Statement of Purpose

Currently, MPMC does not consistently utilize evidence to support the progression of occupational therapy rehabilitation. To address the current deficit in consistent occupational therapy practice in the ICU at MPMC, the purpose of this project was to develop an evidence-based clinical pathway for occupational therapists to address recovery for patients post cardiac surgery. This clinical pathway addresses physical, cognitive, and psychosocial concerns commonly found in patients who receive elective or emergent surgery. Evidence-based practice uses the most current and effective interventions and assessments that are supported by research and literature. The ultimate goal of implementing an evidence-based practice within a clinical pathway is to standardize treatment so as to ensure consistent and unbiased treatment that is supported by evidence.

Theoretical Framework

The two primary theoretical frameworks guiding this project are the rehabilitative frame of reference (FOR) and the biomechanical FOR. Each FOR will guide the rehabilitation process of patients post cardiac surgery to increase their level of functioning and improve their overall well-being. The rehabilitative FOR was developed by Eleanor Slagle, William Rush Dunton, George Barton, Susan Cox Johnson, and Thomas Kidner in the early 1900s when reconstruction aides began using occupations as approaches for rehabilitation during World War I (Boyt Schell, Gillen, & Scaffa, 2014; Curtis & Newman, 2005). Also developed during World War I, the biomechanical FOR was designed by Bird T. Baldwin to help rehabilitate wounded soldiers (Hagedorn, 2001). The rehabilitative FOR and biomechanical FOR are closely linked and are often used in conjunction with one another to improve overall occupational performance (Hagedorn, 2001).

The aim of the rehabilitative FOR is to facilitate patients' return to their fullest physical, mental, social, vocational, and economic level of independence. The focus is to minimize disability and barriers for the performance of occupations. When underlying deficits cannot be remediated, environmental adaptations, adaptive tools, and compensatory strategies may be utilized to assist in functional independence (Cole & Tufano, 2008). For example, if a patient is easily fatigued, the occupational therapist would educate the patient on energy management techniques and adapt the activity to facilitate the patient's highest level of independence in occupational performance.

The rehabilitative FOR guides this project because the goal of the evidence-based clinical pathway is to guide the progression of occupational therapy interventions in order

to facilitate the return of patients post cardiac surgery to their level of functioning prior to the surgery. For example, when patients require a sternotomy, sternal precautions must be followed to allow the sternum to heal properly. The rehabilitative FOR guides occupational therapists to teach patients adaptive techniques to complete ADL within the parameters of the sternal precautions. This can be observed when therapists teach patients to log roll when getting out of bed and alternative methods to put on a button up shirt without having to reach both arms behind at the same time. When applying the rehabilitative FOR with physiological guidelines, patients are taught to monitor their RHR+20 or the activity's MET limitation to remain within the physician prescribed ranges. Lastly, the rehabilitative FOR encourages therapists to address all aspects of the patients, physical, cognitive, and psychosocial. Early identification of cognitive and psychosocial impairments will allow the therapists to provide the best treatment to improve or maintain a patient's current level of functioning in their daily occupations.

The biomechanical FOR focuses on strengthening parts of the body that impede typical functioning and inhibit occupational participation (Keilhofner, 2009). This FOR draws from theories developed outside of occupational therapy, including musculoskeletal anatomy, neuromuscular physiology, kinesiology, and physics. These concepts contribute to the knowledge of human movement and are applied to daily occupations by improving joint ROM, muscular strength, and endurance (Nelson, 1997). Occupational therapists choose interventions to facilitate distinct movements and strengthen specific muscle groups to produce desired effects (Hagedorn, 2001). Activities can be graded up or down by adding assistance, adjusting resistance, or changing the speed and duration to meet the just right challenge for each patient's functional limitation

(Hagedorn, 2001). Furthermore, repetition and practice of purposeful activities can be increased to improve occupational performance. For example, having patients perform preparatory leg exercises multiple times a day can improve leg strength needed to complete a morning routine that requires standing by a sink. Occupational therapists can analyze the components of each activity and use biomechanical principles to guide intervention strategies.

The biomechanical FOR applies to this project because the clinical pathway will guide occupational therapists to increase the function of body components so that overall performance can be improved (Jacobs & Simon, 2015). After cardiac surgery, patients may have a series of physical impairments such as decreased muscle strength due to disuse muscle atrophy and pain. Patients will also be limited physically by sternal precautions established by physicians to allow for proper healing of the sternum. The biomechanical FOR can be used to guide occupational therapy intervention in the ICU as patients and therapists work on improving strength and endurance of muscles and maintaining ROM of joints. For example, the progression of recovery may begin with ROM exercises, followed by having patients complete ADL at bed level, and progress to patients walking to the bathroom to engage in ADL as weakness and pain subside. By integrating both the rehabilitative FOR and biomechanical FOR, occupational therapists will be able to combine use of remediation and compensatory approaches to increase patients' occupational performance and thereby, improve their quality of life.

Ethical Considerations

The ethical principles as described in *The Occupational Therapy Code of Ethics and Standards* were used to guide the development of the clinical pathway (AOTA,

2015). *The Occupational Therapy Code of Ethics and Standards* is a document designed to address the major ethical concerns of the occupational therapy profession. The ethical principles of beneficence, nonmaleficence, and justice were central in the development of this project.

Beneficence is defined in *The Occupational Therapy Code of Ethics and Standards* as demonstrating concern for the safety and well-being of the recipients of services (AOTA, 2015). The project developers strived to achieve beneficence by providing the most appropriate and current evidence when creating the occupational therapy clinical pathway for the ICU at MPMC. Extensive research of the literature regarding the physical, cognitive, and psychosocial factors of patients post cardiac surgery was conducted prior to the development of the clinical pathway.

An additional ethical consideration that the project developers addressed was nonmaleficence. The principle of nonmaleficence includes an obligation to not impose harm even if the potential risk is without malicious or harmful intent (AOTA, 2015). The goal of the proposed clinical pathway was to facilitate each patient's return to the highest possible level of physical, cognitive, and psychosocial function. Without a clinical pathway in place, the interventions and assessments being used by occupational therapists may not be the most effective for the population. By implementing an evidence-based clinical pathway, it will ensure consistent treatment through interventions and assessments that are supported by evidence to facilitate patients' return to optimal functioning.

Lastly, the principle of justice was an ethical consideration that the project developers strived to achieve by developing this evidence-based clinical pathway. Justice

ensures that treatment and standards are applied fairly in practice (AOTA, 2015). The evidence-based clinical pathway will establish a standard of care and ensure that cardiac patients in the ICU at MPMC receive equitable treatment. Occupational therapists who use the clinical pathway to guide their interventions will be able to provide fair and impartial treatment that is unbiased. This, in turn, can guarantee that all cardiac patients in the ICU of MPMC will have an equal opportunity to achieve engagement in their desired occupations according to their own ability.

The nature of this project did not require the project developers to interact directly with the patient population. Therefore, ethical issues such as anonymity, informed consent, and vulnerable populations did not apply to this project. Permission to present the clinical pathway to MPMC's occupational therapy department was obtained through signed consent from the Director of Rehabilitation Services, Mrs. Velvet Hewitt, MPA, OT/L (Appendix A)

Methodology

Agency Description

Mills-Peninsula Health Services, a not-for-profit organization associated with the Peninsula Coastal Region of Sutter Health, includes MPMC and Mills Medical Center. This project was designed specifically for MPMC located in Burlingame, California. MPMC is a 241-bed facility for patients receiving medical care, 24 of which are in the ICU. MPMC is not a level I or level II trauma center, therefore patients who require high-intensity medical care are triaged before being relocated to an alternative trauma center. While the ICU cares for patients with a variety of critical conditions such as sepsis, pneumonia, and subdural hematoma, it primarily provides care for cardiopulmonary

patients age 40 to 80 recovering from elective and emergency cardiac surgeries. Other services provided at MPMC include emergency care, orthopedic surgery, pulmonary rehabilitation, outpatient rehabilitation, and a transitional care unit, named stepdown ICU, for patients requiring intermediate level of care before discharge. There are equivalent to five full time occupational therapists who provide occupational therapy services to patients in the acute health center of MPMC (Sutter Health Mills-Peninsula Health Services, 2015).

Currently, the ICU at MPMC does not have a consistent clinical pathway to guide occupational therapy intervention. The occupational therapists in the ICU at MPMC mainly addressed physical impairments of patients following cardiac surgery and were solely relying on professional experience and clinical reasoning, rather than utilizing evidence-based practice, to guide the progression of rehabilitation. The AOTA's *Centennial Vision* states "that occupational therapy is a powerful, widely recognized, science-driven, and evidence-based profession with a globally connected and diverse workforce meeting society's occupational needs," (AOTA, p.1, 2006). Therefore, there is a need for an evidence-based clinical pathway to guide occupational therapy for patients post cardiac surgery in the ICU of MPMC that addresses physical, cognitive, and psychosocial concerns.

Project Design

This project included the development of an evidence-based clinical pathway for the occupational therapists treating patients post cardiac surgery in the ICU at MPMC, a comprehensive clinical manual explaining the clinical pathway, and also proposed revisions to be made to the Cardiac Surgery and Recovery binder that is distributed to all

patients who are recovering from cardiac surgery with sternotomy. The clinical manual includes an illustration of the evidence-based clinical pathway, as well as evidence tables that describes the literature in support of the different components in the proposed clinical pathway and assessment information for the RPE, MoCA©, and HADS. As for the Cardiac Surgery and Recovery binder, it contained contradictory information regarding sternal precautions, such as differing recommendations for the weight limit patients should be allowed to lift during their recovery following cardiac surgery. The binder also did not include a postoperative progression guide that extended beyond discharge from acute care to facilitate the return to occupational performance. Therefore, the project developers provided recommendations for additional educational material to be included in the binder.

Target Population

The target population of this project was the occupational therapists who treat patients post cardiac surgery in the ICU at MPMC. Both the occupational therapists and the patients who have cardiac surgery at MPMC would benefit from having a clinical pathway. It would create a standardized approach to treatment, thereby ensuring consistency amongst therapists, and encouraging evidence-based practice within the profession of occupational therapy. The evidence-based clinical pathway further ensures that interventions provided are comprehensive in addressing the physical aspects of recovery as well as potential cognitive and psychosocial concerns. Lastly, it will create a standard level of care to improve quality of life.

Project Development

The lead occupational therapist in the ICU at MPMC, Ms. Jamie Thompson, OTR/L, requested the help of the project developers, in the formation of an evidence-based clinical pathway, to guide occupational therapy intervention. After accepting the request, the project developers along with their faculty advisor, Dr. Kitsum Li, met with Ms. Thompson at MPMC on September 11th, 2015 in order to determine the need for this project. In the needs assessment meeting, Ms. Thompson described the hospital setting, the environment of the ICU, the demographics of the ICU patients, and the cardiac conditions commonly treated in the ICU of MPMC. Ms. Thompson briefly discussed the interventions she provided and the precautions she took to ensure patients' safety. Additionally, she explained how each occupational therapist had a unique approach to the treatment and progression of rehabilitation for patients post cardiac surgery. With no standard protocol to guide occupational therapy practice in place, there may be inconsistencies in treatment provided.

Per Ms. Thompson, the interventions currently being implemented in the ICU of MPMC is based on the clinical reasoning of each individual occupational therapist. Therefore, Ms. Thompson expressed a need for a clinical pathway supported by research to guide the progression of occupational therapy for patients post cardiac surgery. Furthermore, Ms. Thompson stated the need for cognitive and psychosocial factors to be included in treatment because they were under addressed in the ICU. Since the length of stay in the ICU typically ranges from five to six days, including the days spent in the stepdown ICU, occupational therapists may have limited time to address cognitive and psychosocial factors. However, early identification of cognitive and psychosocial

impairments should be a part of the clinical pathway so that patients can be discharged to the appropriate setting and receive additional follow up services. Therefore, the use of a clinical pathway would ensure consistency in practice among occupational therapists and lead to a higher standard of care for patients who have undergone cardiac surgery.

Lastly, Ms. Thompson brought up her concerns regarding the Cardiac Surgery and Recovery binder. Patients receive the Cardiac Surgery and Recovery binder before admission for elective surgery or after surgery for patients in emergency situations. The binder includes information about the surgical team, what to do in preparation for surgery, general information about the hospital stay and the initial recovery period at home, as well as a brief overview of cardiac anatomy and various surgical procedures. At the time of the needs assessment, the binder did not provide a comprehensive overview of the recovery process after discharge from acute care. Ms. Thompson suggested an update to the binder to include more guidance regarding resuming desired occupations and roles, as well as gradually increasing the intensity of activities in the months following hospital discharge.

Based on the information gathered from the needs assessment meeting, the project developers reviewed current literature focusing on the physical, cognitive, and psychosocial factors and recovery associated with cardiac surgery in the ICU. The most current and pertinent evidence that supported the development of the clinical pathway was then summarized in a comprehensive literature review. Each article from the literature review was then organized into the literature review summary evidence table.

On January 29, 2016 the project developers presented and discussed their findings from the literature review with Ms. Thompson. During this meeting, the project

developers also obtained Ms. Thompson's clinical reasoning that guides her practice. She discussed the progression she uses with patients post cardiac surgery throughout their stay in the ICU and stepdown ICU. She also provided the project developers with additional MPMC educational handouts currently being provided to patients following cardiac surgery and MPMC protocol information including vital sign guidelines.

In addition to collaborating with Ms. Thompson, the project developers shadowed with occupational therapists at University of California, San Francisco's (UCSF) Medical Center ICU. The developers found that there was a lack of a consistent evidence-based clinical pathway within the ICU environment. This observation further supports the need for guidelines to progress occupational therapy interventions in the ICU.

After meeting with Ms. Thompson and observing at UCSF, the project developers created an outline based on Ms. Thompson's clinical reasoning. The project developers further analyzed and ranked the literature according to guidelines adapted from Moore, Mcquay, and Gray's level of evidence outlined by AOTA's Evidence-Based Practice Project (as cited in Holm, 2000). The interventions with the highest level of evidence were compared and combined with Ms. Thompson's clinical reasoning to create a clinical pathway. The clinical pathway supports the progression of rehabilitation following cardiac surgery to specify how and when to address physical, cognitive, and psychosocial factors from day one after cardiac surgery until the patient is discharged from acute care.

A clinical pathway summary evidence table was created to be included in the clinical manual provided to the occupational therapists at MPMC as a reference. The literature included in the table supported therapy interventions and assessments that were illustrated in the clinical pathway. The evidence table was further categorized into

physical, cognitive, and psychosocial factors, with each section including additional subtopics. The subtopics under physical rehabilitation included early mobilization, sternal instability, METs, and vital signs. The cognitive subtopic included assessments, while the psychosocial subtopics included assessments, partner inclusion, and interventions that could be carried out in an ICU and acute care setting.

In addition to creating the clinical pathway, the project developers identified gaps in the Cardiac Surgery and Recovery binder. To address the gaps in information, the project developers created a list of supplemental educational materials and suggested they be added to the Cardiac Surgery and Recovery binder. The additional educational materials provide resources to support patients and caregivers before and after cardiac surgery. The project developers also proposed to divide the binder into three tabs, labeled "Before Surgery", "After Surgery", and "Resources" to improve the ease of use and to decrease the overwhelming nature of cardiac surgery information.

On April 28, 2016, the project developers presented the proposed clinical pathway and the suggested educational materials for the Cardiac Surgery and Recovery binder to the Mrs. Hewett and Ms. Thompson. During the meeting, Mrs. Hewett and Ms. Thompson provided their suggestions to further modify the clinical pathway and the Cardiac Surgery and Recovery Binder to meet the needs of MPMC. For example, Mrs. Hewett and Ms. Thompson suggested that the timeline of the proposed clinical pathway be adjusted and two of the recommended psychosocial assessments be excluded to fit the realistic environment of the ICU. Regarding the Cardiac Surgery and Recovery binder, Mrs. Hewett and Ms. Thompson informed the project developers that modifying the binder would not be feasible. Therefore, they suggested the creation of supplemental

handouts with more layman terminology specific to cardiac surgery. In addition, Mrs. Hewett and Ms. Thompson suggested the need to consult with the physicians' assistants and cardiologists regarding the recommendation on the activity guide.

The final proposed clinical pathway guides the progression of occupational therapy intervention to address physical, cognitive, and psychosocial factors. To address the physical concern of disuse muscle atrophy, the clinical pathway includes early mobilization rehabilitation guided by MET, vital signs as established and individualized by the cardiac surgeons at MPMC, and RHR+20. Additionally, to address the concern of sternal instability, the clinical pathway includes education and training of sternal precautions and abdominal and thoracic exercises. To address cognitive impairments, the clinical pathway includes the MoCA© to screen for MCI. To address impairments in psychosocial functioning, the clinical pathway includes the HADS to screen for anxiety and depression. It also includes interventions to address impairments in psychosocial functioning appropriate for ICU and acute care environments. The clinical pathway also addresses the importance of patient and caregiver education throughout the recovery process. By combining evidence-based research, clinical reasoning, and the clinical parameters currently being utilized by MPMC, the project developers proposed a clinical pathway to help occupational therapists provide consistent treatment to patients who have undergone cardiac surgery.

Incorporating Mrs. Hewett's and Ms. Thompson's comments regarding the supplemental educational handouts, the project developers finalized the handouts to be given to patients during the rehabilitation process. The final educational materials included *Sternal Precautions*, *How to Progress and Return to Your Daily Routin*e,

Activity Progression Calendar, *Tips for Coping with Feeling Down*, *Tips for Coping with Stress and Feeling Anxious*, *Tips to Feel More Focused in Your Daily Life*, and *Tips for Caregivers* (Appendix B). These handouts provide information on sternal precautions, a progression for returning to activities with an interactive calendar information for caregivers, tips for stress management, recognizing cognitive decline, tips for dealing with stress, anxiety, and depression.

Project Implementation

In preparation for the presentation to the occupational therapy department of MPMC, the project developers had bound copies of the clinical manual, *Clinical Pathway for Post Cardiac Surgery* (Appendix C), printed with funding from a scholarship received from the California Foundation of Occupational Therapy (CFOT). The clinical manual included the clinical pathway, a narrative description of the clinical pathway, the clinical pathway summary evidence table, an instrument review of the MoCA© and HADS, and the literature review summary evidence table. Additionally, the project developers prepared laminated pocket-sized clinical pathway cards for occupational therapists at MPMC to increase accessibility and ease of implementation (Appendix D).

On November 9, 2016, the project developers presented the proposed evidence-based clinical pathway, the supporting evidence, the clinical manual, the pocket guide, and the supplemental educational materials to the occupational therapy department of MPMC. Seven occupational therapists and the director of rehabilitation, Mrs. Hewett, were in attendance. The objectives of the presentation were for occupational therapists to learn about current evidence that supports the progression of physical interventions following cardiac surgery in the ICU, assessments that are sensitive for detecting early

signs of impairments in cognition, and assessments for detecting impairments in psychosocial functioning, as well as providing interventions, if applicable. After the presentation of the evidence-based clinical pathway, the project developers obtained feedback from the occupational therapists of MPMC.

Project Evaluation

The project was evaluated based on the feedback obtained through an evaluation survey (Appendix E) provided to the occupational therapists immediately after the presentation of the evidence-based clinical pathway. The survey was conducted to determine if the proposed evidence-based clinical pathway, recommended cognitive and psychosocial assessments, and educational handouts addressed the issues outlined in the needs assessment. The survey included four Likert-scale statements and four open-ended questions with room for additional comments. The occupational therapists were asked to assess the feasibility of incorporating the clinical pathway in future practice, its ease of use, and its applicability to the population of patients at MPMC.

From the survey, the occupational therapists that attended the presentation found the inclusion of cognitive and psychosocial aspects in the clinical pathway and additional educational materials beneficial. All of the therapists that attended agreed or strongly agreed that they would use the evidence-based clinical pathway to guide their interventions with patients undergoing cardiac surgery in the ICU. None of the occupational therapists felt that the clinical pathway conflicted with current treatment approaches being implemented at MPMC.

Discussion, Summary, and Recommendations

This project will contribute to the knowledge of the occupational therapy profession by developing a clinical pathway that combines evidence with clinical reasoning to provide the highest quality of care to patients after cardiac surgery in the ICU. The goal of this project was to develop an evidence-based clinical pathway to guide occupational therapy intervention with patients following cardiac surgery at MPMC. After an initial meeting with the lead occupational therapist in the ICU of MPMC, Ms. Thompson, the program developers did a comprehensive search and reviewed the most up-to-date literature. The purpose was to identify available evidence in support of a clinical pathway for occupational therapists that addresses patients post cardiac surgery during the recovery process. Our initial intention was to present to the occupational therapy department at MPMC in April of 2016. However, after a follow up meeting with Mrs. Hewett and Ms. Thompson, the project developers further modified the proposed clinical pathway to better meet the needs of MPMC. Therefore, the clinical pathway was created, finalized, and printed in a clinical manual to be presented to the occupational therapy department at MPMC on November 9, 2016.

During the creation of our project, the project developers found that although there was a significant amount of literature on the physical, cognitive, and psychosocial concerns that occur after cardiac surgery, there was a gap in the evidence regarding specific occupational therapy progression of recovery following cardiac surgery. The number of studies that were directly related to occupational therapy interventions was very limited, and the literature that was available failed to specify when interventions and assessments should be administered following cardiac surgery in the ICU. Therefore,

studies on rehabilitation in other settings and other populations, as well as input from the occupational therapists of MPMC, were included in the development of the project.

The proposed evidence-based clinical pathway promotes the use of evidence-based practice by occupational therapists in the ICU. Using evidence-based practice ensures consistent quality of care by all therapists. This project presents an important direction confirming the occupational therapist's role in addressing the high prevalence of cardiac conditions, cardiac surgeries, and the overall recovery of the patient's return to daily occupations following cardiac surgery. This project also supports *AOTA's Centennial Vision* for the profession to be "science driven" and evidence-based" (AOTA, 2006).

This project has several limitations. Currently, the occupational therapists of MPMC's ICU are not utilizing a clinical pathway to guide their interventions and some therapists may find the pathway to be too restrictive. For example, there is a variability in the level of experience among therapists, and therapists who have more experience may be more reluctant to change their approach to interventions. The individual needs of each patient will vary from person to person and therapists may feel the need to individualize interventions than to strictly following the clinical pathway. Additionally, as new evidence continues to evolve, the clinical pathway will need to be updated periodically. In other words, occupational therapists or future capstone project developers will need to revise the clinical pathway to include the most current evidence. Lastly the fast paced environment of the ICU requires quick decision-making, and occupational therapists may prefer to rely on their own clinical reasoning in those situations rather than consulting the clinical pathway. These factors have been accounted for by including clinical reasoning

into the clinical pathway, however, this may result in variability in treatment. The limitations were further addressed by educating the occupational therapists through a presentation that included the evidence supporting the clinical pathway. Furthermore, the occupational therapists were provided a pocket-size clinical pathway and a clinical manual to refer to while treating patients.

Future Directions

There are a number of approaches that can be taken in the future to assess and validate the proposed evidence-based clinical pathway. Future studies should assess if the clinical pathway is effective in improving patient outcomes by comparing patient outcomes from the year before the implementation of the clinical pathway and the year after its implementation at MPMC. The ease of use and feasibility of implementing the evidence-based clinical pathway should be assessed continuously by gathering input from the occupational therapists in the ICU of MPMC six months after implementation. Data-gathering regarding incidence of sternal instability can also be analyzed to determine the effectiveness of the sternal precaution algorithm and thoracic and abdominal exercises. Lastly, the evidence-based clinical pathway should be continuously revised to include the most updated evidence available.

Summary and Conclusion

As hospitals continue to see a rise in patients needing cardiac surgeries, occupational therapists will need to provide rehabilitative services to facilitate the patient's return to their prior level of physical, cognitive, and psychosocial function. In the ICU at MPMC, the individual occupational therapist use his or her clinical reasoning and experience to guide intervention strategies for patients following cardiac surgery. At

the time of the needs assessment, the interventions primarily addressed physical impairments. While cognitive and psychosocial factors are within the scope of occupational therapy intervention, they were being under addressed at MPMC. Therefore, it was determined that a greater emphasis should be placed on using valid assessments and screening tools to assist occupational therapists in the early identification of cognitive and psychosocial conditions.

The results of the literature review support the use of early mobilization to prevent disuse muscle atrophy and facilitate the earlier return of patients to participate in their desired occupations and life roles. MET values, vital signs, RPE, and RHR+20 have been determined as valid measures for guiding early mobilization. Sternal instability has been found to have a debilitating effect on the performance of ADL. Thoracic exercises, trunk stabilization exercises, and less restrictive sternal precautions would be appropriate to prevent sternal instability. Given the increased risk of developing cognitive impairments incorporating the MoCA© to screen for MCI is needed to support patients, especially those without reliable caregivers, return to previous roles and IADL. Furthermore, early detection of depression and anxiety by using the HADS as a screening assessment is crucial to help cardiac patients improve their overall function and return to meaningful engagement in occupations.

As an evidence-based profession, occupational therapists benefit from having a clinical pathway supported by evidence to provide consistent and effective interventions. The purpose of this project was to develop an evidence-based clinical pathway to guide occupational therapy intervention for patients post cardiac surgery in the ICU at MPMC. This clinical pathway defines the role of occupational therapy while addressing physical,

cognitive, and psychosocial concerns of patients post cardiac surgery in the ICU. It is the hope of the project developers that the clinical pathway will establish a standard of care, ensure fair and unbiased treatment, and improve the quality of patients' lives. Furthermore, the clinical pathway will also assist occupational therapists in applying evidence-based practice, thereby advancing the AOTA's Centennial Vision to establish occupational therapy as a science-driven and evidence-based profession.

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Appendix A
Letter of Permission to Agency Directors

DOMINICAN UNIVERSITY of CALIFORNIA
LETTER OF PERMISSION TO AGENCY DIRECTORS

Velvet Hewett, OTR/L, MPA
1501 Trousdale Drive
Burlingame, CA 94010

Dear Ms. Hewett,

This letter confirms that you have been provided with a brief description of our capstone project, which is to develop a clinical pathway for post-operative cardiac surgery patients recovering in the ICU and ICU stepdown. This project is an important part of our graduate requirements to receive a Master's in Occupational Therapy. This project is being supervised by Dr. Kitsum Li, Assistant Professor of Occupational Therapy at Dominican University of California, and Jamie Thompson OTR/L of Mill-Peninsula Medical Center.

We plan to present our evidence-based clinical pathway, together with the recommended additional patient education material for the Cardiovascular Surgery and Recovery binder, to the occupational therapy department at Mills-Peninsula Medical Center in April 2016. We also plan to obtain feedback on the appropriateness, ease of use, and gaps in our proposed clinical pathway from your occupational therapists.

If you agree with the specifications of this project, please sign and date this letter and return it to us in the envelope provided at your earliest convenience. If you have questions about our capstone project you may contact our liaison for the group Kristen Henderson (kristen.henderson@students.dominican.edu) or our faculty advisor Dr. Kitsum Li (kitsum.li@dominican.edu).

Liaison:	Project Supervisor:	Supervising OT:
Kristen Henderson	Dr. Kitsum Li	Jamie Thompson
(757) 814-8334	(415) 458-3753	(650) 696-5447

Thank you very much for your time and consideration.

Sincerely,

The ICU Capstone team
Kelsie Colombini, Kristen Henderson, Michelle Huie, Courtney Malachowski

If you agree to the above outlined project and request, please sign below:

_____ _____

Velvet Hewett, MPA, OT/L Date
Director of Rehabilitation
Mills-Peninsula Health Service

Appendix B
Educational Handouts Post Cardiac Surgery

Educational Handouts Post Cardiac Surgery

Educational Materials for Occupational Therapy
in the Intensive Care Unit

Sutter Health
Mills-Peninsula Health Services

Table of Contents

How to Incorporate

Sternal Precautions

into Your Daily Life at Home

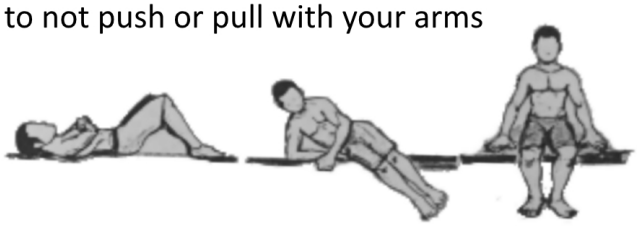
X No pushing, pulling, or lifting more than 5 pounds

- When standing up from a chair, do not push up with your arms
  Instead, lean forward (remember "nose over toes") and use your leg strength
- Purchase ½ gallon cartons of milk instead of a large gallon jug,
  which weighs approximately 8 pounds.
- Carry only half full laundry baskets to the laundry room.
- Use laundry detergent "pods" to avoid lifting heavy laundry detergent bottles.
- Ask for help to transfer pots of water from the sink to the stove.
- Reorganize kitchen so commonly used pots and pans are on the counter.
- Consider seeking alternate options for walking large pets.

X No twisting of trunk

- Use log rolling technique to get in and out of bed:
  1. When lying on back, roll onto one side.
  2. Let your legs slowly fall off the edge of the bed.
  3. Allow the momentum to help your upper body rise up.

*Remember to not push or pull with your arms



X No reaching behind back with both arms at the same time

- For dressing:
  Use one hand in the front and one in the back to lift pants, or use just one hand
  Wear loose fitting crew neck T shirt
- For showering:
  Use a long handled loofah

X No driving for 4 weeks after surgery

How to Progress and Return to Your Daily Routine

Activity Demand

Activity Level
Light Activity
Sleeping Lying quietly Sitting quietly Standing quietly Writing, typing, desk work Dressing Ironing Dishes Grooming/styling hair Activities while sitting (reading, watching T.V., arts and crafts) Cooking Light grocery shopping (below 5 pounds) Mild stretching Watering plants with small bottle or watering can Light effort household tasks (dusting)
Light to Moderate Activity
Moderate effort household tasks (vacuuming, but consider sternal precautions for lifting vacuum) Carrying small children Walking a small dog Yoga Gentle mopping (consider sternal precautions for lifting water bucket) Gardening: weeding, raking Water aerobics Sailing (small boat)
Moderate to Heavy Activity
Heavy effort household tasks (window washing, floor scrubbing) Walking medium size dog Gardening: digging Biking at 6 mph Moderate grocery shopping (weekly shopping) Walking at 5 mph Weight lifting Mowing the lawn
Heavy Activity
Biking at 10 mph Biking on flat ground Leisure swimming Heavy grocery shopping (Costco) Tennis Backpacking/Hiking Kayaking Jogging at 5 mph Biking at 15 mph Racquetball Jogging at 6 mph Basketball Running at 8 mph

Walking/Activity Schedule	
Week 1	Walk 10 to 15 minutes a day Light Activities
Week 2	Walk 15 to 20 minutes a day Light Activities
Week 3	Walk 20 to 25 minutes a day Light Activities
Week 4	Walk 25 to 30 minutes a day Light to Moderate Activities

Walking/Activity Schedule	
Week 5	Walk for at least 30 minutes a day Begin driving with medical clearance Light to Moderate Activities
Week 6	Walk for at least 30 minutes a day Begin lifting objects heavier than 10lbs Light to Moderate Activities
Week 7	Walk for at least 30 minutes a day Light to Moderate Activities
Week 8	Walk for at least 30 minutes a day Moderate to Heavy Activities

Activity Progression Calendar

These are a few guidelines to facilitate your progression to resuming your daily activities. Listen to how your body is feeling and your physician's specific recommendations.

Week 1: -Engage in light activities -No vacuuming or mowing lawn for first 4 weeks	**Day 0** Discharge from hospital May shower as soon as you like, warm water is better than hot	**Day 1** Walk 10-15 minutes a day →	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**
Week 2: -Engage in light activities	Day 7 Walk 15-20 minutes a day →	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13
Week 3: -Engage in light activities	Day 14 Walk 20-25 minutes a day →	Day 15	Day 16	Day 17	Day 18	Day 19	Day 20
Week 4: -Engage in light to moderate activities -Walking for about 30 minutes is the goal for the end of the month, you still have 9 days to work up to this recommendation.	Day 21 Walk 25-30 minutes a day →	Day 22	Day 23	Day 24	Day 25	Day 26	Day 27

Week 5: -Engage in light to moderate activities -Can now soak in bath if prefered	Day 28 Walk 30+ minutes a day	Day 29	Day 30 ***End of 1 month*** You should be walking for at least 30 continuous minutes a day.	Day 31	Day 32	Day 33	Day 34
Week 6: -Engage in light to moderate activities -Able to lift objects heavier than 10 lbs with clearance from your doctor	Day 35	Day 36	Day 35	Day 36	Day 37	Day 38	Day 39
Week 7: -Engage in light to Moderate activities	Day 40	Day 41	Day 42	Day 43	Day 44	Day 45	Day 46
Week 8: -Engage in moderate to heavy activities	Day 47	Day 48	Day 49	Day 50	Day 51	Day 52	Day 53
Week 9: -Can return to work within 2 months of surgery	Day 54	Day 55	Day 56	Day 57	Day 58	Day 59	Day 60 ***End of 2 months*** Breastbone should be fully healed

Tips for Coping with Feeling Down

It is normal for individuals following heart surgery to feel less focused, feel down, or struggle with returning to their routine or roles at home. Below is a list of strategies to help you return to your routine again.

- Get dressed every day.
- Practice stress management and relaxation techniques. See website for free guided imagery podcasts for health wellness and relaxation:
    - http://www.meditationoasis.com/podcast/
- Get out and walk daily.
- Follow your prescribed exercise regimen.
- Ask your healthcare provider about a cardiac rehabilitation program.
- Resume hobbies and social activities you enjoy within your sternal precautions
- Share your feelings with your spouse, friend, or a member of the clergy.
- During your recovery from surgery, visits with friends should be limited to 15 minutes at first. Then, increase the amount of time spent with visitors, depending on how you feel.
- Get a good night's sleep.
- Eat well-balanced, nutritious meals and follow your prescribed dietary guidelines. Make sure you stay hydrated as well.
- Ask your healthcare provider about support groups that may help you cope. (Support groups are available for patients who have had heart surgery and their families.)
- Don't use harmful habits to cope, such as smoking, using drugs, drinking excessively, or overeating. These harmful habits increase your risk for heart disease and stroke.
- Seek help and consult your primary care physician if you are feeling overwhelmed.

Adapted from:
http://my.clevelandclinic.org/services/heart/prevention/emotional-health/stress-relaxation/depression-heart-disease

Tips for Coping with Stress and Feeling Anxious

- Take a timeout. Practice yoga, listen to music, meditate, get a massage, or learn relaxation techniques. Stepping back from the problem helps clear your head. Website for examples of mindfulness exercise include:
    - UCSD Center for Mindfulness: http://health.ucsd.edu/specialties/mindfulness/programs/mbsr/Pages/audio.aspx
    - UCLA Mindful Awareness Research Center: http://marc.ucla.edu/body.cfm?id=22
- Eat well-balanced meals. Do not skip any meals. Do keep healthful, energy-boosting snacks on hand.
- Limit alcohol and caffeine, which can aggravate feelings of stress.
- Get enough sleep. When stressed, your body needs additional sleep and rest.
- Exercise daily to help you feel good and maintain your health.
- Take deep breaths. Inhale and exhale slowly.
- Count to 10 slowly. Repeat, and count to 20 if necessary.
- Do your best. Instead of aiming for perfection, which isn't always possible, be proud of what you can accomplish.
- Accept that you cannot control everything. Put your stress in perspective: Is it really as bad as you think?
- Welcome humor. A good laugh goes a long way.
- Maintain a positive attitude. Make an effort to replace negative thoughts with positive ones.
- Get involved. Volunteer or find another way to be active in your community, which creates a support network and gives you a break from everyday stress.
- Know your triggers. Is it work, family, school, or something else you can identify? Write in a journal when you're feeling stressed or anxious, and look for a pattern.
- Talk to someone. Tell friends and family you're feeling overwhelmed, and let them know how they can help you. Talk to a physician or therapist for professional help.

Adapted from: http://www.adaa.org/tips-manage-anxiety-and-stress

Tips to Feel More Focused in Your Daily Life

Following a heart surgery, you may feel less focused. Remember to be patient with yourself and follow a few simple strategies below to help you return to your routine.

Daily Tasks & Appointments

- Keep a pen and a calendar near the telephone.
- Write follow up appointments, birthdays, church services, meetings, social activities, trash pick-up, and due dates for bills on the calendar.
- You may also want to use your smartphone to set up a reminder alarm for important appointments or dates
- Write a daily to-do list and keep it somewhere you can see it such as on your nightstand or next to your keys.
- Try to avoid scheduling too many dates in your calendar if you do not feel physically or mentally able to commit.

Medication Management

- Keep daily medications organized and in a visible location.
- Use a pillbox organized by days and times.
- Set pill bottles on the table or next to the bed as reminders to take the medication.

Household Responsibilities

- Plan your household tasks ahead of time and prioritize what needs to be accomplished first.
- Break household tasks down into smaller tasks. For example, wash the dishes first and then dry the dishes at a later time.
- Keep bills and important papers in a visible place such as the kitchen countertop by your keys, not tucked away in a desk, basket, or cupboard.
- Write reminder notes. Carry a pocket-sized notepad or place a notebook on the kitchen table and write down things to do or important information.
- Avoid multitasking and keep focus on one task at a time.

Driving

- Clearance from doctor is needed before resuming driving.
- Drive when the traffic is light and allow plenty of time to get to places.
- Drive during clear weather and during daylight hours.
- Take advantage of public transportation and people's offer to give you a ride.

Communication

- Program frequently used phone numbers into the phone's speed dial feature.
- Use a cell phone to check in with family throughout the day.
- Record what you did that day or use it save important matters you want to tell others.

Adapted from: http://www.gerontology.vt.edu/docs/Gerontology_MCI_final.pdf

Tips for Caregivers

It is normal for individuals following heart surgery to feel less focused, feel down, or struggle with returning to their routine or roles at home. Below is a list of strategies and supports for you to help your loved one, friend, or family member to return to his or her routine again.

Be supportive & encouraging

- Accept that the person may struggle with returning back to their daily routine not only physically but also mentally. They may express their struggles through hostility, rejection, and irritability.
- Allow extra time for the person to respond to a question.
- Encourage nurturing behaviors such as caring for a pet or plants.
- Encourage usefulness by suggesting responsibility for simple household tasks.
- Promote feelings of success by giving one task to complete at a time.
- Adopt an interaction style that puts your loved one in charge. For example, instead of suggesting, “Let’s go to the movies tonight,” try this: “I’d like to see a movie tonight. Which one of these do you want to see with me?”
- Help the person stay physically healthy.
- Avoid becoming overprotective.

Be patient & respectful

- Include the person in social events and community activities.
- Respond to the same question even if they have already asked it before.
- Avoid beginning or ending sentences with “I already told you...”
- Simplify your language if the person does not understand.

It is also important to take care of yourself during this time because you can only help others when you are at your best.

Caring for the Yourself

- Take one day at a time - some days are better than others.
- Pick your battles and don’t sweat the small stuff. And forgive yourself, being a perfect caregiver everyday is impossible.
- Reach out & ask family, friends, and health professionals for help and information.
- Don’t forget to focus on your own health. Take a break and get enough sleep.
- Talk to others with similar experiences or join a support group. Support groups can provide validation and encouragement, as well as problem-solving strategies for difficult situations.
- Allow the person to remain independent in a safe environment.
- Investigate community resources that can assist such as meal programs, transportation, and adult day services.
- Laugh! They say, laughter cures all, right? Watch funny movies, share funny jokes with friends, attend laughter yoga.

Adapted from:
http://my.clevelandclinic.org/services/heart/prevention/emotional-health/stress-relaxation/depression-heart-disease;
http://www.gerontology.vt.edu/docs/Gerontology_MCI_final.pdf;
http://www.mayoclinic.org/healthy-lifestyle/stress-management/in-depth/caregiver-stress/art-20044784

Appendix C
Clinical Pathway For Post Cardiac Surgery

Clinical Pathway for Post Cardiac Surgery

Progression of Occupational Therapy
in the Intensive Care Unit

Sutter Health
Mills-Peninsula Health Services

Table of Contents

Sutter Health
Mills-Peninsula Health Services

Occupational Therapy Evidence-Based Clinical Pathway

The purpose of the proposed occupational therapy evidence based clinical pathway at Mills-Peninsula Medical Center is to provide a clinical guide for occupational therapy interventions for patients post cardiac surgery on the intensive care and step-down units. The clinical pathway addresses common physical, cognitive, and psychosocial concerns that may arise in patients post cardiac surgery and creates a standard for consistent and effective treatment.

Guidelines

1. Follow established vital signs parameters per orders from Cardio-Thoracic surgeon
2. Apply mobility safety screen and no therapy under these conditions:

Cardiovascular Measures:
- MAP goal > 60 on less than 3 vasoactive medications
- Resting HR < 50 or > 140 bpm
- New arrhythmia developed
- New onset angina-type chest pain

Pulmonary Measures:
- SpO2 < 88%
- Respiratory Rate > 35

Mental Status
- RASS > -3

Invasive Monitoring
- No IABP

Labs
- Hgb < 7.0
- Hct < 25%
- BS > 300mg/dl
- K+ < 3.2 mEq/L, > 5.5mEq/L
- Platelets <20,000
- INR> 5

Day 1

Educate:
- Sternal Precautions; refer to "Sternal Precautions" handout
  - *Cahalin et. al., 2011 [V]*
- Heart Hugger/Sternal support bra (don/doff)
- Incentive Spirometer (10 reps/hr)
  - *Joo et al., 2004 [III]; Karabulut, 2015, [IV]*

Early Mobilization:
- Modified log roll with HOB < 20°
- EOB exercises while contracting abdominal muscles
  - Marching in place
  - Ankle pump
  - Knee extension
    - *El-Ansary et al., 2007, [I]; Sturgess, 2014, [I]*
- Level 4 Mobility-in room and hallway
  - Standing and balance exercises at bedside
  - 5 walks/day
  - Hygiene and grooming activities
    - *Ku et al., 2002, [I]; Wahab et al., 2015, [II]; Waugaman et al., 2015, [III]; Savage, 2007, [IV]; Ainsworth et al. 2011, [V]; Jetté, 1990, [V]*

Caregiver(s) Education*:
- Education primarily directed towards caregiver(s)
  - *Cheraghi, 2015, [I]; Bunzel, 2007, [II]; Young, 2005, [II]*

*Caregiver(s) should be educated throughout the recovery process

Day 2

Educate:
- Sternal precautions - Determine adherence to precautions
- Modified ADL techniques

Early Mobilization:
- Modified log roll or regular log roll with HOB < 20°
- Contracting abdominal muscles while completing ADL
- Level 4 Mobility-in room and hallway
  - 5 Walks/day
  - Sinkside hygiene and grooming
  - UB dressing with modified technique
  - Toilet transfer and simulated toilet hygiene
    - *Savage, 2007, [IV]; Ainsworth et al. 2011, [V]; Jetté,1990, [V]*

Caregiver(s) Education*:
- Caregiver(s) receives the same education as the patient

Day 3: Transfer to Step-Down Unit

Early Mobilization:
- Log Rolling
  - *El-Ansary et al., 2007, [I]; Sturgess, 2014, [I]; Brocki et al., 2010, [V]; Cahalin et al., 2011, [V]*
- Contracting abdominal muscles while completing ADL
- Do not exceed RHR+20 during activity
  - *Joo et al., 2004, [III]*
- Level 4 Mobility-in room and hallway
  - 5 walks/day
  - Sinkside hygiene and grooming
  - UB/LB dressing w/ modified technique
  - Toilet transfer and toilet hygiene

Cognition:
- Refer patient to "Tips to Feel More Focused in Your Daily Life" handout
- Administer MoCA© if:
  - No reliable caregiver(s)
  - Clinical observation warrants assessment
    - *Ball et al., 2013, [I]; Aykut et al., 2013, [II]; Cameron et al., 201, [III]; Newman, et al., 2001, [III]*
- MoCA© score below 18: May indicate Moderate Cognitive Impairment
  - All education and instructions should be directed to reliable caregiver(s)
  - Consider referral for additional services at discharge
- MoCA© score below 26: May indicate Mild Cognitive Impairment
  - Educate patient and consider environmental modifications
  - Consider referral for additional services at discharge

Caregiver(s) Education*:
- Refer caregiver(s) to "Tips for Caregivers" handout

Day 4 to Discharge

Educate:
- Start with low level activities and slowly progress to higher level activities.
- Refer patient to "How to Progress Back to Your Daily Routine" handout
  - *Savage, 2007, [IV]; Ainsworth et al. 2011, [V]; Jetté, 1990, [V]*
- Instruct IADL with sternal precautions. Refer patient to "Sternal Precautions" handout
  - *El-Ansary et al., 2007, [I]; Sturgess, 2014, [I]; Brocki et al., 2010, [V]; Cahalin et al., 2011, [V]*

Early Mobilization:
- Log rolling
- Contracting abdominal muscles while completing ADL
- Level 4 Mobility-in room and hallway
  - 5 walks/day
  - Sinkside ADL
  - Simulated standing shower and shower transfer
- Home management tasks - e.g. retrieving/arranging clothing from closet
- Meal preparation - e.g. practice using microwave or make a sandwich
  - *Savage, 2007, [IV]; Ainsworth et al. 2011, [V]; Jetté, 1990, [V]*

Psychosocial Functioning:
- Administer the HADS to patient
  - *Bjelland, 2001, [I], Bratas, 2014, [IV]*
- HADS score of 8 and above in either the depression and/or anxiety category:
  - Refer patient to "Tips for Coping with Feeling Down " and "Tips for Coping with Stress and Feeling Anxious" handouts
  - Music/quiet time for two 20-minute sessions each day
    - *Heidari, 2015, [I]; Sendelback, 2006, [I]*

Caregiver(s) Education*:
- Refer caregiver(s) to "Tips for Caregivers" handout

PROGRESSION OF REHABILITATION → **DISCHARGE**

Sutter Health
Mills-Peninsula Health Services

Narrative of Clinical Pathway

Guidelines

Before providing treatment to a patient following cardiac surgery, the treating occupational therapist must follow the established vital signs parameters per orders from Cardio-Thoracic surgeon. Furthermore, the occupational therapist must apply the mobility safety screen and should not continue therapy under these conditions:

Cardiovascular Measures:

- MAP goal > 60 on less than 3 vasoactive medications
- Resting HR < 50 or > 140 bpm
- New arrhythmia developed
- New onset angina-type chest pain
- Pulmonary Measures:
- SpO2 < 88%
- Respiratory Rate > 35
- Mental Status
- RASS > -3

Invasive Monitoring:

- No IABP
- Labs
- Hgb < 7.0
- Hct < 25%
- BS > 300mg/dl
- K+ < 3.2 mEq/L, > 5.5mEq/L
- Platelets <20,000
- INR> 5

Occupational Therapy Evidence-Based Clinical Pathway

***Evidence supports the inclusion of caregiver(s) throughout the entire rehabilitation process, including education and therapy sessions, until discharge.*

Postoperative Day 1

On the first day following cardiac surgery, the occupational therapist may provide education to the patient and caregiver(s). Due to the residual effects of anesthesia, education should be primarily directed to the caregiver(s). Education may include reviewing sternal precautions, fitting, donning, and doffing the heart hugger or sternal support bra, and use of the incentive spirometer. For the sternal precautions, the occupational therapist can refer the patient and caregiver(s) to *Sternal Precautions* handout. In regards to the incentive spirometer, it is advised that the patient should complete 10 repetitions per hour.

In addition to providing education, the occupational therapist may include early mobilization into the treatment session on the first day following cardiac surgery. The occupational therapist may instruct the patient on how to complete a modified log roll with the head of bed at an incline of greater than 20 degrees. Next, the occupational therapist may have the patient engage in exercises at the edge of bed. The exercises may include marching in place, ankle pumps, and knee extension, making sure the patient is contracting his or her abdominal muscles while completing the exercises. Lastly, if the patient is able, the occupational therapist may have the

patient complete Level 4 Mobility in the room and hallway. This includes having the patient engage in standing and balance exercises, and hygiene and grooming activities at bedside, as well as completing five walks throughout the day.

Postoperative Day 2

On Day 2 following cardiac surgery, the occupational therapist may continue to provide education to the patient and caregiver(s) on sternal precautions. During this session, the occupational therapist can assess the patient's understanding of and adherence to the sternal precautions. Additionally, the occupational therapists can provide the patient with education on how to complete activities of daily living (ADL) using modified techniques to comply with the sternal precautions.

Early mobilization may continue to progress on day two following cardiac surgery if the patient was able to complete Day 1 activities safely and within the guidelines. The patient can continue to practice the modified log roll with the head of the bed elevated greater than 20 degrees, or if able, a regular log roll with the head of bed at an incline of less than 20 degrees. Continue with Level 4 Mobility in the room and hallway, and five walks throughout the day. The next activity progression may also include sinkside hygiene and grooming, upper body dressing with modified technique, toilet transfers, and simulate toilet hygiene. Again, the occupational therapist should make sure the patient is contracting his or her abdominal muscles while completing the activity of daily living and exercises

Postoperative Day 3 (Transfer to Step-down Unit)

On Day 3 following cardiac surgery, the occupational therapist may continue to progress early mobilization if the patient was able to complete Day 2 activities safely and within the guidelines. This includes having the patient continue to practice log rolling along with Level 4 mobility which includes the patient completing 5 walks throughout the day. Additionally, the patient should also engage in sinkside hygiene and grooming, upper and lower body dressing, and toileting. All activities should be completed in conjunction with abdominal muscles contraction. Furthermore, the occupational therapist will need to monitor the patient's vital signs during activity with a primary focus on resting heart rate. It is important to make sure that the patient's heart rate does not exceed 20 beats per minute over the his or her resting heart rate.

Given the high prevalence of mild cognitive impairments following cardiac surgery, all patients can be provided with *Tips to Feel More Focused in Your Daily Life* handout as a resource for when the patient returns back to his or her daily routine. The Montreal Cognitive Assessment (MoCA©) can be administered to the patient if there is not a reliable caregiver(s) present and/or if clinical observation warrants assessment. If a patient scores below 18 on the MoCA©, this may indicate moderate cognitive impairment. Therefore, all education and instructions should continue to be directed to the reliable caregiver(s). Additionally, the occupational therapist should consider a referral for additional services at discharge. If a patient scores below 26, but greater than 18, on the MoCA©, this may indicate mild cognitive impairment. Therefore, the occupational therapist may need to modify environment when providing intervention and refer the patient to *Tips to Feel More*

Focused in Your Daily Routine handout which may provide helpful strategies for a patient to return to his or her daily routine in spite of having mild cognitive impairments. Lastly, the occupational therapist may need to consider referral for additional services at discharge to address the mild and subtle changes in cognition.

Postoperative Day 4 to Discharge

On Day 4 following cardiac surgery, the occupational therapist may continue to provide education to the patient and caregiver(s) on activity progression in preparation for discharge. The occupational therapist can educate the patient on beginning with low level activities and work up to higher level activities. The occupational therapist can refer all patients to *How to Progress Back to Your Daily Routine* handout. Furthermore, the occupational therapist may reinforce the importance of sternal precautions in regards to ADL and instrumental activities of daily living (IADL). For example, a gallon of milk weighs over eight pounds, which is too heavy to lift according to the sternal precautions.

In regards to early mobilization, the patient may continue to progress on to Day 4 following cardiac surgery if he or she is able to complete Day 3 activities safely and within the guidelines. The patient can continue practicing regular log rolling and following Level 4 mobility by having the patient completes 5 walks throughout the day, sinkside ADL, shower transfer and simulated standing shower. During all ADL, the patient should continue to contract abdominal muscles. Additionally, the occupational therapist can engage the patient in home management tasks. Home management tasks may include having the patient retrieve and arrange clothing from the closer or simple meal preparation, such as practicing using a microwave or making a sandwich.

Additionally on Day 4, the occupational therapists can assess psychosocial functioning given the high prevalence of psychosocial impairments in functioning following cardiac surgery. The occupational therapist may administer the Hospital Anxiety and Depression Scale (HADS) during OT treatment session. If a patient scores 8 or above on the HADS in either the depression or anxiety categories, refer patient to *Tips for Coping with Feeling Down* and *Tips for Coping with Stress and Feeling Anxious* handouts. The occupational therapist can also encourage the patient to listen to calming music or engage in quiet time for two 20-minute sessions each day. Inclusion of music is preferred because it is supported by current evidence.

Furthermore, literature shows a high prevalence of caregiver(s) being affected by symptoms of depression and anxiety. Therefore, the caregiver(s) should also receive education using the *Tips for Caregivers* handout.

CLINICAL PATHWAY EVIDENCE TABLE

PHYSICAL FACTORS						
Early Mobilization						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Ku, Ku, & Ma, 2002.	To assess the effects of phase I cardiac rehabilitation intervention on anxiety of patients hospitalized for coronary artery bypass graft (CABG) surgery.	Level: I Design: Prospective, quasi-experimental, random assignment with repeated measurements. Setting: The Veterans General Hospital Taipei, Taiwan, Republic of China Participants: 70 patients randomly assigned to one of two groups (experimental and control). 60 participants were included in the data analyses. Participant Characteristics: The average age of the participants was 68.47 years in the experimental group and 69.03 in the control group. Of the 60 participants, 50 were male. 53 of the participants were married. Only seven participants were employed at the time of the study. Inclusion Criteria: Over the age of 40; able to understand and speak Mandarin and/or Taiwanese; able to read Chinese or have an interpreter.	Intervention: Individual instruction on progressive exercises and daily activities according to the phase I cardiac rehabilitation program during hospitalization. The phase I cardiac rehabilitation program consisted of a manual which included indications and contraindications of cardiac rehabilitation, exercise programs (e.g. passive to active ROM of major muscle groups, deep breathing, stair climbing), and a daily activities program (e.g. sitting, walking, participation in ADLs). Furthermore, the researcher spent 15 minutes each day to discuss with each participant their concerns about the surgery and to record their daily exercise and activity level. When necessary, the researcher would then recommend progressive exercises and ADLs. Outcome measures: Psychological status as evaluated by the state of anxiety on the State Trait Anxiety Inventory. Anxiety was measured 3 times: at admission before the patient underwent CABG; the day before the patient underwent the CABG; and the day of discharge from the hospital.	The application of phase I cardiac rehabilitation intervention can reduce the anxiety level during hospitalization of patients undergoing CABG. All participants (60) experienced moderate levels of anxiety over the complications of CABG and their recovery. The control group did not receive information on cardiac rehabilitation and while their daily exercise and activity levels were recorded, their concerns were not addressed and recommendations for activity progression were not provided. The patients received phase I cardiac rehabilitation experienced lower levels of anxiety both before and after the operation ($p < .001$).	The study used a relatively small sample size which was limited to only patients undergoing CABG. The study also failed to provide details regarding how researchers determined the progression of exercises and activities.	The results of the study support patient education and early mobilization as interventions for patients undergoing CABG.

Early Mobilization						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Mendes et al., 2010	The purpose of this study was to determine if short term physiotherapy exercise after coronary artery bypass grafting (CABG) during inpatient cardiac rehabilitation would improve cardiac autonomous regulation.	Level: I Design: Randomized control trial Setting: Irmandade Santa Casa de Misericordia Hospital of Araraquara Participants: Forty-seven patients undergoing elective CABG surgery with cardiopulmonary bypass Participant Characteristics: Exercise experimental group: average age 60 years old, 16 males Usual care control group: average age 58 years old, 20 males Inclusion Criteria: Diagnosed with Coronary Artery Disease and have a clinical indication for CABG	Intervention: The experimental group received a physiotherapy exercise protocol, which consisted of daily progressive exercises from ROM active-assistive movements to climbing flights of stairs, as well as usual physiotherapy care. The control group received only physiotherapy usual care which consisted of consisted of voluntary deep-breathing and coughing exercises. Outcome Measures: Cardiac autonomous regulation, including linear and non-linear measures of heart rate variability.	Post-operatively, the experimental group demonstrated higher parasympathetic heart rate variability values, global power, non-linear heart rate variability indexes, and average respiratory rate when compared to the control group ($p<.05$).	First, the results of this study cannot be generalized to all patients undergoing cardiac surgery other than those who underwent a CABG. Second, since patients' left ventricular function was not considered, it is uncertain if there is a discrepancy in improvement after cardiac rehabilitation with different cardiac basal states.	These results demonstrate that a progressive rehabilitation program can improve cardiac autonomic function by the time of patient discharge from hospital, as assessed by heart rate variability.

Early Mobilization						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Wahab et al., 2015	The purpose of this study was to examine the effects of an early rehabilitation program in five ICUs on patient's ICU and hospital length of stay before and after a quality improvement project.	Level: II Design: Retrospective Review Setting: Three medical, one cardiac, and one surgical intensive care units in New York Presbyterian Hospital/Columbia University College of Physicians and Surgeons and the New York Presbyterian Hospital/Weill Cornell Medical College Participants: 3,945 patients admitted amongst the five ICUs pre-program implementation and 4200 patients admitted amongst the five ICUs post-program implementation. Participant Characteristics: Pre-program implementation: average age 63.1 years old, 2152 males, 1007 admitted for cardiovascular disease Post-program implementation: average age 63 years old, 2370 males, 3347 admitted for cardiovascular disease Inclusion Criteria: Admission to the ICU	Intervention: The early rehabilitation program consisted of all patients receiving six days of therapy a week. Physical therapy interventions included passive range of motion, transfers, and ambulation. Occupational therapy interventions included training in feeding, grooming, and dressing. Outcome Measures: Primary outcomes were hospital and ICU length of stay.	There was a statistically significant decrease in four of the five ICUs' total length of stay. Overall, the average ICU length of stay in all five ICUs decreased by 6.9% days, from 5.8 days pre-program implementation to 5.4 days post-program implementation ($p<.001$). The average hospital length of stay in all five ICUs also decreased by 5.4%, from 14.7 days pre-program implementation to 13.9 days post-program implementation ($p<.001$).	The study did not record or account for confounding variables, such as severity of illness or need for mechanical ventilation, which may have impacted patients' hospital and ICU length of stay. The generalizability of these results may be a limitation since all five of the ICUs included in the study were in a single hospital system, however the study did include medical, surgical, and cardiac ICUs in two locations. These limitations may be weak as the findings of this study are consistent with prior literature.	The results of this study indicate that early mobilization was correlated with a decreased length of stay in the ICU. These findings support the implementation of early mobilization in the ICU setting.

Early Mobilization						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Waugaman, VanNortwic, Dionne, Whitmore, & Bradley, 2015	The purpose was to assess the impact of early mobilization on patients post cardiac surgery.	Level: III Design: Single subject design Setting: Rex Healthcare in Raleigh, North Carolina Participants: Patients post cardiac surgery Participant Characteristics: Not Specified Inclusion Criteria: Not Specified	Intervention: Early mobilization and physical therapy Outcome Measures: Over the course of 6 months, data including patient length of stay in the cardiothoracic intensive care unit and hospital, postoperative complications, and readmissions were collected.	The results of the study showed patients post cardiac surgery experienced an increase in mobility from 46% to 56%, postoperative complication of pneumonia decreased by 0.9% and deep vein thrombosis decreased 0.1%, readmission rates decreased by 4%, hospital length of stay decreased by 0.1 days, and patient surveys from before and after the early mobility program implementation reported improvement in quality and quantity of sleep.	The study does not specify whether the results are clinically or statistically significant.	The results of this study demonstrate that early mobilization was associated with positive outcomes for patients post cardiac surgery including increased mobility, decreased rates of pneumonia and deep vein thrombosis, and decreased readmission rates and hospital length of stay. These findings support the implementation of early mobilization for patients post cardiac surgery.

Sternal Instability						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Brocki, Thorup, & Andreasen, 2010.	Identify the mechanical stress factors which cause sternal instability and infection to create evidence based guidelines for activity following a sternotomy.	Level: V Design: Literature review Setting: Not specified. Participants: Search was restricted to the adult population in all five cardiothoracic centers in Denmark. Participant Characteristics: Keywords included "postoperative period, surgical-wound-infection, postoperative-care, postoperative-complications, thoracic-surgery / heart-surgery / sternum-surgery, sternal instability / dehiscence, and mobilization." Inclusion Criteria: Adult population and papers published in English and Scandinavian languages from January 1992 to June 2008.	Interventions: Search strategies included a database search, information about activity instruction from cardiothoracic centers in Denmark, and a review of literature on mechanical stress of the sternal region. Outcome measures: Predisposing conditions, the common mechanical forces and abnormal mechanical stress forces which act upon the sternotomy site and skin. Abnormal mechanical stress forces include frequent coughing, obesity, loaded movements of the arms, skin stress disruption at surgical site, recruitment of abdominal muscles during positional changes.	No evidence was found to support weight limitations regarding activity as long as the upper arms are kept close to the body and the individual is pain-free during the activity. The following sternal precautions are recommended based on the outcomes of this study. Avoid stretching both arms backwards at the same time for at least 10 days following surgery. Loaded activities should be done with the elbows close to the body for at least 8 weeks. Only move arms within pain-free range. Use leg rolling with counter-weighing when doing bed transfers. Cross arms to self-hug during coughing. A supportive bra or vest should be worn by individuals with cup sizes of D or larger, BMI 35 or greater, or by individuals with frequent cough.	A limitation of this study is the low grade of the recommendations. The level of evidence varies from 3B (prospective cohort studies or extrapolations from level 1 studies) to 5 (case studies, expert opinion). This indicates there is a gap in the evidence regarding the issue of sternal complications due to overexertion. Furthermore, how to perform leg rolling is not specified.	The results of this study demonstrate that current sternal precautions regarding weight limitations may be too restrictive. This study also includes a number of recommendations for sternal precautions.

Sternal Instability						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Cahalin, LaPier & Shaw, 2011	The purpose of this literature review was to assess the available research related to the median sternotomy procedure and the impact of physical activity including (a) complications after cardiac surgery and median sternotomy, (b) symptoms and functional status after cardiac surgery, and (c) the changes in pulmonary function and thoracic motion after cardiac surgery.	Level: V Design: Literature Review Setting: Not specified Participants: Individuals with median sternotomy complications Participant Characteristics: Not specified Inclusion Criteria: Not specified	Intervention: No intervention was provided to the participants. Outcome Measures: Median sternotomy complications (sternal instability, dehiscence, mediastinitis), the relationship between activities and sternal complications, strategies to reduce sternal complications, functional consequences and symptom impact of median sternotomy.	At present, the sternal precautions prescribed to patients after a median sternotomy are more restrictive than precautionary. Precautionary sternal precautions would encourage optimal sternal healing and facilitate functional recovery after a median sternotomy. A review of the current literature suggests a change is needed. Progressive rehabilitation can facilitate thoracic motion, pulmonary function, symptoms, and functional status after a median sternotomy as opposed to restrictive precautions that can impede healing. An algorithm was proposed for which allows for less restrictive and more individual recommendations of sternal precautions. Using this algorithm, patients are placed into one of three categories based on risk for sternal complications (low, moderate, high). Each category specifies the type and degree of activity allowable, and also includes the progression of activity based on how well the patient is healing.	The location the literature was obtained from and how the literature was reviewed were not reported. The search strategy was also not discussed.	The results of this study indicate that current sternal precautions may be too restrictive and inhibit patients post cardiac surgery from participating in activities that may facilitate their recovery. The study also proposed an algorithm for the purposes of determining the progression of activities following surgery.

Thoracic Exercises						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
El-Ansary, Waddington, & Adams, 2007.	Determine whether trunk stabilization exercises reduce sternal separation and pain; and improve the quality and control of the performance of tasks in individuals with chronic sternal instability.	Level: I Design: Randomized crossover study with concealed allocation and intention-to-treat analysis Setting: Not specified. Participants: Nine participants with chronic sternal instability for 4 years following a median sternotomy for cardiac surgery. Participant Characteristics: Average age of 64 years. Eight males and one female. The majority of participants had a CABG and scored a 3 on the Sternal Instability Scale. Inclusion Criteria: Score of at least 2 (on a scale of 0-3) on the Sternal Instability Scale following physical examination by a cardiac surgeon and a physiotherapist.	Intervention: The experimental intervention included trunk stabilization exercises for 10 minutes twice daily targeting the muscles of the anterior chest wall and abdomen for a 6-week period. Trunk stabilization exercises included the contraction of abdominal muscles in a variety of positions including supine lying on a noodle, side-lying, sitting, sitting with unilateral and bilateral arm elevation, and standing with resisted unilateral and bilateral arm elevation. The control intervention did not include any stabilization exercises for a 6-week period. Outcome measures: Sternal separation measured by ultrasound in mm, pain during the performance of nine everyday tasks measured on a 100-mm visual analog scale (VAS), and quality and control of the performance of two tasks scored on a 100-mm VAS. Control of task performance was rated by therapists who watched video footage of the participants' performance.	Sternal non-union and instability was found to occur in 2-16% of individuals following surgery, and an estimated 42-45% of these individuals report chronic sternal instability. Sternal separation during the period of trunk stabilization exercises decreased more than during the control intervention period. Pain decreased when performing everyday tasks more than during the control period. Task performance during the period of trunk stabilization exercises did not improve more than during the control intervention period. Trunk stabilization exercises should be included in the rehabilitation of individuals who experience sternal instability following cardiac surgery.	This study may be limited by a small sample size and the short duration of the training period. No information was provided on how the participants acquired their sternal instability.	The results of this study indicate that trunk stabilization exercises reduced sternal separation and pain despite the fact that patients in this study had been suffering from chronic sternal instability for four years. Therefore, trunk stabilization exercises may be an effective intervention when implemented earlier inpatient rehabilitation.

Thoracic Exercises						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Sturgess, Denehy, Tully, & El-Ansary, 2014.	To investigate whether thoracic exercises result in improved pain, range of movement, and health-related quality of life (HRQOL) following open heart surgery (OHS), and to evaluate patient perception of the role of thoracic exercises in recovery.	Level: I Design: Assessor blinded parallel group, randomized pilot trial. Setting: Tertiary public hospital in Australia. Participants: 38 participants allocated to either the experimental group (Group 1, n=23) or the control group (Group 2, n=15) Participant Characteristics: Average age was 63 years in Group 1 (experimental) and 59 in Group 2 (control). The majority of the participants were male (73.9% and 93.3%, respectively). Of the participants who had a CABG, 17 were in Group 1 and 14 were in Group 2. Inclusion Criteria: All patients who were scheduled for open heart surgery. Inclusion criteria were extended to include patients from a co-located private hospital due to slow recruitment.	Intervention: Both the control and experimental groups were prescribed a twice daily walking program. A progressive thoracic exercises program was also prescribed to the experimental group. The five thoracic exercises included resting sagittal thoracic posture, thoracic extension, shoulder flexion, trunk lateral flexion, and trunk rotation. The program was individually tailored to each patient by modifying exercises and/or the number of repetitions based on patient response, including quality and ease of movement, fatigue, and pain. Outcome measures: Measurements of shoulder and thoracic ROM, pain, and HRQOL taken at 3 times - preoperatively, 4 weeks following discharge, and 3 months post-operatively.	Thoracic exercises following open heart surgery (OHS) may be effective in reducing sternal pain. The reduction in sternal pain (0-6 weeks) for participants in the experimental group was statistically and clinically significant (*p=.03*). Thoracic exercises may reduce post-operative pain by improving neuromuscular control and muscular activation patterns of the anterior thoracic cage and the abdominal muscles which can be inhibited in the presence of pain following OHS. Results indicate that patients undergoing OHS should routinely complete a post-operative thoracic exercise program as it positively impacts pain 4 weeks following discharge, and may facilitate patients to resume participation in life roles and occupations.	This study may be limited by a small sample size. No significant differences were noted between the control group and the experimental group with regards to shoulder and thoracic ROM and HRQOL.	The results of this study support the use of thoracic exercises for reducing pain following open heart surgery. Reduction in pain may facilitate patients' return to desired occupations.

Metabolic Equivalent of Task						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Savage, Toth, & Ades, 2007	The purpose of this study was to compare the generally accepted value of one Metabolic Equivalent of Task (MET) with the measured resting metabolic rate (RMR) of a group of participants with coronary heart disease (CHD).	Level: IV Design: Single-subject, exploratory design Setting: Not Specified Participants: 109 participants, 60 men and 49 women Participant Characteristics: Average age 66 years old, average weight 89.4 kg, average BMI 31.8 kg/m^2, average percent body fat 39.3, average fat mass 33.7 kg, average fat free mass 52.3 kg Inclusion Criteria: Documented CHD for more than 6 months, body mass index ≥ 25 kg/m^2, and nonsmoker	Intervention: No intervention was provided to the participants. Outcome measures: Participants' RMR, body weight, body height, and body composition including fat mass, fat free mass, percent body fat, and bone density.	Of the participants, the average value for 1-MET was 2.58 ± 0.4 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$, similar between men ($p<.6$) and women ($p<.4$). This is 23% to 36% lower than the standard 1-MET value of 3.5 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$. Fat free mass, age, and gender have the largest influence on RMR variance ($p<.001$). Since the value of MET is significantly influenced by individual characteristics, the researchers noted that MET values should serve as a general guide to identify the energy demands of various activities.	The dosage and type of Beta-blocker therapy was not standard among the participants which may have impacted the study results. Since participants were overweight individuals with CHD, the results of the study cannot be generalized to individuals with cardiac conditions other than CHD or individuals who are not overweight.	The results of this study demonstrate that the absolute 1-MET value varies amongst individuals since it is dependent on a number of characteristics including age, gender, and fat free body mass. Therefore, only the relative MET values of activities should be used as a general guide to progress the activity level of patients post cardiac surgery.

Metabolic Equivalent of Task						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Ainsworth et al., 2000	The purpose was to provide an update to the initial Compendium of Physical Activities, originally published in 1993, to include modifications to the coding scheme that represent different activities and measurements of the Metabolic Equivalent of Task (MET) intensities for activities that were only estimated before. Additional categories of common activities done daily were also included.	Level: V Design: Expert opinion Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to the participants. Outcome measures: No outcome measures were specified.	The Compendium of Physical Activities provides the relative MET value of many common activities such bicycling, conditioning exercise, home activities, lawn and garden care, and walking. In this update, religious activities and volunteer activities, two of the most common types of physical activity observed in women over age 40, were the two major headings added to the Compendium. The relative MET values of 129 new activities were also added to the Compendium including carrying groceries, jumping jacks, and building a fence.	A limitation of Compendium of Physical Activities is MET intensities may not precisely estimate the energy cost of physical activity for each individual since MET does not account for differences such as body mass, age, or sex.	The updated Compendium of Physical Activities provides relative MET values for a wider variety of activities. The relative MET value may be used in the ICU to guide the progression of activities from light to moderate or heavy intensities.

Metabolic Equivalent of Task						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Ainsworth et al., 2011	The purpose of this update of the Compendium of Physical Activities is to further expand the variety of activities included in the coding scheme and update the estimated Metabolic Equivalent of Task (MET) values with measured values.	Level: V Design: Expert opinion Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to the participants. Outcome measures: No outcome measures were specified.	This update to the Compendium of Physical Activities now includes 217 additional codes for various physical activities. This update also modified the estimated MET values to include measured MET values for 68% of the coded activities, contributing to the Compendium becoming more evidence based. Additionally, a website containing the updated information was created and may be found at https://sites.google.com/site/compendiumofphysicalactivities/.	A limitation of Compendium of Physical Activities is that not all of the MET values listed are measured values. Additionally, MET values may not precisely estimate the energy cost of physical activities for each individual since MET does not account for differences such as body mass, age, or sex.	The updated Compendium of Physical Activities provides MET values for a wider variety of activities and more precise MET values. The measured MET values may be used in the ICU to guide the progression of activities from light to moderate or heavy intensities.

Metabolic Equivalent of Task						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Jetté, Sidney & Blumchen, 1990	The purpose of this article was to define the Metabolic Equivalent of Task (MET), compare MET and watt values of various household and recreational activities, and to describe the use of METs in physical prescription.	Level: V Design: Literature review Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to the participants. Outcome measures: No outcome measures were specified.	MET is defined as the resting metabolic rate, that is, the amount of oxygen consumed at rest, sitting quietly in a chair, where 1-MET is approximately $3.5mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$ for a 70 kg person. There are three levels of intensity: Light, Moderate, and Heavy. Activities of Light intensity elicit minimal perspiration and only a slight increase in breathing above normal and have an energy expenditure up to 4 METs. Activities of Moderate intensity elicit definite perspiration and above normal breathing and have an energy expenditure between 5 and 8 METs. Activities of Heavy intensity elicit heavy perspiration and heavy breathing and have an energy expenditure of 8 METs and above.	Since the value of 1-MET is largely dependent on the individual, including their body mass, sex, and age, it is difficult to apply this estimated value of energy expenditure accurately. For this reason, MET values should be used as a relative guide to identify the energy demands of activities.	This literature divides activities of certain MET values into three categories according to intensity. These relative MET values and categories may be used to identify and educate patients recovering from cardiac surgery on what activities are safe to participate in.

Vital Signs						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Joo et al., 2004.	The goal of this study is to determine the actual exercise intensity, expressed as a percentage of peak oxygen uptake reserve. In cardiac rehabilitation programs, exercise intensity is often set at 20 beats per minute above the standing resting heart rate (RHR+20) or in the range of 11-13 on Borg's Scale for Rating of Perceived Exertion (RPE 11-13).	Level: III Design: Non-randomized, one group Setting: Wake Forest University Participants: Patients (five women, six men) ages 43-63 years who had been referred to the phase II cardiac rehabilitation program. Participant Characteristics: Five women and six men were included in the study. Average age was 53.4 years. Average weight was 167.9 lbs. Of the 11 participants, three were low risk, four were moderate risk, and four were high risk patients. Inclusion Criteria: Not specified. Participants were referred to the phase II cardiac rehabilitation program.	Intervention: A field test consisting of two separate parts with a 10-minute rest period in between. Part one consisted of participants walking over the ground in the gym at a self-selected effort level that they perceived to be a RPE 11-13, and maintaining that pace for 10 minutes. The rest period consisted of 10 minutes of seated recovery until baseline HR values were achieved. Part two consisted of the participants walking with a target intensity of 20 BPM higher than their standing heart rate for 10 minutes (while unaware of their heart rate, which was being monitored by the investigator) Outcome measure: Oxygen uptake reserve values.	Using the RHR+20 guide failed to provide a stimulus exceeding 40% of the resting VO2R in 4 participants, of which 3 were classified as low risk patients. The RHR+20 technique (which yields a low and presumably safe exercise intensity) may not produce an adequate physiologic stimulus for patients who could and should be exercising at higher intensities. Using the RPE 11-13 was more likely than RHR+20 to yield an exercise intensity between 50%-85% VO2R for patients with cardiac conditions. However, two of the high risk [complex ventricular arrhythmias/angina during baseline testing] patients in this study exceeded 85% resting VO2R using RPE 11-13 (may be beyond what is safe). This demonstrated how highly variable the RPE scale is, which may place high risk patients at risk for overexertion. In conclusion, RHR+20 would be safer for high risk patients, while the RPE would be more appropriate for low risk patients.	On average these participants were overweight or obese and have multiple cardiovascular conditions and other comorbidities, so generalization of the results to all patients with cardiac conditions should be made with caution.	The results of the study support the use of RHR+20 as a guide for determining exercise intensity for high risk patients. This would be appropriate for use in cardiac ICU as most patients in phase I cardiac programs are considered high risk.

Vital Signs						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Karabulut, Aktaş, Gürçayır, Yılmaz, & Gökmen, 2015.	To determine patient satisfaction with pain management and comfort levels after undergoing open heart surgery.	Level: IV Design: Descriptive study Setting: Cardiovascular surgery clinic of Region Training Research Hospital in Erzurum, Turkey. Participants: 52 patients who had recently undergone open heart surgery. The study included 32 males and 20 females, with a mean age of 58.4 years, ranging from 25-77 years old. Participant Characteristics: 32 males and 20 females of Turkish nationality with a mean age of 58.4 years. Inclusion Criteria: Patients who had undergone open heart surgery in the cardiovascular surgery clinic of the Region Training Research Hospital between January 31 and April 29, 2011. Participants were required to be at least 18 years and older, literate, able to respond to the questionnaire, and provide consent to participate in the study.	Intervention: No intervention was provided to the participants. Outcome measures: Pain management and comfort levels.	Patients had more severe pain on the first day after surgery and at first ambulation, and pain gradually decreased as patients neared hospital discharge. The most commonly used non-pharmacological method was deep breathing exercises with a spirometer applied by the nurse. The study found that while doctors and nurses inquired about pain, no written educational material was provided to the patients about the importance of pain management; stresses the need for pre-operative education	A limitation of this study is the small sample size and the use of only one cardiovascular surgery clinic, which may limit the generalizability of results to patients who may have undergone different protocols in open heart surgery.	The results of this study support the therapeutic value of use of a spirometer for patients who have recently undergone open heart surgery for pain control.

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COGNITIVE FACTORS						
Incidence						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Newman et al., 2001	Sought to determine the course of cognitive change during five years after CABG and the effect of perioperative decline on long term cognitive function.	Level: III Design: Descriptive Longitudinal Setting: Duke Heart Center Participants: 261 patients undergoing elective coronary artery bypass grafting enrolled, 172 patients who completed follow up, 89 patients who did not complete follow up, & 197 patients who completed follow-up, had a stroke, or died Participant Characteristics: Average age 61, 71% of patients that completed the study were male, 89% were white race Inclusion Criteria: Patients that did not have a history of symptomatic cerebrovascular disease, no psychiatric illness, no renal disease or active liver disease, higher than a seventh grade education level, and who could read.	Intervention: No intervention was provided to the participants Outcome Measures: Psychometricians administered a brief battery of neurocognitive tests before CABG, on the day before discharge (7 days after CABG), six weeks and five years after CABG. Neurocognitive Assessments administered: Short story module of the Randt Memory test, Digit Span Subtest of the Wechsler Adult Intelligence Scale, Benton Revised Visual Retention Test, Digit Symbol subtest of the Wechsler Adult Intelligence Scale, Trail Making test (Part B). Cognitive decline defined as 1 standard deviation in performance in any one of the four domains.	The incidence of cognitive decline was 53% at discharge, 36% at six weeks, 24% at six months, and 4 % at five years. The results also indicated that patients whose cognitive function declined immediately after surgery (approximately 50 percent of patients undergoing CABG) are at increased risk for long term cognitive decline and reduced level of overall cognitive functioning.	This study lacks generalizability because cognition was measured through the use of assessments. More information is needed to determine the implications of the results on real life occupations. The study is limited by the loss of 89 patients to follow-up that is inevitable in a longitudinal study.	The results of this study support the high prevalence of cognitive impairments immediately following discharge after CABG and five years after. Thus, supporting the need to assess cognition in patients post CABG prior to discharge from an ICU setting.

Assessments						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Ball, Carrington, Stewart, 2013	Examine cognitive function in older hospitalized patients with chronic atrial fibrillation (AF).	Level: I Design: Prospective sub-study of a multicenter randomized trial Setting: Three tertiary referral hospitals within Australia Participants: 260 patients with chronic AF Participant Characteristics: mean age 72 ±11 years, 53% men Inclusion Criteria: Documented diagnosis of recurrent paroxysmal, persistent or permanent AF, living independently in the community or their own home post hospitalization	Intervention: Patients were randomly assigned to either post discharge care or a home-based, multidisciplinary, AF-specific intervention designed to reduce morbidity and mortality. Cognitive function was assessed at baseline (during inpatient stay) using the MoCA©. Outcome measures: The extent of mild cognitive impairment (MCI- defined as MoCA© score <26) in patients with AF and identification of independent predictors of MCI.	Overall, 66% of patients were found to have MCI at baseline (mean MoCA© score 21). Multiple deficits in cognitive domains were identified, most notably in executive functioning, visuospatial abilities and short term memory. Predictors of MCI were lower education level (including less than 8 years education or trade qualifications) and in those with a higher CHA2ds-VASc score (calculated risk for patients with AF) and prescribed digoxin (slows heart rate in patients with AF).	The limitation mentioned was that the investigators applied only one clinical assessment tool to assess cognitive function. More significant psychometric testing is needed to confirm mild cognitive impairment; however is not realistic given the fast paced nature of the ICU environment. Additionally, the chaotic acute clinical setting under which the MoCA© was conducted in addition to the patients' altered health state may not represent an ideal testing situation. Thus, MoCA© should be administered shortly before being discharged when patient is more alert and oriented in order to obtain a more accurate level of cognitive functioning.	The results of this study support the need to assess cognition using the MoCA© for patients with AF which is a common occurrence following cardiac surgery. Clinicians should be aware of the risk of MCI in patients with AF.

Assessments						
Author/ Year	**Study Objectives**	**Level/ Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitation**	**Clinical Application**
Aykut, Albayrak, Guzeloglu, Baysak, & Hazan, 2013	Aimed to compare the postoperative respiratory complications of patients with preoperative mild cognitive dysfunction with postoperative respiratory complications of patients with normal cognitive dysfunction.	Level: II Design: Prospective cohort control Setting: University hospital Participants: 48 of patients undergoing elective coronary artery bypass graft (CABG) surgery. Participant Characteristics: Group A: mean age 70 years old; 14 females, 11 males Group B (control): mean age 72 years old, 12 females, 11 males Inclusion Criteria: Patients with prolonged respiratory support requirement for >24 hours, less than 70 years old, patients scheduled to undergo CABG	Intervention: Investigators separated 48 patients who were scheduled for elective CABG surgery into two groups: patients with preoperative mild cognitive impairment (group A, n=25) and patients with no cognitive impairment (control group; group B, n=23). Outcome measures: The patient's cognitive status was evaluated by the Montreal Cognitive Assessment (MoCA©) test and administered by psychologists who were blinded to the rest of the study before the surgery.	The preoperative mean MoCA© scores was 19.25 in group A (indicative of MCI) and 27.16 in group B (p=.036). The rate of postoperative atelectasis which is the collapse or closure of a lung was detected in 84% of the participants in the mild cognitive impairment group A and 17% in control group on postoperative day 3. The difference between the groups was statistically significant (p<.001). The rate of prolonged mechanical ventilation in the first group was determined to be 24%, whereas in the control group it was 0%. The difference between the groups was statistically significant (p<.05).	The MoCA© was administered only preoperatively. The MoCA© should also be administered after cardiac surgery in order to inform clinicians on how to progress with interventions and appropriately discharge the patients as well as to detect if any other changes in their cognition occurred post CABG.	This study suggested that mild cognitive impairment (MCI) may be associated with pulmonary complications after CABG. Hence it is recommended to assess MCI post CABG to predict the recovery or need for specialized attention to patients with MCI that may experience pulmonary complications post cardiac surgery. As stated in the article, pulmonary complications after cardiac surgery prolong hospital stays and increase healthcare costs.

Assessments						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Cameron, Worrall-Carter, Page, Stewart, & Ski, 2013	Aimed to compare the Montreal Cognitive Assessment (MoCA©) with the Mini Mental State Exam (MMSE) in screening for mild cognitive impairment in patients with congestive heart failure.	Level: III Design: Cross Sectional Observational Setting: Hospital Participants: 93 hospitalized patients with congestive heart failure (CHF) without a history of neurocognitive problems living in Australia Participant Characteristics: Mean age 70, 71% male, 39 were living alone, 77% had not completed more than 12 years of formal education Inclusion Criteria: Age over 45 years with a diagnosis of CHF	Intervention: No intervention was provided to the participants Outcome measures: MMSE and MoCA© were randomly administered to patients with CHF 5 days from hospital admission date.	Twenty-five of the participants had scores greater than 26 on the MoCA© and greater than 27 on the MMSE which indicated no mild cognitive impairment. 68 participants were observed to have low scores suggestive of MCI and the need for further cognitive testing. Participants with scores greater than 26 on the MoCA© and greater than 27 on the MMSE were 8 years younger. In other words, participants that were considered to have MCI were older in age. There were statistically more participants with MoCA© scores less than 26 as compared with MMSE scores less than 27 (71% vs. 32%, p=.02). Of the 66 participants with MoCA© scores less than 26, 38 (41%) had MMSE scores less than 27. Conversely, of the 30 participants with MMSE scores less than 27, two participants had MoCA© scores less than 26. The Kappa measure of agreement was 0.25 (p=.001) indicating a significantly low level of agreement between MoCA© and MMSE in identifying MCI.	The target population was patients with congestive heart failure rather than patients with open heart surgery.	The results of this study support that the MoCA© identified clinically relevant cognitive dysfunctions with greater frequency than MMSE. Therefore suggesting that the MoCA© may be a more reliable tool than the MMSE in detecting mild cognitive impairment in patients with congestive heart failure. Thus, the MoCA© would be appropriate for the clinical pathway due to the lack of evidence supporting the use of MMSE in patients with cardiac conditions.

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PSYCHOSOCIAL FACTORS						
Assessments						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Bjelland, Dahl, Haug, & Neckelmann, 2001	To review the literature of the validity of the Hospital Anxiety and Depression Scale (HADS) in terms of (a) structure, discriminant validity, and internal consistency, (b) performance as a case finder for anxiety and depression, and (c) concurrent validity.	Level: I Design: Systematic Review Settings: Not applicable Participants: 71 studies that used the HADS Inclusion Criteria: The study had to address factor structure, discriminant validity, internal consistency, concurrent validity, and the performance as a case finder for depression and anxiety.	Intervention: The criteria for the systematic review included a search of the Medline, ISIS, and PsycINFO database. The search performed used the terms 'Hospital' and 'Anxiety' and 'Depression' or 'HAD' or 'HADS' in the title. Outcome measures: The study wanted to examine the following factors: factor structure, discriminant validity, concurrent validity, internal consistency, case finder for anxiety disorders and depression.	Factor structure, discriminant validity, internal consistency: The review supports the two-factor structure of HADS. The results on the discriminant validity show both a high Pearson correlation and a low Pearson correlation (ranging from .49 and .74, with an average of .59) A high correlation is hypothesized to be observed due to common causal factors of both depression and anxiety, whereas a low correlation represents good discriminant validity. The internal consistency was fulfilled in all of the studies examined. The HADS-A and HADS-D had an average Chronbach coefficient of .83 and .82 respectively. HADS as a case a finder for anxiety disorders and depression: The HADS as a screening tool to determine prevalence of anxiety and depression demonstrates optimal balance between sensitivity and specificity (.8) with cut off scores of 8+ for both HADS-A and HADS-D. Concurrent validity: Despite its brevity, the HADS demonstrated similar sensitivity and specificity to the General Health Questionnaire, Beck Depression Inventory, Spielberger's State-Trait Anxiety Inventory, Clinical Anxiety Scale, and Symptoms Checklist-90	The limitation of this study was that many of the studies were from samples of patients with cancer. Furthermore, only three papers used in a general population reported the psychometric properties. This systematic review did not mention if the HADS was used in a cardiac sample.	The results of this study support the use of HADS as a screening tool to determine the presence of depression and anxiety with a cut off scores of 8+ for both HADS-A and HADS-D.

Assessments						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Bratas, Gronning, & Forbord, 2014	To compare the psychometric properties between the Hospital Anxiety and Depression Scale (HADS) and the General Health Questionnaire-Version 20 (GHQ-20) in detecting psychological distress in patients with chronic obstructive pulmonary disease (COPD).	Level: Level IV Design: Case series Setting: 4-week rehabilitation program Participants: 161 patients with mild to very severe COPD Participant Characteristics: 79 males, 82 females, average age of 65 Inclusion Criteria: COPD stages I-IV, patients who wished to participate returned the questionnaire.	Intervention: No intervention was provided to the participants. Outcome measures: The aim of the study was to compare the mean scores of the HADS and GHQ-20 and determine the correlations and internal consistency the two assessments.	The two questionnaires showed no significant difference in mean scores (p = .00). There was also no significant difference in the prevalence of possible cases of psychological distress and cases without any indication of psychological distress (p = .00). Furthermore, the internal consistency between both questionnaires was marginal (Chronbach's alpha coefficients were .91 and .94).	The limitations of the study include a small sample size, thus making the study exploratory in nature. The study also limits generalizability because of the lack of randomization and specific COPD population. Lastly, the lack of a clinical interview decreases the knowledge of the sensitivity and specificity of the two screening tools.	The results of this study support the use of HADS as a screening tool to determine the presence of depression and anxiety in patients instead of using the GHQ.

Partner Inclusion						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Bunzel, Roethy, Znoj, & Laederach -Hofmann, 2007	To investigate the long-term psychological aftermath of the implantation of a ventricular assist device as bridge to successful heart transplant	Level: II Design: Cross-sectional, retrospective study Setting: Vienna University Heart Transplant Center Participants: 30 patients after cardiac surgery and 21 partners Participant Characteristics: Average age 48, 28 males, two females Inclusion Criteria: Patients with highly advanced heart failure, implantation of mechanical circulatory assist device.	Intervention: No intervention was provided to the participants Outcome Measures: The study used multiple measures to examine different psychosocial concerns: (a) Impact of Event Scale-Revised (IES-R) to assess severity of Posttraumatic Stress Disorder (PTSD) symptoms, (b) the Hospital Anxiety and Depression Scale to measure the severity of anxiety and depressive symptoms, and (c) Artificial Heart Questionnaire to examine the most pressing fears and complaints during surgery.	Partners displayed significantly higher values in all dimensions of the Impact IES-R ($p < .002$). Partners also showed higher levels of both mild to moderate depression and anxiety symptoms than patients ($p = .005$).	The limitations of the study include that researchers did not evaluate patients at predefined time intervals, therefore they were unable to judge time course for the development of PTSD. Furthermore, they used a self-assessment instead, which is not as accurate as a diagnostic interview.	The results of this study support incorporating patients' partners into psychosocial education because of their high prevalence of depression and anxiety symptoms.

Partner Inclusion						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Young et al., 2005	To examine whether the intensive care unit population differ from an elective cardiac surgery group with regards to their anxiety and depression symptom reporting.	Level: II Design: Case control study Setting: ICU follow-up program Participants: 20 patients in the ICU and their partners; 15 patients undergoing elective cardiac surgery and their partners Participant Characteristics: ICU sample: 15 males, five females, average age 54; relatives of ICU sample: 15 females, five males, average age 53; elective sample: 12 males, three females, average age 60; relatives of elective sample: 12 females, three males, average age 60. Inclusion Criteria: Patients in the ICU; matched patients undergoing elective cardiac surgery.	Intervention: No intervention was provided to the participants Outcome Measures: The Hospital Anxiety and Depression Scale (HADS) to assess symptoms of anxiety and depression. The cut off scores used in the study were broken into two groups. Possible clinical disorder was a score between 8-10 and the score for probable clinical disorder was between 11-21.	There was no significant difference found between patients in the ICU and patients undergoing cardiac surgery in their anxiety and depression symptoms ($p <$ .05). However relatives reported a significantly higher number of anxiety symptoms than patients themselves in both groups. Furthermore, relatives were more troubled by the recovery period, finding the experience life altering and the impact was more profound.	The limitations of the study included a small number of participants, which limits the generalizability. Also, research HADS utilizes different cut off scores, making it harder to compare to other studies.	The results of this study support incorporating patients' partners into psychosocial education because of their high prevalence of anxiety symptoms.

Interventions						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Asilioglu, & Celik, 2004	Evaluate the effect of preoperative teaching methods on anxiety levels of patients	Level: II Design: Comparative control trial Setting: Cardiovascular surgery unit Participants: 100 patients undergoing open cardiac surgery Participant Characteristics: Control group: seven females, 43 males; Intervention group: nine females, 41 males Inclusion Criteria: Undergone routine planned open cardiac surgery, read and write in the Turkish language	Intervention: The study aimed to evaluate preoperative education by providing an education booklet to the intervention group to educate them on care before and after surgery. The educational group was educated by the researchers. The control group was only informed about pre-and postoperative routines by a registered nurse. The education was provided before surgery to both groups in a class that lasted 20-30 minutes. Outcome measures: The study used the Self-evaluation State and Trait Anxiety Inventory form to measure anxiety levels.	State and trait anxiety scores were not statistically significant ($p > .05$), however the intervention group that received preoperative education had lower anxiety scores than the control group.	The limitations of the study included the lack of randomization into the two groups. This decreases the generalizability of the study.	The results of this study support preoperative education booklets about preoperative and postoperative care to decrease anxiety.

Interventions						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Cheraghi, Toulabi, Baharvand, & Farhadi, 2015	To determine the effect of educational programs and telephone follow-up on the quality of life satisfaction in patients with acute coronary syndrome	Level: I Design: Randomized control Trial Setting: Coronary care unit within hospital Participants: 90 patients with acute coronary syndrome Participant Characteristics: 41 males, 49 females, average age 54 years Inclusion Criteria: Age limitation between 25-70 years old, hospitalization in cardiac care unit and post cardiac care unit wards, access to telephone, no hearing or speaking problems, able to speak Persian, Lori, or Laki dialect, feeling no pain, not suffering from mental disorder.	Intervention: The study aimed to use education to improve quality of life after staying in the coronary care unit. The participants were randomly assigned to three preoperative preparations. The education program group received educational sessions on the department's facilities, patient's familiarity with the department, care and mental requirements, nature and cause of heart-disease, medicine consumed, treatment process follow-up, nutritional diet, and activity during hospitalization. The education plus phone calls group received the education sessions while in the hospital, as well as phone calls after discharge. The control group did not receive intervention. The education program consisted of three 30-minute sessions during hospitalization. The phone calls consisted of ten phone calls that spanned two months after discharge. Outcome Measures: The Quality of Life Questionnaire (QOL) was used to measure the emotional, physical, and social functions of life.	There was a significant difference in quality of life between the two intervention groups that received education and the control group. However, there was no significant difference between the two intervention groups in quality of life. The group who received the phone calls had the highest mean satisfaction after intervention.	The limitations of the study included that some patients did not pose all their problems during education session. Additionally, some patients were lost to follow up because their phone numbers belonged to family members. Lastly, cooperation for filling out the questionnaire was below 100%.	The results of this study support heart disease education postoperatively to improve quality of life.

Interventions						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Heidari et al., 2015	To investigate the effect of music therapy on anxiety and cardiovascular indices in patients undergoing CABG	Level: I Design: Randomized control trial Setting: Cardiovascular surgical intensive care unit Participants: 60 patients hospitalized in the cardiac ICU Participant Characteristics: Intervention group: 15 male, 15 female, mean age 56; control group: 12 male, 18 females, mean age 60 Inclusion Criteria: Orientation to time, place, and person, undergoing coronary artery bypass graft surgery, no hearing impairments, no known anxiety disorder, no history of cardiac surgery, no history of endocrine disorder, no tracheal tube, pacemaker, or intra-aortic balloon pump.	Intervention: The study aimed to use music to impact anxiety. The participants were randomized into two different groups The intervention group received one 30-minute session of light music that included sounds of nature and the control group received one 30-minute period of rest in bed without distractions Outcome measures: The study used physiological parameters to examine heart rate, blood pressure, and mean arterial pressure. To measure anxiety, the visual analogue scale for anxiety was used	All three measurements of anxiety were significantly lower in experimental group ($p < .037$). Furthermore, the decreasing scores in anxiety trends were significant ($p < .001$). There was no significant difference in heart rate, diastolic blood pressure, systolic blood pressure, and mean arterial pressure.	One limitations of the study was that physiological parameters were not measured after 30 minutes. This limiting the knowledge of music therapy having a lasting effect on anxiety. Furthermore, people have different preferences of music. Thus, they may not like the music selected or find it relaxing.	The results of this study support inclusion of music therapy that incorporates sounds of nature postoperatively to decrease patient levels of anxiety.

Interventions						
Author/ Year	**Study Objectives**	**Level/Design/ Participants**	**Intervention and Outcome Measures**	**Results**	**Study Limitations**	**Clinical Application**
Sendelback, Halm, Doran, Miller, & Gaillard, 2006	To compare the effects of music therapy versus a quiet, uninterrupted rest period on pain intensity, anxiety, physiological parameters, and opioid consumption after cardiac surgery	Level: I Design: Randomized control trial Setting: Cardiovascular units in 3 different hospitals in the Midwest Participants: 86 patients undergoing cardiac surgery Participant Characteristics: 60 males, 16 females, average age 63 years Inclusion Criteria: Scheduled for non-emergent CAB and/or valve replacement surgeries	Intervention: The study aimed to use music to help achieve a specific change in behavior or feeling. The music played must elicit a relaxing response and include (a) no dramatic changes, (b) consonance, (c) instrumental music, and (d) 60-70 beats per minute. The control group was advised to rest for 20 minutes. The intervention group received a brief script on relaxation given by the research assistant that advised them to clear their minds and allow their muscles to relax, this was followed by a music session of 20 minutes. There were two 20-minute sessions a day, one in the morning and one in the evening. Each participant received three relaxation sessions. Outcome Measures: The study used multiple measures to examine different psychosocial concerns: (a) State Personality Inventory was used as an abbreviated measure to assess anxiety, anger, and curiosity and (b) State Anxiety Inventory to measure anxiety levels. The study also looked at physiological changes in heart rate (HR), blood pressure (BP), and pain	The anxiety levels were significantly lower in the music group ($p < .001$), but there were no differences between groups in regard to systolic BP, diastolic BP, and HR ($p = .17$; $p = .11$; $p = .76$) Furthermore, there was not a difference in opioid use between the two groups.	The limitations of the study included the inability to constantly maintain a quiet environment. This was further complicated by the hospital's protocol of around the clock dosing as a nursing standard.	The results of this study support inclusion of music therapy with a brief relaxation script postoperatively to decrease patient levels of anxiety.

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Rehabilitation Measures Database

Title of Assessment	**Montreal Cognitive Assessment**
Link to instrument	**http://www.mocatest.org**
Purpose	**Rapid screen of cognitive abilities designed to detect mild cognitive dysfunction**
Acronym	**MoCa**
Instrument Reviewer(s)	**Initially reviewed by Karen McCulloch, PT, PhD, NCS and the TBI Edge task force of the Neurology Section of the APTA in 10/2012; Erin Hussey, DPT, MS, NCS and the PD Edge task force of the Neurology Section of the APTA in 2013.**
Summary Date	**16 11 2012**
Description	**16 items and 11 categories to assess multiple cognitive domains (eg, visuo-spatial and executive functions, naming, memory, attention, language, abstraction, orientation).** **◦ Visuospatial / Executive: Alternating trail making, (visuoconstructive skills with cube or other figure, viscuoconstructive skills with clock** **◦ Naming: Animals** **◦ Memory: Introduce word list and delayed recall** **◦ Attention: Forward digit span, backward digit span, vigilance, serial 7's)** **◦ Language: Sentence repetition and verbal fluency** **◦ Abstraction: Recognize similarity** **◦ Orientation** **• Total possible total score = 30** **• Scoring criteria are provided for each category/item. Three different forms of the test are available to reduce likelihood of practice effects** **• Test manual (directions, scoring instructions) and score sheets are available at website www.mocatest.org**
ICF Domain	**Body Structure, Body Function**
Time to Administer	**10 minutes**
Number of Items	**16 items in 11 categories**
Equipment Required	**• Scoresheet** **• Stopwatch** **• Pencil** **• Paper**
Training Required	**Training is provided by reading an article and instructions for the test**
Actual Cost	**Free**
Populations Tested	**• Alzheimer's Disease** **• Brain tumor** **• Dementia** **• Huntington's Disease** **• Parkinson's Disease** **• Stroke** **• Temporal dementia**
Standard Error of Measurement (SEM)	**Not Established**
Minimal Detectable Change (MDC)	**Not Established**
Minimally Clinically Important Difference (MCID)	**Not Established**
Cut-Off Scores	**Cognitive Impairment:** **(Nasreddine et al, 2005)** **• A score of 26 or above is considered normal** **• For individuals with 12 years or fewer of formal education, one point is added to the score as a correction**

Sensitivity and Specificity (%) MoCA and MMSE			
Cut-off	>26	<26	<26
Group (n)	Normal Controls (90)	Mild Cognitive Impairment (94)	Alzheimer's Disease (93)
MoCA	87	90	100
MMSE	100	18	78

Heart Disease:
(Rossetti et al, 2011; *n* = 2653; mean age 50.03, range 18-85; sample from Dallas Heart Study incorporating multiple ethnicities: 25% Caucasian, 52% African-American, 11% Hispanic)

- **Suggests the cut-off score recommended by developers may be too low, since 62% of the sample would be classified with cognitive impairment even with points added based on years of education.**
- **Normative values provided in study may be a better guide for performance especially for different ethnic backgrounds.**

Cognitive Impairment:

(Smith et al, 2007; From a population in a memory clinic: 32 subjects diagnosed with dementia; 23 subjects with mild cognitive impairment; 12 comparison subjects; mean age 73.6 (10) years; mean MMSE score at baseline 27.4 (1.6);mean MoCA score 22.3 (3.6))

	Sensitivity (95% CI)		Specificity (95% CI)	
Test	MMSE	MoCA	MMSE	MoCA
MCI	0.17 (0.08-0.34)	0.83 (0.66-0.92)	1.00 (0.82-1.0)	0.50 (0.29-0.72)
dementia	0.25 (0.15-0.39)	0.94 (0.83-0.98)	1.00 (0.82-1.00)	0.50 (0.29-0.72)

- **The MoCA had better sensitivity (100%) identifying subjects with MCI who were diagnosed with dementia at a six month followup, than the MMSE with sensitivity of 25%.**

Parkinson's Disease:

(Dalyrimple-Alford et al, 2010; *N* = 114 PD and 47 controls; median duration PD motor symptoms 12.5, (1-30) years. 3 groups identified as PD-N (normal cognition, *n* = 72, disease duration 4.6 (3.9), HY stage 1.9 (0.9)], PD-MCI (mild cognitive impairment, *n* = 21, disease duration 7.3 (5.2), Mean HY 2.6 (0.9)]and PD-D [dementia, *n* = 21, disease duration 12.6 (8.1); H&Y stage mean = 3.4 (0.8)].

- **MoCA screening cutoff for PD-MCI < 26/30 (SN 90%, SP 75%; AUC 90%; 95% CI 82-95%, NPV = 92%)**

- **MoCA best at differentiating PD-MCI**
  - **MoCA vs SCOPA-Cog (AUC difference of 12%, *p* < 0.05)**
  - **MoCA vs MMSE-sevens (AUC difference 12%; *p* < 0.05)**
- **MoCA screening cutoff for PD-D = 21/30 (SN 81%, SP 95%, AUC 97%; 95% CI 92-99%, NPV = 95%)**
  - **MoCA vs MMSE-world (AUC difference 10%, *p* < 0.05)**
  - **MoCA, MMSE, and SCOPA-COG, All 3 accurately discriminated for PD-D without statistical distinction on ROC values between measures**

(Hoops et al, 2009; *N* = 132 with idiopathic PD; 75.8% male; 94.7% white; mean age 65.1 (9.7); PD duration 6.5 (5.3); Education level = 16.4 (3.1) years. 30% determined to have cognitive disorder using Dementia criteria: ≥ 1.5 SD below normative mean in at least 2 of 4 cognitive domains, self-report of cognitive dysfunction, and cognition interfering with IADL. PD-Norm (*n* = 92): H&Y stage 1: 50%, 2: 41.3% 3: 7.6% 4: 1.1%; GDS-15 3.0 (3.4), (*n* = 40) PD-MCI and PD-D (*n* = 40): H&Y stage 1 = 17.5%, 2 = 62.5%, 3 = 15.0%, 4 = 2.5%, 5 = 2.5%; GDS-15 score 4.3 (4.0).

- **MoCA cutoff for any cognitive disorder (MCI or D) = 26/30 (sensitivity = 0.90, specificity = 0.53). PPV = 46; NPV = 92, and 64% accuracy.**
- **In comparison, cutoff for MMSE = 29/30 (SN 0.9, SP 0.38), PPV = 0.39 and 54% accuracy**

(Robben et al, 2010; *N* = 41; Young group (< 66, *n* = 22. PDD, *n* = 5, HY stages [%]: 1 = 7, 2 = 12, 3 = 3) Older group (> 65, *n* = 19, PDD *n* = 10; HY stages [%]: 2 = 6, 3 = 6, 4 = 6, 5 = 1). Prospective study; Blinded examiner. Questionnaire, MoCA, FAB, ACE-R)

- **MoCA cutoff for PD-Dementia = 22/30 for the older group. (SN 100%, SP 100%, AUC (95% CI) = 1.0 (1.0-1.0) and 23/30 for PDD young group (SN 80%, SP 88.2%, AUC (95% CI) = 0.81 (0.58-1.0). Scores on MoCA, FAB, and ACE-R significantly lower in PDD young group (MW U: p < 0.05) Scores on MoCA, FAB, and ACE-R significantly lower in PDD older group (MW-U: p < 0.01)**
- **MoCA did not show a false negative result but did take longer to administer (~16 min) than FAB and ACE-R.**
- **Recommended sequence: 1) questionnaire, if positive, follow-up with 2) Screening with MoCA or other screening measure, if positive, followup with 3) full Neuropsychologic Exam assessment battery**

Normative Data

Cognitive Impairment:
(Nasreddine et al, 2005 and mocatest.org website)

MoCA Items Average Scores			
	NC	**MCI**	**AD**
Trails	0.87 (0.34)	0.56 (0.50)	0.27 (0.45)
Cube	0.71 (0.46)	0.46 (0.50)	0.25 (0.43)
Clock	2.65 (0.65)	2.16 (0.82)	1.56 (0.98)
Naming	2.88 (0.36)	2.64 (0.58)	2.19 (0.82)
Memory	3.73 (1.27)	1.17 (1.47)	0.52 (1.03)
Digit Span	1.82 (0.44)	1.83 (0.43)	1.49 (0.62)
Letter A	0.97 (0.18)	0.93 (0.26)	0.67 (0.47)
Serial 7	2.89 (0.41)	2.65 (0.65)	1.82 (1.12)
Sentence Rep	1.83 (0.37)	1.49 (0.71)	1.37 (0.80)
Fluency F	0.87 (0.34)	0.71 (0.45)	0.32 (0.47)
Abstraction	1.83 (0.43)	1.43 (0.68)	0.99 (0.80)
Orientation	5.99 (0.11)	5.52 (0.84)	3.92 (1.73)
Total*	27.37 (2.20)	22.12 (3.11)	16.16 (4.81)
*Total is adjusted for education			

Normative sample:
(Rossetti et al, 2011)

MoCA Score by Age and Education Level								
	Years of Education							
	<12		12		>12		Total by age	
Age group, y	No.	Mean(SD)Median	No	Mean(SD)Median	No	Mean(SD)Median	No	Mean(SD)
<35	20	22.8(3.38)23	65	24.46(3.49)25	122	25.93(2.48)26	207	25.16(3.08)
30-40	37	22.84(3.18)23	106	23.99(2.93)24	264	25.81(2.64)26	408	25.07(2.95)
35-45	55	22.11(3.33)23	177	23.02(3.67)24	355	25.38(3.05)26	588	24.37(3.51)
40-50	77	21.36(3.73)22	227	22.26(3.94)23	418	25.09(3.16)26	723	23.80(3.80)
45-55	77	20.75(3.80)21	216	21.87(3.95)22	461	24.70(3.24)25	755	23.48(3.84)
50-60	62	19.94(4.34)20	172	22.25(3.46)22	424	24.34(3.38)25	659	23.37(3.78)
55-65	60	19.60(4.14)20	143	21.58(3.93)22	369	24.43(3.31)25	573	23.20(3.96)
60-70	57	19.30(3.79)19	113	20.89(4.50)21	246	24.32(3.04)25	418	22.69(4.12)
65-75	38	18.37(3.87)19	67	20.57(4.79)21	122	24.00(3.35)24	228	22.05(4.48)
70-80	14	16.07(3.17)17	23	20.35(4.91)20	42	23.60(3.47)24	79	21.32(4.78)
Total by education	230	20.55(4.04)21	608	22.34(3.97)23	1306	24.81(3.20)25	2148	23.65(3.84)

Parkinson Disease:

(Hoops et al, 2009)

- **PD norm = MoCA score 26.2 (2.9); MMSE score 28.7 (1.5),**
- **PD-MCI and PD-D = MoCA score 22.2 (4.1); MMSE score 26.8 (2.3)**

(Gill et al, 2008; *N* = 38 (17.5% female); mean age = 71.3 (10.5) yrs, Education 14.8 (3.1) yrs, , H&Y stage 2.9 (0.94), Schwab and England 79% (12), Symptom duration 6.6 (5.4) yrs, Geriatric Depression Scale 1.9 (1.3))

- **MoCA displays lower scores across progressive disease stages and wider range of scores than MMSE. Range of scores: 6-28 for MoCA, while MMSE range was 16-30**
- **Mean MoCA score of 23.3 (2.1) was significantly lower than mean MMSE score of 27.4 (1.9) for this group ($p < 0.01$)**
    - **HY Stages 1-2: Mean MoCA = 23.3 (4.1); MMSE = 27.6 (2.5)**
    - **HY stage 3: mean MOCA = 21.2 (4.8) ; MMSE = 26.9 (3.5)**
    - **HY stages 4-5: Mean MoCA = 19.9 (4.3); MMSE = 25.4 (3.0)**

Test-retest Reliability

Older adults with MCI and AD:
(Nasreddine et al, 2005; *n* = 94 with MCI, mean age 75.2 (6.3) years; mean 12.28 (4.3) years of education; *n* = 93 patients with AD, mean age = 76.7 (8.8) years; mean 10.03 (3.8) years of education; *n* = 90 healthy controls; mean age 72.8 (7.0) years; mean 13.3 (3.4) years of education)

- **Excellent test retest reliability (*r* = 0.92) with subgroup of 26 patients with cognitive impairment tested on average 35.0 (17.6) days apart**
- **Mean change in scores = 0.9 ± 2.5 points**

Parkinson's Disease:

(Gill et al, 2008)

- **Excellent test-retest reliability (*n* = 8): ICC = 0.79 (95% CI: 0.36–1.2); Tested on average 133 days apart**

Interrater/Intrarater

Parkinson's Disease:

Reliability	**(Gill et al, 2008)** • **Excellent interrater reliability (*n* = 11): ICC = 0.81 (95%, CI: 0.41–1.2); tested on average 129 days apart**
Internal Consistency	**Older adults with MCI and AD:** **(Nasreddine et al, 2005)** • **Excellent internal consistency (a = 0.83)** **Subacute mild stroke:** **(Toglia et al, 2011; *n* = 72; mean age 70 (17) years; 8.5 days post-stroke with mild neurological (NIHSS 4) and cognitive (MMSE median 25) deficits)** • **Excellent internal consistency (Chronbach's alpha = 0.78)** • **Higher internal consistency than MMSE (a = 0.60)**
Criterion Validity (Predictive/Concurrent)	**Parkinson's Disease:** **(Gill et al, 2008)** • **Excellent correlation with neuropsychologic battery ICC = 0.72 ($p < 0.0001$). Neuropsychology Battery included Hopkins Verbal Learning Test-Revised, the Letter Number Sequencing subtest of the Wechsler Adult Intelligence Scale, the Comalli–Kaplan adaptation of the Stroop, and the Phonemic and Category Verbal Fluency tests** • **Excellent correlation between MMSE and MoCA ICC = 0.66 ($p < 0.0001$)** **Subacute mild stroke:** **(Toglia et al, 2011)** • **Excellent correlation of MoCA with MMSE ($r = 0.79$) and Cognitive FIM scores ($r = 0.67$)** • **Adequate correlation with discharge status ($r = 0.40$), which is higher than MMSE ($r = 0.30$)** • **Stronger relationship of MoCA scores to rate of functional improvement (formula using admission and discharge FIM scores, LOS) than the MMSE** • **MoCA visuoexecutive subscore was strongest predictor of functional status and improvement in FIM scores**
Construct Validity (Convergent/Discriminant)	**Parkinson's Disease:** **(Dalyrimple et al, 2010)** • **Poor correlation with premorbid IQ ($r = 0.19$; $p < 0.05$)** **(Nazem et al, 2009): *N* = 100 with idiopathic PD (70% male, 96% white); Age 65.3 (11.5); Education level 15.7 (3.6) years; disease duration 7.7 (6.4) years; median Hoehn & Yahr stage = 2; mean GDS-15 score 3.4 (3.8) (26% showing clinically sig depression); evaluated "on" medication state; 19% with DBS; intact global cognition (MMSE > 25; in top 75th percentile when adjusted for age & education)** • **Despite normal MMSE scores (> 25), 52% scored positive for cognitive impairment on MoCA (< 26) indicating greater potential sensitivity of MoCA.** • **Association between MoCA and UPDRS (Odds Ratio 1.07 (95% CI = 1.02–1.11) p = 0.006 was determined to be due to the motor items of the MoCA.** • **Regression analysis demonstrated: Poor correlation MoCA (visuospatial and executive subscores) and UPDRS motor score ($r = -0.14$, $p = 0.17$)** **Older adults with MCI and AD:** **(Nasreddine et al, 2005)** • **Total scores and majority of items differentiated between known groups of healthy controls, individuals with MCI and AD** • **All items differentiated between at least two of the groups**
Content Validity	**Not Established**
Face Validity	• **Was developed based on clinical intuition of first author and clinical testing over a five year period prior to validation study in 2005 (Nasreddine et al, 2005)**
Floor/Ceiling Effects	**Parkinson's Disease:** **(Hoops et al, 2009)** • **There was no ceiling effect for MoCA but there was ceiling effect for MMSE. MoCA results involved larger range of scores with 19-point spread (12-30) while the MMSE range was narrower at 9-point spread (22-30)** **(Zadikoff et al, 2008; *N* = 88 (M: 62, F: 26); mean age = 65 +/-10 yrs; mean disease duration 9.5 (5) years; mean UPDRS III 20.7 (11.6); Education level identified for adjustment; Tested "on" med status; Tested using combined version of MoCA and MMSE using cutoff of 26 for each measure)** • **MoCA demonstrated less of a ceiling effect when compared to the MMSE (when controlled for educational level).**

- More subjects scored < 26 on MoCA than on MMSE ($x^2 = 22.5$, $p < 000002$)
- If subject scored > 25 on MoCA, they did not score < 26 on the MMSE.
- In contrast, 36% of those who scored >25 on MMSE had score of <26 on MoCA ($p < 0.0001$)

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Subacute mild stroke:

(Toglia et al, 2011)

- Identified more patients as having cognitive impairment than usual cutoff points for MMSE (89% vs. 63%)
- Attributed to greater ceiling effects with MMSE
- Mean scores for delayed recall, visuoexecutive and verbal fluency were all < 50% of maximum score

Responsiveness

Not Established

Professional Association Recommendations

Recommendations for use of the instrument from the Neurology Section of the American Physical Therapy Association's Multiple Sclerosis Taskforce (MSEDGE), Parkinson's Taskforce (PD EDGE), Spinal Cord Injury Taskforce (PD EDGE), Stroke Taskforce (StrokEDGE), Traumatic Brain Injury Taskforce (TBI EDGE), and Vestibular Taskforce (VEDGE) are listed below. These recommendations were developed by a panel of research and clinical experts using a modified Delphi process.

For detailed information about how recommendations were made, please visit: http://www.neuropt.org/go/healthcare-professionals/neurology-section-outcome-measures-recommendations

Abbreviations:	
HR	Highly Recommend
R	Recommend
LS / UR	Reasonable to use, but limited study in target group / Unable to Recommend
NR	Not Recommended

Recommendations Based on Parkinson Disease Hoehn and Yahr stage:

	I	II	III	IV	V
PD EDGE	*HR*	*HR*	*HR*	*HR*	*LS/UR*

Recommendations based on level of care in which the assessment is taken:

	Acute Care	Inpatient Rehabilitation	Skilled Nursing Facility	Outpatient Rehabilitation	Home Health
TBI EDGE	*NR*	*LS*	*NR*	*LS*	*NR*

Recommendations for use based on ambulatory status after brain injury:

	Completely Independent	Mildly dependant	Moderately Dependant	Severely Dependant
TBI EDGE	*N/A*	*N/A*	*N/A*	*N/A*

Recommendations for entry-level physical therapy education and use in research:

	Students should learn to administer this tool? (Y/N)	Students should be exposed to tool? (Y/N)	Appropriate for use in intervention research studies? (Y/N)	Is additional research warranted for this tool (Y/N)
PD EDGE	*Yes*	*Yes*	*Yes*	*Not reported*
TBI EDGE	*No*	*Yes*	*Yes*	*Not reported*

Considerations

- The MoCA has been extensively used and studied in older adult populations and in PD where cognitive impairment is problematic.
- This review is not exhaustive, but focused on initial development of the measure and its use with persons with stroke to determine possible appropriateness of the measure for use with TBI.
- The MoCA has a greater emphasis on attention and executive function than the MMSE that is commonly used to screen for cognitive impairments.
- For those with mild deficits, the MoCA appears to be more sensitive for those with high premorbid IQ, non-AD dementia and early stages of dementia.
- There are multiple parallel versions of the MoCA, an advantage when it might be used more than once with a partient.
- Chou et al, 2010 reported task force recommendation (based on review of 353 published articles) was to use MoCA over several other cognitive assessment screens (MMSE, MMP, PANDA, and SCOPA-cog) for detection of MCI in those with PD when cognition is not a primary outcome measure

Text

Do you see an error or have a suggestion for this instrument summary? Please e-mail us!

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Link to instrument	http://www.mocatest.org

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Developed by Rehabilitation Institute of Chicago, Center for Rehabilitation Outcomes Research, Northwestern University Feinberg School of Medicine Department of Medical Social Sciences Informatics group.

Rehabilitation Measures Database

Title of Assessment	**Hospital Anxiety and Depression Scale**
Link to instrument	**Available for purchase at MAPI Research Trust**
Purpose	**A two dimension scale developed to identify depression and anxiety among physically ill patients**
Acronym	**HADS**
Instrument Reviewer(s)	**Initially reviewed by Jason Raad, MS and the Rehabilitation Measures Team; Updated with a CHD population by Avani Desai, SPT and Fleur Langner, SPT in 2011**
Summary Date	**26 04 2012**

Description	• The HADS consists of 14 items, divided into two 7 item subscales:
	  ◦ Anxiety (HADS-A); items reflect a state of generalized anxiety
	  ◦ Depression (HADS-D); focus on the concept of anhedonia (Roberts et al, 2001; Flint and Rifat, 2002).
	• The respondent rates each item on a 4-point scale ranging from 0 (absence) to 3 (extreme presence)
	• Items do not assess somatic complaints
	• Five of the 14 items are reverse coded
	• The total score is out of 42, (21 per subscale).
	  ◦ Scores are derived by summing responses for each of the two subscales or for the scale as a whole
	  ◦ Higher scores indicate greater levels of anxiety or depression
	• The total HADS score may be regarded as a global measure of psychological distress (Roberts et al, 2001; Johnston et al, 2000)

ICF Domain	**Body Function**
Time to Administer	**2-6 minutes**
Number of Items	**14-items**
Equipment Required	**None necessary**
Training Required	**None**
Actual Cost	**Contact information and permission to use:** **MAPI Research Trust, Lyon, France:** **Email: PROinformation@mapi-trust.org** **Internet: www.mapi-trust.org**
Populations Tested	**Validated in several patient populations.The HADS was designed for use in a hospital setting, however, research suggests the measure can be used with members of the general public and in general practice (Bjelland et al, 2002)**
Standard Error of Measurement (SEM)	**Coronary Heart Disease: (calculated from Wang, 2009)** • **HADS-A = 1.37** • **HADS-D = 1.44** • **HADS-T=2.05**
Minimal Detectable Change (MDC)	**Coronary Heart Disease: (calculated from Wang, 2009)** • **HADS-A= 3.80** • **HADS-D= 3.99**

- HADS-T= 5.68

Minimally Clinically Important Difference (MCID)

Not Established

Cut-Off Scores

Acute Stroke: (Aben et al, 2002; *n* = 202; mean age = 68.5 (11.6) years; assessed < 1 month post-stroke; Dutch sample)

- ≥ 8 indicates depression (sensitivity: 73.1, specificity: 81.6)

Primary Care Patients: (Wilkinson & Barczak,1988; *n* = 100; mean age = 37.4 (17.4) years)

- ≥ 8 was found to be optimal for detecting DSM-III-defined psychiatric morbidity

Meta-Analysis: (Brennan et al., 2010; n=3244, median=108(69-1078) across 16 studies

- ≥ 8 indicates depression (sensitivity=0.72, specificity=0.86)

Coronary Heart Disease Patients: (Stafford et al, 2007, n=193; mean age = 64.14 (10.37) years)

- 6 indicates depressive disorder; lower cut off score than recommended cut off score to improve test sensitivity while maintaining specificity (sensitivity = 80; specificity=77.8)

Normative Data

Chronic SCI: (Woolrich et al, 2006; *n* = 963; mean age = 48.1 (12.7) years; mean time since injury 19.5 (12.26) years; 65.2% = paraplegic, 34.8% = tetraplegic, 94% used a wheelchair)

Hospital Anxiety and Depression Scale Norms:			
Sample	**HADS-A**	**HADS -D**	**HADS-total**
Total	6.9 (4.2)	5.5 (3.7)	12.3 (7.1)
Male	6.7 (4.2)	5.5 (3.8)	12.1 (7.1)
Female	8.1 (4.2)	5.5 (3.7)	13.2 (7.2)
Tetraplegic	7.0 (4.0)	5.9 (3.5)	12.7 (6.6)
Paraplegic	6.9 (4.3)	5.4 (3.8)	12.1 (7.4)
HADS-A = Hospital Anxiety and Depression Scale anxiety HADS-D = Hospital Anxiety and Depression Scale depression			

Test-retest Reliability

Test-retest reliability: (Herrmann, 1996; meta-analytic results)

- Excellent at 0-2 weeks (n = 79; r = 0.84 - 0.85)
- Adequate to Excellent at >2-6 weeks (n = 111; r = 0.73- 0.76)
- Adequate at >6 weeks (n = 901; r = 0.70)

Coronary Heart Disease:(Wang, 2008; n=173 with coronary heart disease)

- Excellent at 2 weeks (r=0.86-0.90)

Coronary Heart Disease: (Roberts et al, 2001; n=130 people with coronary heart disease)

- Adequate at 8 weeks (r=0.63-0.79)

Interrater/Intrarater Reliability

Not Established

Internal Consistency

Chronic SCI: (Woolrich et al, 2006)

- Excellent Internal consistency HADS-A (Cronbach's alpha = 0.85)
- Adequate Internal consistency HADS-D (Cronbach's alpha = 0.79)

Acute Stroke: (Aben et al, 2002)

- Excellent internal consistency (Cronbach's alpha = 0.85)

Meta-analytic Evidence: (Bjelland et al, 2002; literature review of 747 papers)

- **Adequate to Excellent (0.68 to 0.93)**
- **Adequate to Excellent (0.67 to 0.90)**

Coronary Heart Disease: (Stafford et al, 2007)

- **Excellent internal consistency (Cronbach's alpha = 0.81)**

Criterion Validity (Predictive/Concurrent)

Concurrent Validity: (Bjelland et al, 2002)

Correlations between the HADS and other measures of depression and Anxiety:			
Scale	**HADS-A**	**HADS-D**	**Study**
BDI	.64*	.71*	Lisspers et al, 1997
BDI	.68*	.70*	Savard et al, 1998
BDI	.61*	.73*	Tedman et al, 1997
GHQ-28	.50	.50	Chandarana et al, 1987
CAS	.69*	.44	Snaith & Taylor, 1985
MADRS	.37	.81*	Snaith & Taylor, 1985

BDI = Beck Depression Inventory
GHQ-28 = General Health Questionnaire 28
CAS = Clinical Anxiety Scale
MADRS = Montgomery - Asberg Depression Rating Scale
*indicates excellent correlation

Construct Validity (Convergent/Discriminant)

Acute Stroke: (Aben et al, 2002)

- **Excellent convergent validity (*r* = 0.67) between HADS-A and HADS-D subscales**

Chronic SCI: (Woolrich et al, 2006)

- **Excellent Divergent Validity between the Life Satisfaction Questionnaire (LSQ) and HADS-D (*r* = -0.660)**
- **Adequate Divergent validity between the LSQ and HADS-A (*r* = -0.419) and HADS total score (*r* = -0.585)**

Coronary Heart Disease: (Wang et al, 2009)

- **Factor analysis reveals a three-factor solution (depression, psychic anxiety, and psychomotor anxiety) in CHD patient population**

Content Validity — **Not Established**

Face Validity — **Not Established**

Floor/Ceiling Effects — **Not Established**

Responsiveness

Meta-analytic Evidence: (Bjelland et al, 2002)

- **Scores of 8 on both the HADS-A and HADS-D demonstrated an optimal balance between sensitivity and specificity**

Coronary Heart: (Bambauer et al, 2005)

- **Scores of 8 on the HADS measures showed lower sensitivity and high specificity.**
- **Using a cutoff of 7 (Bambauer et al, 2005) demonstrates a balance between sensitivity and specificity.**
- **Using a cutoff of 6 (Stafford et al, 2007) demonstrates a balance between sensitivity and specificity.**

Professional Association Recommendations

Considerations

- **The GHQ-28 and the GDS were found to be better screening instruments for depression than the HADS-D (Johnson et al, 1995)**
- **Self-assessment scales are only valid for screening purposes**
- **The HADS may perform better in male compared to female acute stroke patients (Aben, 2002)**
- **Cognitive impairments, debilitating comorbid illnesses, and impaired physical states all interfere with the efficiency of the HADS to identify depression and anxiety in a target population (Roberts et al, 2001).**

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Developed by Rehabilitation Institute of Chicago, Center for Rehabilitation Outcomes Research, Northwestern University Feinberg School of Medicine Department of Medical Social Sciences Informatics group.

LITERATURE REVIEW EVIDENCE TABLE

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Aamot, Forbord, Karlsen, & Støylen, 2014.	To determine whether the rating of perceived exertion using the Borg 6-20 scale is a valid method for achieving target exercise intensity during high-intensity interval training in cardiac rehabilitation.	Level: II Design: Non-randomized single-group crossover design. Setting: Outpatient cardiac rehabilitation program at St. Olav's hospital in Norway. Participants: 10 participants, consisting of 9 males and 1 female. Participant Characteristics: The average age was 56.4 years. The average BMI was 26.1. 5 participants had a diagnosis of myocardial infarction, 3 had a CABG, and 2 had stable angina. Inclusion Criteria: Age over 18 years, enrollment in cardiac rehabilitation and ability to perform a symptom - limited cardiopulmonary exercise test (CPET).	Intervention: Participants were enrolled in a high-intensity cardiac rehabilitation program, where high-intensity training was defined as four four-minute rounds of exercise during which the participants achieve 85-95% of the target peak heart rate. The rating of perceived exertion (RPE) and heart rate monitors were used to guide exercise intensity. Sessions took place twice a week over a period of 2 weeks and were performed in groups with guidance from a physiotherapist. Outcome measures: Whether the participants reached the target exercise intensity or not.	When the rating of perceived exertion (RPE) was used as a guide for reaching the target exercise intensity, the target was not reached. Exercise intensity increased significantly when the intensity was also being measured by heart rate monitors. Therefore, the use of RPE on its own is not adequate for exercise prescription in cardiac rehabilitation. RPE should be used in conjunction with heart rate, which is a better objective estimate for determining whether the target intensity has been reached.	The study has a small sample size with only one female participant. This limits the generalizability of the results to the female population however the majority of cardiac patients with cardiac conditions are males. The study population also did not differ greatly in age however the average age of the participants does reflect the average age of patients with cardiac conditions.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Ahlgren, Lundqvvist, Nordlund, Aren, & Rutberg, 2003.	To evaluate neurocognitive function and driving performance after coronary artery bypass grafting (CABG).	Level: II Design: Prospective randomized case control Setting: Hospital Participants: Twenty-seven patients undergoing CABG & twenty patients scheduled for percutaneous coronary intervention (PCI) under local anesthesia (control group). Complete data was obtained in 23 patients undergoing CABG & 19 patients undergoing PCI Participant Characteristics: All participants had their driving licenses for more than 30 years, no participant had a history of alcohol abuse, or a documented neurological or psychiatric or cerebral lesion, in control group one patient had a postoperative stroke. Inclusion Criteria: Not applicable	Intervention: Patients underwent neuropsychological testing, a driving test in a driving simulator, and a on road driving test in real traffic with a certified driving inspector 1-3 days before and 4-6 weeks after the intervention of either PCI or CABG. Outcome measures: Cognition was measured using a neuropsychological test battery consisting of: Trail making part A and B, Rey Complex Figure Test, Rey Auditory Verbal Learning test, total learning, early recall, delayed recall, and recognition. The outcome measures of the Swedish Road and Transport Research Institute (VTI) driving simulator consists of speed, lateral position, reaction time, and collision. On the road evaluation was based on standard procedures used by Swedish Road Administration (SNRA). The outcome measures were speed, maneuvering, lateral position, traffic behavior and attention.	Patients in the CABG group (n=11) showed cognitive decline more than in the PCI control group (n=2). In the on road-driving test, patients undergoing CABG deteriorated after surgery in the cognitive demanding parts like traffic behavior (p=0.01) and attention (p=0.04). Patients undergoing PCI deteriorated in the maneuvering of the vehicle. No deterioration was detected in the simulator in any of the groups after intervention. Patients with cognitive decline after intervention tended to drop in the on road driving scores than did the patients without cognitive decline. The results of this study suggest cognitive impairments are present in patients post CABG that are impacting instrumental activity of daily living (IADLS) such as driving.	One limitation of this study is the small number of patients included. Treatments (CABG or PCI) were not randomly assigned and although care was taken to match the two groups with respect to age, gender, education, and driving experience. More patients in the CABG group had three vessel coronary artery disease but the two groups were similar in respect to risk factors for cerebrovascular disease such as hypertension, diabetes, peripheral vascular disease as well as baseline neurocognitive test score and driving behavior.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Ainsworth et al., 2000.	The purpose was to provide an update to the initial Compendium of Physical Activities, originally published in 1993, to include modifications to the coding scheme that represent different activities and measurements of MET intensities for activities that were only estimated before. Additional categories of common activities done daily were also included.	Level: V Design: Expert opinion Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to the participants. Outcome measures: No outcome measures were specified.	The Compendium of Physical Activities provides the relative MET value of many common activities such bicycling, conditioning exercise, home activities, lawn and garden care, and walking. In this update, religious activities and volunteer activities, two of the most common types of physical activity observed in women over age 40, were the two major headings added to the Compendium. The relative MET values of 129 new activities were also added to the Compendium including carrying groceries, jumping jacks, and building a fence.	A limitation of Compendium of Physical Activities is MET intensities may not precisely estimate the energy cost of physical activity for each individual since MET does not account for differences such as body mass, age, or sex.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Ainsworth et al., 2011.	The purpose of this update of the Compendium of Physical Activities is to further expand the variety of activities included in the coding scheme and update the estimated Metabolic Equivalent of Task (MET) values with measured values.	Level: V Design: Expert opinion Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to the participants. Outcome measures: No outcome measures were specified.	This update to the Compendium of Physical Activities now includes 217 additional codes for various physical activities. This update also modified the estimated MET values to include measured MET values for 68% of the coded activities, contributing to the Compendium becoming more evidence based.	A limitation of Compendium of Physical Activities is that not all of the MET values listed are measured values. Additionally, MET values may not precisely estimate the energy cost of physical activities for each individual since MET does not account for differences such as body mass, age, or sex.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Appleton & Kinsella, 2012.	The purpose was to define ICU-acquired weakness, examine the prevalence and pathophysiology of the condition, and identify how it may be prevented and treated.	Level: V Design: Expert opinion based on clinical evidence. Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to participants. Outcome measures: Not applicable	ICU-acquired weakness is detected weakness in critically ill patients with no specific cause. ICU-acquired weakness can be classified as critical illness polyneuropathy or critical illness neuromyopathy. Approximately 46% of patients with sepsis, organ failure, and on prolonged mechanical ventilation are affected by ICU-acquired weakness. ICU-acquired weakness may be caused by a number of reasons including reduced oxygen and nutrient delivery, impaired mitochondrial oxygen utilization, and reduced muscle membrane excitability. Prevention of ICU-acquired weakness development early rehabilitation is vital.	This was an expert opinion article which defined ICU-acquired weakness. This was not a study therefore no study limitations were specified.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Årgen, Berg, Svedjeholm, & Stromberg, 2015.	To evaluate the effects of an intervention in postop heart failure patient-partner dyads regarding health symptoms of depression and perceived control	Level: I Design: Randomized control trial Setting: Cardiothoracic surgery unit in a university hospital Participants: 42 patient-partner participants groups post-operative cardiac surgery Participant Characteristics: Control group: mean age of patients 70 and mean age of partners was 67, 94% of partners were female; intervention group: mean age of the patients was 69, mean age of partners was 66, 84% of partners were female Inclusion Criteria: Dyad consisting of a patient diagnosed with postoperative heart failure living with a partner in the same household. Patients must be discharged within 2-3 weeks.	Intervention: The patient-partner dyads were randomized into two groups. The control group received standard care as provided by hospital routines. The intervention group received conventional care and psycho educational support from interdisciplinary team. The intervention group received three support sessions between week 4 and 6, week 10 and 12, and week 22 and 24. Outcome measures: The study used multiple measures to examine psychosocial concerns: a) Medical Short Form Health Survey (SF-36) to profile functional health and well-being, b) Beck Depression Inventory to measure the severity of depression, and c) Charlson Comorbidity Index to measure the level of perceived control felt by individuals with cardiac issues.	There was no significant difference between the control group and the intervention group regarding the scores of the SF-36 at three and 12 months. However, there was significant improvement ($p <$ .01) within the intervention group over time. Additionally, the intervention group increased their health at both three and 12 months, whereas the control group only had an increase at three months. There was no significant difference between groups regarding depression. In regards to perceived control, the intervention group significantly improved ($p <$ .05) at both three and 12 months.	The limitations of the study include the small sample size, which may affect the generalizability of the results. Furthermore, the baselines of depression symptoms were different. This potentially contributed to the results not reaching statistical significance.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Asilioglu & Celik, 2004.	Evaluate the effect of preoperative teaching methods on anxiety levels of patients.	Level: II Design: Comparative control trial Setting: Cardiovascular surgery unit Participants: 100 patients undergoing open cardiac surgery Participant Characteristics: Control group: seven females, 43 males; Intervention group: nine females, 41 males Inclusion Criteria: Undergone routine planned open cardiac surgery, read and write in the Turkish language	Intervention: The study aimed to evaluate preoperative education by providing an education booklet to the intervention group to educate them on care before and after surgery. The educational group was educated by the researchers. The control group was only informed about pre-and postoperative routines by a registered nurse. The education was provided before surgery to both groups in a class that lasted 20-30 minutes. Outcome measures: The study used the Self-evaluation State and Trait Anxiety Inventory form to measure anxiety levels.	State and trait anxiety scores were not statistically significant ($p > .05$), however the intervention group that received preoperative education had lower anxiety scores than the control group.	The limitations of the study included the lack of randomization into the two groups. This decreases the generalizability of the study.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Aykut, Albayrak, Guzeloglu, Baysak, & Hazan, 2013.	Aimed to compare the postoperative respiratory complications of patients with preoperative mild cognitive dysfunction with postoperative respiratory complications of patients with normal cognitive dysfunction.	Level: II Design: Prospective cohort control Setting: University hospital Participants: 48 of patients undergoing elective coronary artery bypass graft surgery. Participant Characteristics: Group A: mean age 70 years old; 14 females, 11 males Group B (control): mean age 72 years old, 12 females, 11 males Inclusion Criteria: Patients with a score below 19 points were considered to have severe cognitive impairment as measured by Montreal Cognitive Assessment (MoCA©) were excluded.	Intervention: Investigators separated 48 patients >70 years old who were scheduled for elective coronary artery bypass graft surgery into two groups: patients with preoperative mild cognitive impairment (MCI) (group A, n=25) and patients with no cognitive impairment (control group; group B, n=23). Outcomes measures: The patient's cognitive status was evaluated by the MoCA© and administered by psychologists who were blinded to the rest of the study before the surgery.	The preoperative mean MoCA© scores was 19.25 in group A (indicative of MCI) and 27.16 in group B (p=.036). The rate of postoperative atelectasis detected on postoperative day 3 was 84% in the group with preoperative MCI (group A) and 17% in control group. The difference between the groups was statistically significant (p<.001). The rate of prolonged mechanical ventilation in the first group was determined to be 24%, whereas in the control group it was 0%. The difference between the groups was statistically significant (p< .5). This study shows that mild cognitive impairment was associated with pulmonary complications after CABG suggesting the need to consider MCI prior to CABG to predict the recovery or the need for specialized attention to patients with MCI that may be experiencing pulmonary complications post cardiac surgery. As stated in the article, pulmonary complications after cardiac surgery prolong hospital stays and increase healthcare costs.	The MoCA© was only administered preoperatively which indicates that other factors post CABG might be influencing the risk of pulmonary complications.

Author/ Year	Study Objectives	Level/ Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Bailey et al., 2007.	To determine whether early activity is feasible and safe in respiratory failure patients.	Level: II Design: Prospective cohort study. Participants: 103 patients with respiratory failure that required mechanical ventilation for >4 days prior to being admitted to the 8 bed RICE at LDS hospital. Participant Characteristics: Patients' mean age was 62.5 ∓ 15.5, mean duration of ventilation was 18.7∓ 15.4 days, and mean total length of ICU stay was 22.7∓ 15.9 days. Inclusion Criteria: Patients with respiratory failure who required mechanical ventilation for >4 days	Intervention: Assessed patients for early activity as respiratory ICU care, and prospectively recorded activity events and adverse events. Outcome measures: Activity events were defined as sit on bed, sit on chair, and ambulate. Activity-related adverse events were defined as fall to knees, tube removal, systolic blood pressure >200 mmHg, systolic blood pressure <90 mm Hg, oxygen desaturation <80%, and extubation.	A total of 1,449 activity events occurred, which included 233 (16%) sit on bed, 454 (31%) sit in chair, and 762 (53%) ambulate. In patients with an endotracheal tube in place, there were a total of 593 activity events, of which 249 (42%) were ambulation. Early activity is feasible and safe in respiratory failure patients. A majority of survivors (69%) were able to ambulate >100 feet at RICE discharge. Early activity is a candidate therapy to prevent or treat the neuromuscular complications of critical illness.	Since this study was only conducted on patients with respiratory failure, the results of the study may not be generalized to a wider population of patients with cardiac conditions. However, this study does support the feasibility of early activity within the ICU setting.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Ball, Carrington, & Stewart, 2013.	Examine cognitive function in older hospitalized patients with chronic atrial fibrillation (AF).	Level: I Design: Prospective substudy of a multicenter randomized trial Setting: Three tertiary referral hospitals within Australia Participants: 260 patients Participant Characteristics: Chronic AF; mean age 72 plus or minus 11 years, 53% men Inclusion Criteria: Documented diagnosis of recurrent paroxysmal, persistent or permanent AF, living independently in the community or their own home post hospitalization	Intervention: Cognitive function was assessed at baseline (during inpatient stay) using the MoCA©. Outcome measures: The extent of mild cognitive impairment (MCI- defined as MoCA© score <26) in patients with AF and identification of independent predictors of MCI.	Overall, 169 patients were found to have MCI at baseline (mean MoCA© score 21). Multiple deficits in cognitive domains were identified, most notably in executive functioning, visuospatial abilities, and short term memory. Predictors of MCI were lower education level (including less than 8 years education or trade qualifications) and in those with a higher CHA2ds-VASc score (calculated risk for patients with AF) and prescribed digoxin (slows heart rate in patients with AF). The results of this study support the need to assess cognition using the MoCA© for patients with AF which is a common occurrence following cardiac surgery. AF is believed to be an independent predictor of MCI. Clinicians should be aware of the risk of MCI in patients with AF.	The limitation mentioned was that the investigators applied only one clinical assessment tool to assess cognitive function. More significant psychometric testing is needed to confirm mild cognitive impairment. The decision to use less than 26 as the cut- off score for defining MCI also influences this research, when such a large decrease in the proportion of classified MCI within this population was observed in the sensitivity analysis.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Bjelland, Dahl, Haug, & Neckelmann, 2001.	To review the literature of the validity of the Hospital Anxiety and Depression Scale (HADS) in terms of (a) structure, discriminant validity, and internal consistency, (b) performance as a case finder for anxiety and depression, and (c) concurrent validity.	Level: I Design: Systematic Review Participants: 71 studies that used the HADS Participant Characteristics: Not applicable Inclusion Criteria: The study had to address factor structure, discriminant validity, internal consistency, concurrent validity, and the performance as a case finder for depression and anxiety.	Intervention: The criteria for the systematic review included a search of the Medline, ISIS, and PsycINFO database. The search performed used the terms 'Hospital' and 'Anxiety' and 'Depression' or 'HAD' or 'HADS' in the title. Outcome measures: The study wanted to examine the following factors: factor structure, discriminant validity, concurrent validity, internal consistency, case finder for anxiety disorders and depression.	Factor structure, discriminant validity, internal consistency: The review supports the two-factor structure of HADS. The results on the discriminant validity show both a high Pearson correlation and a low Pearson correlation (ranging from .49 and .74, with an average of .59) A high correlation is hypothesized to be observed due to common causal factors of both depression and anxiety, whereas a low correlation represents good discriminant validity. The internal consistency was fulfilled in all of the studies examined. The HADS-A and HADS-D had an average Chronbach coefficient of .83 and .82 respectively. HADS as a case a finder for anxiety disorders and depression: The HADS as a screening tool to determine prevalence of anxiety and depression demonstrates optimal balance between sensitivity and specificity (.8) with cut off scores of 8+ for both HADS-A and HADS-D. Concurrent validity: Despite its brevity, the HADS demonstrated similar sensitivity and specificity to the General Health Questionnaire, Beck Depression Inventory, Spielberger's State-Trait Anxiety Inventory, Clinical Anxiety Scale, and Symptoms Checklist-90.	The limitation of this study was that many of the studies were from samples of patients with cancer. Furthermore, only three papers used in a general population reported the psychometric properties. This systematic review did not mention if the HADS was used in a cardiac sample.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Borg, 1982.	To address the need for a perceptual effort rating scale to better understand people at work, ratio-scaling, category, and the Borg Scale for ratings of perceived exertion methods were explored.	Level: V Design: Expert opinion Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to participants. Outcome measures: Not applicable	Borg suggested perceived exertion is the best indicator of physical strain as it integrates subjective symptoms with objective findings. In ratio-scaling methods, values of the scale for perceived exertion correlate with approximate heart rates and increase linearly with workload. For example, a perceived exertion of 14 would correlate with a heart rate of 140 beats per minute.	This was an expert opinion article which discussed the use of Borg's Rating of Perceived Exertion Scale as an indicator of physical strain. This was not a study therefore no study limitations were specified.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Bratas, Gronning, & Forbord, 2014.	To compare the psychometric properties between the Hospital Anxiety and Depression Scale (HADS) and the General Health Questionnaire-Version 20 (GHQ-20) in detecting psychological distress in patients with chronic obstructive pulmonary disease (COPD).	Level: IV Design: Case series Setting: 4-week rehabilitation program Participants: 161 patients with mild to very severe COPD Participant Characteristics: 79 males, 82 females, average age of 65 Inclusion Criteria: COPD stages I-IV, patients who wished to participate returned the questionnaire.	Intervention: No intervention was provided to the participants. Outcome measures: The aim of the study was to compare the mean scores of the HADS and GHQ-20 and determine the correlations and internal consistency the two assessments.	The two questionnaires showed no significant difference in mean scores (p = .00). There was also no significant difference in the prevalence of possible cases of psychological distress and cases without any indication of psychological distress (p = .00). Furthermore, the internal consistency between both questionnaires was marginal (Chronbach's alpha coefficients were .91 and .94).	The limitations of the study include a small sample size, thus making the study exploratory in nature. The study also limits generalizability because of the lack of randomization and specific COPD population. Lastly, the lack of a clinical interview decreases the knowledge of the sensitivity and specificity of the two screening tools.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Brocki, Thorup, & Andreasen, 2010.	Identify the mechanical stress factors, which cause sternal instability and infection to create evidence based guidelines for activity following a sternotomy.	Level: V Design : Literature review Setting: Not specified Participants: Search was restricted to the adult population in all five cardiothoracic centers in Denmark. Participant Characteristics: Adult population. Inclusion Criteria: Papers published in English and Scandinavian languages from January 1992 to June 2008. Keywords included "postoperative period, surgical-wound-infection, postoperative-care, postoperative-complications, thoracic-surgery / heart-surgery / sternum-surgery, sternal instability / dehiscence, and mobilization."	Interventions: Database search on information about activity instruction and a review of literature on mechanical stress of the sternal region. Outcome measures: Predisposing conditions, the common mechanical forces that act upon the sternotomy site and skin, and abnormal mechanical stress forces that act upon the sternotomy site and skin. Abnormal mechanical stress forces include frequent coughing, obesity, loaded movements of the arms, skin stress disruption at surgical site, recruitment of abdominal muscles during positional changes.	No evidence was found to support weight limitations regarding activity as long as the upper arms are kept close to the body and the individual is pain-free during the activity. The following sternal precautions are recommended based on the outcomes of this study. Avoid stretching both arms backwards at the same time for at least 10 days following surgery. Loaded activities should be done with the elbows close to the body for at least 8 weeks. Only move arms within pain-free range. Use leg rolling with counter-weighing when doing bed transfers. Cross arms to self-hug during coughing. A supportive bra or vest should be worn by individuals with cup sizes of D or larger, BMI 35 or greater, or by individuals with frequent cough.	A limitation of this study is the low grade of the recommendations. The level of evidence varies from 3B (prospective cohort studies or extrapolations from level 1 studies) to 5 (case studies, expert opinion). This points to a gap in the evidence regarding the issue of sternal complications due to overexertion. Furthermore, how to perform leg rolling is not specified.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Bunzel, Roethy, Znoj, & Laederach-Hofmann, 2007.	To investigate the long-term psychological aftermath of the implantation of a ventricular assist device as bridge to successful heart transplant	Level: II Design: Cross-sectional, retrospective study Setting: Vienna University Heart Transplant Center Participants: 30 patients after cardiac surgery and 21 partners Participant Characteristics: average age 48, 28 males, two females Inclusion Criteria: Patients with highly advanced heart failure, implantation of mechanical circulatory assist device.	Intervention: No intervention was provided to the participants Outcome measures: The study used multiple measures to examine different psychosocial concerns: (a) Impact of Event Scale-Revised (IES-R) to assess severity of Posttraumatic Stress Disorder (PTSD) symptoms, (b) the Hospital Anxiety and Depression Scale to measure the severity of anxiety and depressive symptoms, and (c) Artificial Heart Questionnaire to examine the most pressing fears and complaints during surgery.	Partners displayed significantly higher values in all dimensions of the Impact IES-R ($p < .002$). Partners also showed higher levels of both mild to moderate depression and anxiety symptoms than patients ($p = .005$).	The limitations of the study include that researchers did not evaluate patients at predefined time intervals, therefore they were unable to judge time course for the development of PTSD. Furthermore, they used a self-assessment instead, which is not as accurate as a diagnostic interview.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Byrne, Hills, Hunter, Weinsier, & Schutz, 2005.	The purpose of this study was to investigate the adequacy and limitations of the MET system by measuring resting oxygen consumption (VO_2) and resting energy expenditure of participants to be compared with the standard 1-MET value. Another goal was to explain the cause for variance in resting VO_2 and energy expenditure by examining body size, body composition, age, and gender of participants.	Level: IV Design: Single-subject, exploratory design Setting: Not specified Participants: 593 women and 78 men Participant Characteristics: Generally healthy and 18-74 years old. Inclusion Criteria: Stable weight and no history of anorexia nervosa or bulimia nervosa	Intervention: No intervention was provided to the participants. Outcome measures: Resting VO_2, age, weight, body mass index, skinfold thickness, percent body fat, and fat-free mass.	The average resting VO_2 of the participants was measured to be of 2.56 ± 0.40 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$, 27% lower than the standard 1-MET value. They found resting VO_2 to be significantly related to gender, age, body mass index, percent of body fat, waist circumference, and fat-free mass.	The large disproportion between female and male participants is a limitation to the study. However, the researchers also calculated the average resting VO_2 of 78 men and 78 women of similar age and BMI. The average resting VO_2 of this subsample of participants was 2.59±0.48 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$, similar to the findings from the entire population.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Cahalin, LaPier & Shaw, 2011.	The purpose of this literature review was to assess the available research related to the median sternotomy procedure and the impact of physical activity including (a) complications after cardiac surgery and median sternotomy, (b) symptoms and functional status after cardiac surgery, and (c) the changes in pulmonary function and thoracic motion after cardiac surgery.	Level: V Design : Literature Review Setting : Not specified Participants : Individuals with median sternotomy complications Participant Characteristics: Not specified Inclusion Criteria: Not specified	Intervention: No intervention was provided to the participants. Outcome measures: Median sternotomy complications (sternal instability, dehiscence, mediastinitis, the relationship between activities and sternal complications, strategies to reduce sternal complications, functional consequences and symptom impact of median sternotomy.	At present, the sternal precautions prescribed to patients after a median sternotomy are more restrictive than precautionary. Precautionary sternal precautions would encourage optimal sternal healing and facilitate functional recovery after a median sternotomy. A review of the current literature suggests a change is needed. Progressive rehabilitation can facilitate thoracic motion, pulmonary function, symptoms, and functional status after a median sternotomy as opposed to restrictive precautions that can impede healing. An algorithm was proposed for which allows for less restrictive and more individual recommendations of sternal precautions. Using this algorithm, patients are placed into one of three categories based on risk for sternal complications (low, moderate, high). Each category specifies the type and degree of activity allowable, and also includes the progression of activity based on how well the patient is healing.	The location the literature was obtained from and how the literature was reviewed was not reported. The search strategy was also not discussed.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Cameron, Worrall-Carter, Page, Stewart, & Ski, 2013.	Aimed to compare the Montreal Cognitive Assessment (MoCA)© with the Mini Mental State Exam (MMSE) in screening for mild cognitive impairment in patients with congestive heart failure.	Level: III Design: Cross Sectional Observational Setting: Congestive Heart Failure management program at two metropolitan health networks in Victoria, Australia. Participants: 93 hospitalized patients with congestive heart failure (CHF) without a history of neurocognitive problems living in Australia. Participant Characteristics: Mean age 70, 71% male, 39 were living alone, 77% had not completed more than 12 years of formal education. Inclusion Criteria: Age over 45 years with a diagnosis of CHF, no presence of neurocognitive problems documented in the medical history (CVA, transitional ischemic attack, short term memory loss, confusion, delirium, or dementia), residing in residential nursing home.	Intervention: MMSE and MoCA© were randomly administered to patients with CHF 5 days from hospital admission date. Outcome measure: MCI, Level of MCI agreement (Kappa coefficient) and task errors on assessed cognitive domains.	25 of the participants had scores greater than 26 on the MoCA© and greater than 27 on the MMSE which indicated no mild cognitive impairment. 68 participants were observed to have low scores suggestive of MCI.There were statistically more participants with MoCA© scores less than 26 as compared with MMSE scores less than 27 (71% vs. 32%, p=.02). Of the 66 participants with MoCA© scores less than 26, 38 (41%) had MMSE scores less than 27. Of the 30 participants with MMSE scores less than 27, two participants had MoCA© scores less than 26. The Kappa measure of agreement was 0.25 (p=.001) indicating a significantly low level of agreement between classifying cases as MCI used MoCA© compared with MMSE. The results of this study support that the MoCA© identified clinically relevant cognitive dysfunctions with greater frequency than MMSE. Therefore suggesting that the MoCA© may be a more reliable tool than the MMSE in detecting mild cognitive impairment.	The target population was with patients with congestive heart failure rather than with patients undergoing open heart surgery.

Author/ Year	Study Objectives	Level/ Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Cheraghi, Toulabi, Baharvand, & Farhadi, 2015.	To determine the effect of educational programs and telephone follow-up on the quality of life satisfaction in patients with acute coronary syndrome	Level: I Design: Randomized control trial Setting: Coronary care unit within hospital Participants: 90 patients with acute coronary syndrome Participant Characteristics: 41 males, 49 females, average age 54 years Inclusion Criteria: age limitation between 25-70 years old, hospitalization in cardiac care unit and post cardiac care unit wards, access to telephone, no hearing or speaking problems, able to speak Persian, Lori, or Laki dialect, feeling no pain, not suffering from mental disorder.	Intervention: The study aimed to use education to improve quality of life after staying in the coronary care unit. The participants were randomly assigned to three preoperative preparations. The education program group received educational sessions on the department's facilities, patient's familiarity with the department, care and mental requirements, nature and cause of heart-disease, medicine consumed, treatment process follow-up, nutritional diet, and activity during hospitalization. The education plus phone calls group received the education sessions while in the hospital, as well as phone calls after discharge. The control group did not receive intervention. The education program consisted of three 30-minute sessions during hospitalization. The phone calls consisted of ten phone calls that spanned two months after discharge. Outcome measures: The Quality of Life Questionnaire (QOL) was used to measure the emotional, physical, and social functions of life.	There was a significant difference in quality of life between the two intervention groups that received education and the control group. However, there was no significant difference between the two intervention groups in quality of life. The group who received the phone calls had the highest mean satisfaction after intervention.	The limitations of the study included that some patients did not pose all their problems during education session. Additionally, some patients were lost to follow up because their phone numbers belonged to family members. Lastly, cooperation for filling out the questionnaire was below 100%.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Citerio et al., 2015	The purpose was to define ICU-acquired weakness and examine the pathophysiology of the condition.	Level: V Design: Expert opinion based on clinical evidence Setting: Not specified Participants: Not specified Participant Characteristics: Not specified Inclusion Criteria: Not specified	Intervention: No intervention was provided to participants. Outcome measures: Not applicable	ICU-acquired weakness can be classified as critical illness polyneuropathy or critical illness neuromyopathy. Disuse muscle atrophy and the resulting weakness can lengthen patients' ICU hospital stay and can significantly limit independent participation in basic activities such as bed mobility	This was an expert opinion article which defined ICU-acquired weakness. This was not a study therefore no study limitations were specified.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Considine & Botti, 2004	To review literature pertaining to risk factors for adverse events, to discuss the implications on nursing practice, and to identify the role of nurses in adverse event prevention including physiological assessment and early identification of physiological abnormalities.	Level: V Design: Literature review Setting: Not specified Participants: Not specified Participant Characteristics: Not specified Inclusion Criteria: Not specified	Intervention: No intervention was provided to participants. Outcome measures: Not applicable	Adverse events are complication caused by medical management that result in disability or prolonged hospital stay. Respiratory dysfunction, as measured by respiratory rate, has also been identified as a symptom prior to adverse events such as cardiac arrest. Failure to recognize such physiological abnormalities increase the likelihood of experiencing an adverse event.	This literature review discusses the implications for nursing practice and the role of nurses in preventing adverse medical events. Therefore, it may not be applicable to occupational therapy practice.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Creamer, Bell, & Failla, 2003.	Investigate the psychometric properties of the Impact of Event Scale, Revised (IES-R) in two samples of male Vietnam veterans	Level: IV Design: Case Series Setting: Not applicable Participants: 120 treatment seeking participants with a PTSD diagnosis; 154 participants with varying levels of traumatic stress symptomatology in a community sample Participant Characteristics: Treatment seeking group: average age 49, 75% were married, 17% were employed; community sample: average age 51 years, 83% were married, 48% were employed Inclusion Criteria: Participants who wished to participate returned the questionnaire.	Intervention: No intervention was provided to the participants Outcome measures: The aim of this study was to assess internal consistency for the total scale and all three subscales, correlation between the subscales, confirmatory factor analysis construct validity, concurrent validity, diagnostic validity of the IES-R	The data from the study support the psychometric properties of the IES-R. There was a high internal consistency for the total scale (Cronbach's alpha = .96) as well as the three subscales (intrusion: .94; avoidance: .87; hyperarousal: .91). The IES-R was also significantly and highly correlated well with the PTSD Checklist ($p < .001$; .84). Furthermore, the study determined a cutoff score of 33 for diagnostic power, which provided a sensitivity of .91 and specificity of .82.	The limitations of the study include a specific population of Vietnam veterans creating less differentiation between the core constructs in trauma survivors. This has the potential to impact the generalizability to the general population.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Cunha, Midgley, Montenegro, Oliveira, & Farinatti, 2013.	The goals of this study were to assess the value of one Metabolic Equivalent of Task (MET) in relatively healthy men and compare the results with the generally accepted value of 3.5 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$. The purpose is to determine the extent to which age and anthropometric variables explain the variance in resting VO_2.	Level: IV Design: Single-subject, Exploratory design Setting: Not specified Participants: 125 participants Participant Characteristics: Healthy males with an average age of 22 years old. Inclusion Criteria: Not specified	Intervention: No intervention was provided to the participants. Outcome measures: Participants' maximum oxygen consumption VO_2) and anthropometric variables including age, body weight, body height, and body composition including fat mass, fat-free mass, percent body fat, and bone density.	Of the participants, the average VO_2 was 3.21 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$, with 70% of participant demonstrating resting VO_2·values below the standard 1-MET equivalent of 3.5 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$. There was a significant positive correlation between resting VO_2 and height, body surface area, and fat-free mass.	The fitness levels of participants were not accounted for and varying cardiorespiratory fitness may have affected the results. The study only included male participants therefore the results cannot be generalized to the female population.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Davydow, Zatzick, Hough, & Katon, 2013.	To identify risk factors for PTSD and Depression after medical-surgical ICU admission	Level: III Design: Longitudinal study that took place throughout 3 and 12 months post discharge Setting: ICU within hospital Participants: 120 patients admitted to the ICU Participant Characteristics: Average age of hospitalization was 48.2 years Inclusion Criteria: Not specified	Intervention: No intervention was provided to the participants Outcome measures: The study used the PTSD Checklist-Civilian Version to measure severity of PTSD symptoms and the Patient Health Questionnaire to measure severity of depressive symptoms	At three months, 16% of patients demonstrated PTSD symptoms and 31% had substantial depressive symptoms. After a year, the prevalence of PTSD symptoms decreased to 15% and the prevalence of depressive symptoms decreased to 17%	The study limitations of the study included the inability to assess prolonged delirium. Furthermore, prior traumatic life events, lifetime major depression, and pre ICU substance abuse are subject to recall bias and can contribute to residual confounding factors. The study also used assessments, which cannot replace true diagnoses. Lastly, the results may not be generalizable due to the study only utilizing a single setting.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
El-Ansary, Adams, & Waddington, 2009.	Describe and measure the motion of the sternal edges in a single case with sternal instability following a sternotomy.	Level: V Design: Case report Setting: Australia Participant: 55-year old male. Participant Characteristics: Past history of hypertension, prior myocardial infarction, obesity (BMI=35), and back pain. He had a CABG 5 years prior to the study. During that time he had several syncopal attacks while in the hospital and sustained a fall on his outstretched hands, resulting in sternal instability at one week post-op. Inclusion Criteria: Not applicable	Intervention: Ultrasound imaging in the transverse plane to measure the distance between the two corresponding edges of the sternal halves during a series of three repeated unilateral arm elevation movements: raising right arm three times at a self-selected speed and to a self-selected point in range that the subject determined to be comfortable. Outcome measure: The amount of sternal separation during arm elevation.	Sternal separation was consistently found to occur in the sagittal and transverse planes when the arm was above shoulder level. This confirms the reality of the dynamic instability that exists for patients with sternal instability. The unpredictable and sudden onset of maximal translation/subluxation of the sternal edges observed during upper limb movements may explain some of the pain and discomfort that these patients report during performance of ADLs/IADLs (e.g. reaching up to a shelf, driving, disrupted sleep, etc.).	A limitation of this study is that the ultrasound device was not able to measure motion in the longitudinal axis. The use of a case report design also limits the generalizability of the study to larger populations. Therefore future research on groups of patients is necessary to fully examine the movements of sternal edges.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
El-Ansary, Waddington, & Adams, 2007.	Determine whether trunk stabilization exercises reduce sternal separation and pain; and improve the quality and control of the performance of tasks in individuals with chronic sternal instability.	Level: I Design: Randomized crossover study with concealed allocation and intention-to-treat analysis Setting: Not specified. Participants: Nine participants with chronic sternal instability for 4 years following a median sternotomy for cardiac surgery. Participant Characteristics: Average age of 64 years. Eight males and one female. The majority of participants had a CABG and scored a 3 on the Sternal Instability Scale. Inclusion Criteria: Score of at least 2 (on a scale of 0-3) on the Sternal Instability Scale following physical examination by a cardiac surgeon and a physiotherapist.	Intervention: The experimental intervention included trunk stabilization exercises for 10 minutes twice daily targeting the muscles of the anterior chest wall and abdomen for a 6-week period. Trunk stabilization exercises included the contraction of abdominal muscles in a variety of positions including supine lying on a noodle, side-lying, sitting, sitting with unilateral and bilateral arm elevation, and standing with resisted unilateral and bilateral arm elevation. The control intervention did not include any stabilization exercises for a 6-week period. Outcome measures: Sternal separation measured by ultrasound in mm, pain during the performance of nine everyday tasks measured on a 100-mm visual analog scale (VAS), and quality and control of the performance of two tasks scored on a 100-mm VAS. Control of task performance was rated by therapists who watched video footage of the participants' performance.	Sternal non-union and instability was found to occur in 2-16% of individuals following surgery, and an estimated 42-45% of these individuals report chronic sternal instability. Sternal separation during the period of trunk stabilization exercises decreased more than during the control intervention period. Pain decreased when performing everyday tasks more than during the control period. Task performance during the period of trunk stabilization exercises did not improve more than during the control intervention period. Trunk stabilization exercises should be included in the rehabilitation of individuals who experience sternal instability following cardiac surgery.	This study may be limited by a small sample size and the short duration of the training period. No information was provided on how the participants acquired their sternal instability.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Elliot & Coventry, 2012	To review the five traditional vital signs nurses monitor while patients are receiving critical care which include temperature, pulse, blood pressure, respiratory rate, and oxygen saturation. Additionally, this article recommended monitoring pain, level of consciousness, and urine output.	Level: V Design: Expert opinion with review of literature Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to the participants. Outcome measures: No outcome measures were specified.	Body temperature, pulse, blood pressure, respiratory rate, and oxygen saturation of patients in critical care are regularly monitored. In addition, pain should be monitored via a self report measure so that if pain is present the source may be located and the patient can receive appropriate treatment to minimize suffering. Level of consciousness should be monitored since subtle changes in consciousness may indicate conditions such as hypoxia, hypoglycemia, or side effects to medications. Lastly, urine output should be monitored as it reflects renal function and the patient's level of hydration. It is important that nurses monitor all of these vital signs while patients receive critical care as changes may indicate underlying pathology for which treatment may be provided more quickly.	While it is primarily the role of nurses to monitor the vital signs of patients in critical care, occupational therapists must also be aware of changes in vital signs while working with patients that may indicate physical decline and need to seek additional medical treatment.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Eser, Khorshid, Yapucu Günes, & Demir, 2007.	To test the effects of different body positions on blood pressure readings in Turkish healthy young adults.	Level: III Design: Single cohort, pre-test, re-test, nonrandomized Setting: Ege University School of Nursing, Turkey Participants: 157 students. Participant Characteristics: Healthy females between the ages of 18-24, with no heart disease or use of drugs interfering with the autonomic nervous system. Inclusion Criteria: Not specified	Intervention: BP was measured subsequently in four positions: sitting BP taken from left arm, BP taken after 1 minute of standing, BP taken in the supine position after 1 minute of rest, BP taken in supine with crossed legs Outcome measures: BP changes in the various positions.	Position of the body affects BP readings. Blood pressure was lowest in the standing position compared with the sitting, supine, and supine with crossed legs positions. Systolic and diastolic BP was the highest in supine position when compared with the other positions.	The study was conducted on a young and healthy population and so the results may not be generalizable to the cardiac population.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Fan, 2012.	The purpose of this literature review was to review neuromuscular complications that may result from critical illness and review current literature regarding the benefits, feasibility, and efficacy of interventions such as early mobility in the ICU setting.	Level: V Design: Literature Review Setting: Medical and other ICUs Participants: Individuals with disuse atrophy, critical illness polyneuropathy and myopathy, and ICU-acquired weakness. Participant Characteristics: Not specified Inclusion Criteria: Not specified	Intervention: No intervention was provided to participants. Outcome measures: Not applicable	Disuse atrophy, critical illness polyneuropathy and myopathy, and ICU-acquired weakness are conditions that may arise during critical illness. To prevent and treat ICU-acquired weakness, early rehabilitation and mobilization in the ICU may reduce muscle atrophy and improve muscle strength and physical function.	This literature review included studies about medical and other ICUs, and therefore the results may not specifically be applicable to the cardiac population.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Fletcher, Froelicher, Hartley, Haskell, & Pollock, 1990.	Provide standards and guidelines for exercise testing and training of persons free of clinical manifestations of cardiovascular disease and those with known cardiovascular disease.	LevelUV Design: Expert opinion Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to the participants. Outcome measures: The factors being examined in this article were types of exercise (isometric vs. isotonic), oxygen uptake, response to dynamic exercise, heart rate response, arterial blood pressure response, and hemodynamic responses such as blood pressure or heart rate during exercise.	The article identified the purposes of exercise testing following a myocardial infarction. The risks of serious complications of physical activity are highest during vigorous exercise and in individuals with heart disease. The clinical characteristics and activity guidelines for individuals from low risk to high risk are outlined.	This was an expert opinion that discussed standards and guidelines for exercise testing and training for those with and without cardiovascular disease. This was not a study therefore no study limitations were specified.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Gao et al., 2005.	Purpose of the review is to discuss developments in the pathophysiologic mechanism, prevention, and treatments to ameliorate brain dysfunction after cardiac surgery.	Level: V Design: Review Article Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to the participants. Outcome measures: Not applicable	Postoperative cognitive deterioration is a common and potentially devastating complication. Postoperative cognitive dysfunction affects length of hospital stay, quality of life, the rehabilitation process, and work performance. The review indicates that postoperative cognitive dysfunction is higher after cardiac than noncardiac surgery and that the risk increases with age.	This was a review article that compiled and discussed results of multiple studies. This was not a study therefore no study limitations were specified.

Author/ Year	Study Objective	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Halpin, Speir, CapoBianco, & Barnett, 2002.	To assess the effect of guided imagery versus not guided imagery after cardiac surgery.	Level: II Design: Comparative control trial Setting: Cardiac surgery unit Participants: 789 patients undergoing cardiac surgery Participant Characteristics: Intervention group: 103 males, 31 females, mean age 60; control group: 492 males, 163 females, mean age 62 Inclusion Criteria: Not specified	Intervention: The study aimed to use guided imagery to decrease anxiety and pain in patients post cardiac surgery. The patients were asked to participate in guided imagery; patients who wished to participate were placed in the intervention group. The intervention group listened to imagery tapes and the control group followed the same clinical pathway as the intervention group, without the guided imagery. Guided imagery was incorporated throughout the whole cardiac surgery process. It was implemented (a) the week before surgery 2 times a day, (b) on the day of surgery in the waiting room, (c) during induction of anesthesia, (d) after surgery while being extubated, (e) during times of pain, (f) to help with sleep, and (g) until the follow up appointment. Outcome measures: The Guided Imagery Questionnaire was used to assess anxiety, pain, and satisfaction of guided imagery.	Participant anxiety improved by an average of 41.3% from before implementing the tapes to the follow up appointment. Furthermore, there was a statistically significant shorter length of stay by 1.5 days for participants who used the guided imagery (p = .00).	The limitations of the study included a sample size that was not randomized. This decreases the ability to generalize the findings to the general population. The study also did not use a validated questionnaire, which decreases the scientific rigor of the study.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Harkness, Demers, Heckman,& McKelvie, 2011.	To determine the presence of cognitive impairment in older patients with heart failure using the MoCA©.	Level: IV Design: Cross- sectional descriptive Setting: outpatient heart function clinic at the Hamilton Health Science, Ontario Participants: 44 patients with heart failure who were older than 65 years of age. Participant Characteristics: 55% males, 68% education grade greater than or equal to 12, 68% lived with family or caregiver, 68% organization there own medication, 41% hospitalized in previous 6 months. Inclusion Criteria: no documentation of cognitive impairment, not residing in long term care facility, able to communicate in English, not receiving active treatment for major depression, and passed the visual or Whisper tests.	Intervention: The MoCA© was administered by occupational therapists in a standardized format. Testing lasted approximately 10 minutes per patient. Outcome measures: Descriptive statistics for patient demographic data, medical history, medications, and blood pressure were determined using mean standard deviation for continuous variables and frequency for categorical variables. Comparisons between patients with normal versus abnormal MoCA© scores were conducted using *t* test or Mann-Whitney nonparametric test (Skewed distribution). Statistical tests were 2-sided and a p value less than 0.05 was considered statistically significant.	More than 70% of patients scored below the MoCA© cut-off score of 26 suggesting the presence of mild cognitive impairment. Within this cohort 2 patients scored <19 on the MoCA©. There was no difference between patients with normal versus abnormal MoCA© scores with respect to age, gender, cardiovascular risk factors, blood pressure, or cardiac medications. In the cohort with normal MoCA© scores, only 17% of patients were hospitalized in the previous 6 months, whereas in the cohort with abnormal MoCA© scores 50% were hospitalized in the previous 6 months. Cognitive domains showing significant difference in subscores are short term memory, visuospatial ability, executive function, and language.	The sample size was small because of a short recruitment time. The patients were not formally screened for symptoms of depression even though patients with documented depression were excluded. This study also did not include age- and gender-matched control groups of healthy patients and patients with coronary artery disease without HF. Lastly, it was not clear the reasoning of the participants that were hospitalized in the previous 6 months and that might be a possible contributing factor for MCI.

Author/ Year	Study Objectives	Level/ Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Heidari et al., 2015.	To investigate the effect of music therapy on anxiety and cardiovascular indices in patients undergoing CABG	Level: I Design: Randomized control trial Setting: Cardiovascular surgical intensive care unit Participants: 60 patients hospitalized in the cardiac ICU Participant Characteristics: Intervention group: 15 male, 15 female, mean age 56; control group: 12 male, 18 females, mean age 60 Inclusion Criteria: Orientation to time, place, and person, undergoing coronary artery bypass graft surgery, no hearing impairments, no known anxiety disorder, no history of cardiac surgery, no history of endocrine disorder, no tracheal tube, pacemaker, or intra-aortic balloon pump.	Intervention: The study aimed to use music to impact anxiety. The participants were randomized into two different groups The intervention group received one 30-minute session of light music that included sounds of nature and the control group received one 30-minute period of rest in bed without distractions Outcome measures: The study used physiological parameters to examine heart rate, blood pressure, and mean arterial pressure. To measure anxiety, the visual analogue scale for anxiety was used	All three measurements of anxiety were significantly lower in experimental group ($p <$ .037). Furthermore, the decreasing scores in anxiety trends were significant ($p <$ .001). There was no significant difference in heart rate, diastolic blood pressure, systolic blood pressure, and mean arterial pressure.	One limitations of the study was that physiological parameters were not measured after 30 minutes. This limiting the knowledge of music therapy having a lasting effect on anxiety. Furthermore, people have different preferences of music. Thus, they may not like the music selected or find it relaxing.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Howley, 2000	The purpose of this article was to define Metabolic Equivalent of Task (MET) and explain how the term arose.	Level: V Design: Expert opinion, based on clinical evidence Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to the participants. Outcome measures: No outcome measures were specified.	This article defined MET in terms of oxygen uptake and energy expenditure. This article also explored how the concept of MET first began and pinpointed its origin to be *Physiology of Body Exercise,* a book by Fernand LaGrange published in 1890. MET become a more commonly utilized concept after 1959 when Bruno Balke identified the need for a quantitative method to categorize physical activity during the Colloquium on Exercise and Fitness.	This was an expert opinion that defined MET.This was not a study therefore no study limitations were specified.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Hoyer et al., 2008.	To investigate the degree and course of Heart Focused Anxiety in cardiac diseases before and after cardiac surgery	Level: II Design: Longitudinal case-control at 6 weeks and 6 months Setting: Dresden Heart Center; inpatient rehabilitation unit Participants: 90 patients undergoing elective cardiac surgery; 72 orthopedic participants without heart complications Participant Characteristics: Elective cardiac surgery group: average age was 66.9, 67 males, 23 females, 75% were married. Comparison group: average age was 65.5, 53 males, 19 females Inclusion Criteria: Elective cardiac surgery group: Consecutive patients, before and after elective cardiac surgery, above the age of 18, and spoke German. Comparison group: No history of cardiac disease.	Intervention: No intervention was provided to participants. Outcome measures: The study used multiple measures to assess different psychosocial factors: a) Cardiac Anxiety Questionnaire (CAQ) to measure fear, avoidance, and attention, b) Hospital Anxiety and Depression Scale to measure anxiety and depressive symptoms 3. Medical Short Form Health Survey to measure physical and psychological quality of life	Before surgery, the patients undergoing cardiac surgery scored significantly higher on all three scales of CAQ ($p < .001$). Furthermore, the quality of life score was significantly lower in patients post cardiac surgery ($p < .001$). CAQ scores also were positively correlated with indicators of anxiety and depression. Overtime, there was improvement in functioning. The CAQ-Total Score significantly decreased after six weeks ($p < .001$) and further decreased after six months. The CAQ-Fear score was significantly reduced at six weeks, but no change was observed at 6 months. Lastly, the CAQ-Avoidance score was unchanged at six weeks but declined to presurgery levels at 6 months.	The limitations of the study included not having a waitlist group, making the interpretation of HFA changes and other variables difficult. Additionally, they were unable to conduct a full cardiology and psychological examination.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Jekel et al.,2015.	Aimed to summarize research results regarding the performance of patients with MCI in specific IADL (sub) domains compared with persons who are cognitively normal and/or patients with dementia.	Level: I Design: Systematic review Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: (1) The abstract indicated that the focus of the study was the investigation of IADL in MCI versus healthy controls and/or patients with dementia. (2) General IADL and/or specific subdomains were investigated. (3) The method of IADL assessment was standardized. (4) MCI was defined according to Petersen and/or Winblad criteria (5) No other concepts, such as cognitive impairment, no dementia , aging-associated cognitive decline or age-associated memory impairment, were used. (6) The original article was written in English.	Intervention: The databases PsycINFO, PubMed and Web of Science were searched for relevant literature in December 2013. Publications from 1999 onward were considered for inclusion. Altogether, 497 articles were retrieved. Reference lists of selected articles were searched for potentially relevant articles. After screening the abstracts of these 497 articles, 37 articles were included in this review. Outcome measures: No outcome measures were specified.	In 35 studies, IADL deficits (such as problems with medication intake, telephone use, keeping appointments, finding things at home and using everyday technology) were documented in patients with MCI. Financial capacity in patients with MCI was affected in the majority of studies. Effect sizes for group differences between patients with MCI and healthy controls were predominantly moderate to large. Performance-based instruments showed slight advantages (in terms of effect sizes) in detecting group differences in IADL functioning between patients with MCI, patients with Alzheimer's disease and healthy controls.	Based on the findings, there was no uniform agreement about which IADL domains are specifically or typically impaired in MCI and which types of instruments may be sensitive in detecting those IADL impairments.

Author/ Year	Study Objectives	Level/ Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Jetté, Sidney & Blumchen, 1990	The purpose of this article was to define the Metabolic Equivalent of Task (MET), compare MET and watt values of various household and recreational activities, and to describe the use of METs in physical prescription.	Level: V Design: Expert opinion Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to the participants. Outcome measures: Not outcome measures were specified.	MET is defined as the resting metabolic rate, that is, the amount of oxygen consumed at rest, sitting quietly in a chair, where 1-MET is approximately $3.5mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$ for a 70 kg person. There are three levels of intensity: Light, Moderate, and Heavy. Activities of Light intensity elicit minimal perspiration and only a slight increase in breathing above normal and have an energy expenditure up to 4 METs. Activities of Moderate intensity elicit in definite perspiration and above normal breathing and have an energy expenditure between 5 and 8 METs. Activities of Heavy intensity illicit in heavy perspiration and heavy breathing and have an energy expenditure of 8 METs and above.	Since the value of 1-MET is largely dependent on the individual, including their body mass, sex, and age, it is difficult to apply this estimated value of energy expenditure accurately. For this reason, MET values should be used as a relative guide to identify the energy demands of activities.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Joo et al., 2004.	The goal of this study is to determine the actual exercise intensity, expressed as a percentage of peak oxygen uptake reserve. In cardiac rehabilitation programs, exercise intensity is often set at 20 beats per minute above the standing resting heart rate (RHR+20) or in the range of 11-13 on Borg's Scale for Rating of Perceived Exertion (RPE 11-13).	Level: III Design : Non-randomized, one group Setting: Wake Forest University Participants : Patients (five women, six men) ages 43-63 years who had been referred to the phase II cardiac rehabilitation program. Participant Characteristics: Five women and six men were included in the study. Average age was 53.4 years. Average weight was 167.9 lbs. Of the 11 participants, three were low risk, four were moderate risk, and four were high risk patients. Inclusion Criteria: Not specified. Participants were referred to the phase II cardiac rehabilitation program.	Intervention: A field test consisting of 2 separate parts with a 10 minute rest period in between. Part 1 consisted of participants walking over the ground in the gym at a self-selected effort level that they perceived to be a RPE 11-13, and maintaining that pace for 10 minutes. The rest period consisted of 10 minutes of seated recovery until baseline HR values were achieved. Part 2 consisted of the participants walking with a target intensity of 20 BPM higher than their standing heart rate for 10 minutes (while unaware of their heart rate, which was being monitored by the investigator) Outcome measure: Oxygen uptake reserve values.	Using the RHR+20 guide failed to provide a stimulus exceeding 40% of the VO2R in 4 participants, of which 3 were classified as low risk patients. The RHR+20 technique (which yields a low and presumably safe exercise intensity) may not produce an adequate physiologic stimulus for patients who could and should be exercising at higher intensities. Using the RPE 11-13 was more likely than RHR+20 to yield an exercise intensity between 50%-85% VO2R for patients with cardiac conditions. However, two of the high risk [complex ventricular arrhythmias/angina during baseline testing] patients in this study exceeded 85% VO2R using RPE 11-13 (may be beyond what is safe). This demonstrated how highly variable the RPE scale is, which may place high risk patients at risk for overexertion. In conclusion, RHR+20 would be safer for high risk patients, while the RPE would be more appropriate for low risk patients.	The data from this study does not address the comparison between the two approaches on outcome measures such as blood lipids, functional capacity, or quality of life. On average these participants were overweight or obese and have multiple cardiovascular conditions and other comorbidities, so the results may not be generalizable to the cardiac patient population.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Kalisch, Lee, & Dabney, 2014.	To review current research evidence on the outcomes of mobilizing hospitalized adults.	Level: V Design: Literature review Participants: Hospitalized adults from stroke, surgery, and ICU units in a total of 36 studies. Participant Characteristics: Adult inpatient population in acute care hospital settings. Inclusion Criteria: Studies which were a) empirical research that included a report of outcomes related to inpatient mobilization; b) published in peer-reviewed journals between 1999-2011 for the most current evidence; c) written in English; and d) about the adult inpatient population in acute care hospital settings.	Intervention: N/A Outcome measures: Four themes were identified to examine the effects of inpatient mobilization: physical outcomes (e.g. pain, deep vein thrombosis, fatigue), psychological outcomes (e.g. anxiety, depressive mood, distress, comfort, satisfaction), social outcomes (e.g. quality of life, independence), and organizational outcomes (e.g. length of stay, mortality, cost).	Mobilizing hospitalized adults brings benefits for physical functioning and emotional and social well-being. Ambulation yielded important organizational benefits (length of stay, mortality, cost). In terms of physical outcomes, pain relief was found as the most frequently observed positive outcome of inpatient mobilization. Reduced incidence of new pneumonia, delirium, UTI, and more ventilator free days were observed in patients. Inpatient ambulation was also found to facilitate patient's return to independent walking and improved walking distance. There were positive effects on anxiety, depressive mood, and symptom distress, as well as increased levels of comfort and satisfaction in patients who had cardiac catheterization.	This review includes but is not specific to studies regarding patients post cardiac surgery (also includes patients with stroke, patients post hip surgery, patients with cancer, etc.). There is a wide variety of outcome measures being observed, varied sample sizes among the studies, and possible publication bias. Furthermore, the review examined studies, which only included hospitalized adults from stroke, surgery, or ICU units, which may have created heterogeneity in the sample population.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Kapur et al., 2013.	To investigate the relationship between obesity and hypoxemia in a population based study using the Cardiovascular Health Study.	Level: V Design: Analytic observational cohort study Setting: Coordinating center based in Seattle, Washington. Participants: 2,252 older adults. Participant Characteristics: Aged 65 years and older at baseline exam. Inclusion Criteria: Participants who had participated in the Cardiovascular Health Study and was still living.	Intervention: Measurements of oxygen saturation in the seated position. Outcome measures: Oxygen saturation levels.	Obesity was found to be a major determinant of hypoxemia. It was associated with restricted and impaired ventilation, diminished vital capacity, and reduced total lung capacity. This was due to the mechanical load of adipose tissue, which can reduce chest wall compliance and restrict the movement of the diaphragm. These findings suggest the effects of obesity on gas exchange in adults deserve more attention as a clinical indicator of hypoxemia.	The study did not verify the accuracy of the oxygen saturation measurements using arterial blood gases or a validation instrument. The researchers did not consider the use of medications, which may possible influence oxygen saturation. The data collected did not include measurements in other positions such as lying in supine or during exercise.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Karabulut, Aktaş, Gürçayır, Yılmaz, & Gökmen, 2015.	To determine patient satisfaction with pain management and comfort levels after undergoing open heart surgery.	Level: IV Design: Descriptive study Setting: Cardiovascular surgery clinic of Region Training Research Hospital in Erzurum, Turkey. Participants: 52 patients who had recently undergone open heart surgery. The study included 32 males and 20 females, with a mean age of 58.4 years, ranging from 25-77 years old. Participant Characteristics: 32 males and 20 females of Turkish nationality with a mean age of 58.4 years. Inclusion Criteria: Patients who had undergone open heart surgery in the cardiovascular surgery clinic of the Region Training Research Hospital between January 31 and April 29, 2011. Participants were required to be at least 18 years and older, literate, able to respond to the questionnaire, and provide consent to participate in the study.	Intervention: No intervention was provided to the participants. Outcome measures: Pain management and comfort levels.	Patients had more severe pain on the first day after surgery and at first ambulation, and pain gradually decreased as patients neared hospital discharge. The most commonly used non-pharmacological method was deep breathing exercises with a spirometer applied by the nurse. The study found that while doctors and nurses inquired about pain, no written educational material was provided to the patients about the importance of pain management; stresses the need for pre-operative education.	Limitations of this study include the small sample size and the use of only one cardiovascular surgery clinic, which may limit the generalizability of all patients who have undergone open heart surgery.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Kasper, Talbot, & Gaines, 2002.	The purpose of this article was to review the physiological process of skeletal muscle damage and recovery.	Level: V Design: Expert opinion based on clinical evidence Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to participants. Outcome measures: Not applicable	Disuse muscle atrophy is a common condition that occurs as a result of decline in muscle mass. Just four hours of immobility and disuse can initiate the process of decline in cell diameter, number of muscle fibers, muscle mass, and endurance, particularly in the lower extremities. It is important for critically ill patients to perform low level activity such as transferring out of bed and sitting in a chair several times a day. By participating in low level activity, patients may reduce the effects of disuse muscle atrophy which is essential for recovery.	Disuse muscle atrophy is prevalent in patients with critical illness who are on mechanical ventilation and bed rest for an extended period of time. Disuse muscle atrophy may not be as prevalent in patients post cardiac surgery since patients are not typically on extended ventilation and participate in functional mobility within the day post surgery.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Kelly & Kizhakkemuri, 2012.	Establish a protocol for the physical therapy management of the patient status post radical sternectomy. Determine the appropriateness for further use of the upper extremities in functional mobility	Level: V Design: Case study Setting: Not specified. Participant: 41 year old female admitted to the cardiovascular intensive care unit status post CABG who required a radical sternectomy following a bacterial infection. Participant Characteristics: Not specified. Inclusion Criteria: Not specified.	Intervention: Early intervention physical therapy for supine therapeutic exercises and bed mobility Outcome measures: Chest wall movement (including sheering, torque forces)	The patient had minimal sheering during bilateral weight bearing and more torque forces of the thoracic walls during unilateral weight bearing. Upper extremity weight bearing protocol was set using these observations – 20 lbs of bilateral symmetrical, lifting, pushing, and pulling force. A new and higher limit allowed for the advancement of activity orders to include the use of an assistive device for gait. Within 3 weeks the patient was able to ambulate household distances with a rolling walker with modified independence.	The use of a case study report limits the generalizability of these findings to the cardiac patient population.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Ku, Ku, & Ma, 2002.	To assess the effects of phase I cardiac rehabilitation intervention on anxiety of patients hospitalized for coronary artery bypass graft (CABG) surgery.	Level: I Design: Prospective, quasi-experimental, random assignment with repeated measurements. Setting: The Veterans General Hospital Taipei, Taiwan, Republic of China Participants: 70 patients randomly assigned to one of two groups (experimental and control). 60 subjects were included in the data analyses. Participant Characteristics: The average age of the participants was 68.47 years in the experimental group and 69.03 in the control group. Of the 60 participants, 50 were male. 53 of the participants were married. Only seven participants were employed at the time of the study. Inclusion Criteria: Over the age of 40; able to understand and speak Mandarin and/or Taiwanese; able to read Chinese or have an interpreter.	Intervention: Individual instruction on progressive exercises and daily activities according to the phase I cardiac rehabilitation program during hospitalization. The phase I cardiac rehabilitation program consisted of a manual which included indications and contraindications of cardiac rehabilitation, exercise programs (e.g. passive to active ROM of major muscle groups, deep breathing, stair climbing), and a daily activities program (e.g. sitting, walking, participation in ADLs). Furthermore, the researcher spent 15 minutes each day to discuss with each participant his or her concerns about the surgery and to record their daily exercise and activity level. When necessary, the researcher would then recommend progressive exercises and ADLs. Outcome measures: Psychological status as evaluated by the state of anxiety on the State Trait Anxiety Inventory. Anxiety was measured 3 times: at admission before the patient underwent CABG; the day before the patient underwent the CABG; and the day of discharge from the hospital.	The application of phase I cardiac rehabilitation intervention can reduce the anxiety level during hospitalization of patients undergoing CABG. All subjects (60) experienced moderate levels of anxiety over the complications of CABG and their recovery. The control group did not receive information on cardiac rehabilitation and while their daily exercise and activity levels were recorded, their concerns were not addressed and recommendations for activity progression were not provided. The patients received phase I cardiac rehabilitation experienced lower levels of anxiety both before and after the operation ($p < .001$).	The study used a relatively small sample size which was limited to only patients post CABG. The study also failed to provide details regarding how researchers determined the progression of exercises and activities.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Kun & Xuibin, 2009	Discussion of the details on median sternotomy closures, including the biomechanics, number of wire twists, biomaterial, etc.	Level: V Design: Expert opinion Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to the participants. Outcome measures: Biomechanics, number of wire twists, technique of approximation, materials for sternal fixation, and reconstruction and re-approximation.	Currently there are no alternative materials which are superior to the steel wire used for biomechanical stabilization post-cardiac surgery. The study recommends four peri-sternal single/double steel wires as the most stable for sternal closure.	The strength of the evidence for this study is low.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Lipshutz & Gropper, 2013.	To explore the use of early mobilization in the ICU to prevent ICU acquired weakness.	Level: V Design: Expert opinion with a review Setting: Not applicable Participants: Patients in the ICU. Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to the participants. Outcome measures: The physiological consequences of bedrest, ICU-acquired weakness, and the safety and feasibility of early mobilization in patients with medical and surgical needs.	Neuromuscular weakness is common in the ICU and can persist for years after discharge. Early mobilization is a safe and feasible intervention for critically ill patients and is associated with improved outcomes.	The study needs more data on patients in surgical and ICU trauma units.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
McLennan, Mathias, Brennan, & Stewart, 2010	Aimed to investigate the sensitivity and specificity of the Montreal Cognitive Assessment (MoCA©) for detecting amnestic mild cognitive impairment (MCI) & multiple domain MCI in sample with a high level of cardiovascular pathology.	Level: III Design: Prospective Setting: Recruited from cardiac and diabetic/endocrine outpatient clinics at a large tertiary- referral hospital in South Australia Participants: 110 patients from cardiovascular outpatient clinics Participant Characteristics: over 45 years Inclusion Criteria: Cardiovascular disease or risk factors(smoking, diabetes, hypertension, or dyslipidemia), had no previous diagnosis of dementia, had capacity to provide informed consent, & speak English	Intervention: Participants were interviewed and were assessed with the MoCA© and Neuropsychological Assessment Battery Screening Module (NAB-SM). Outcomes: Sensitivity was defined as the percentage of participants who met the MCI criteria who scored below 26 on MoCA©. Specificity was defined as the percentage of participants who did not meet the criteria for MCI who scored 26 or higher on the MoCA©.	Using the recommended cutoff (<26), the MoCA© detected both Amnestic mild cognitive impaired and Multiple domain cognitive impairment (sensitivity 100%) but failed to screen out 70.8% of the people who were free of amnestic MCI (specificity 29.2%). Results of the average MoCA© performance was relatively low (mean=22.8, SD=3.8) with 72.1% (n=66) of participants scoring below the recommended cutoff for cognitive impairment.	Given that the testing session lasted two hours, people who had poorer cardiovascular health or poorer cognitive function may have been less inclined to participate. The sample size was relatively low and when base rate are low, individual cases can have a large impact on sensitivity/specificity calculations.

Author/Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
McMullan et al., 2013.	Explore the prevalence of injured patients who require prehospital supplemental oxygen based on existing recommendations, and determine whether the actual use exceeds those recommendations.	Level: IV Design: Observational prospective cohort study. Setting: The emergency department of a level I trauma center by a participating EMS agency Participants: 224 patients. Participant Characteristics: Median age was 34 years. 48.7% were non-white. 75.4% were male. Inclusion Criteria: Adults at least 18 years of age with any mechanism of injury or injury severity who were transported to the emergency department of a level I trauma center by a participating EMS agency.	Intervention: No intervention was provided to the participants. Outcome measures: The indication for supplemental oxygen.	Hypoxemia is a peripheral oxygen saturation of less than 90%, which is an indication for supplemental oxygen.	This study focused on civilian trauma patients so the findings may not be applicable to patients undergoing cardiac surgery.

Author/Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Mendes et al., 2010	The purpose of this study was to determine if short term physiotherapy exercise after coronary artery bypass grafting (CABG) during inpatient cardiac rehabilitation would improve cardiac autonomous regulation.	Level: I Design: Randomized control trial Setting: Irmandade Santa Casa de Misericordia Hospital of Araraquara Participants: Forty-seven patients undergoing elective CABG surgery with cardiopulmonary bypass Participant Characteristics: Exercise experimental group: average age 60 years old, 16 males. Usual care control group: average age 58 years old, 20 males Inclusion Criteria: Diagnosed with Coronary Artery Disease and have a clinical indication for CABG	Intervention: The experimental group received a physiotherapy exercise protocol, which consisted of daily progressive exercises from ROM active-assistive movements to climbing flights of stairs, as well as usual physiotherapy care. The control group received only physiotherapy usual care which consisted of consisted of voluntary deep-breathing and coughing exercises. Outcome measures: Cardiac autonomous regulation, including linear and non-linear measures of heart rate variability.	Post-operatively, the experimental group demonstrated higher parasympathetic heart rate variability values, global power, non-linear heart rate variability indexes, and average respiratory rate when compared to the control group (p<.05).	First, the results of this study cannot be generalized to patients post cardiac surgery other than those who underwent a CABG. Second, since patients' left ventricular function was not considered, it is uncertain if there is a discrepancy in improvement after cardiac rehabilitation with different cardiac basal states.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Needham, 2008	The purpose of the article was to review literature related to the epidemiology of neuromuscular dysfunction, its clinical presentation and evaluation, and evidence supporting rehabilitation in the ICU setting.	Level: V Design: Literature review Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to participants Outcome measures: Not applicable	A growing body of literature demonstrates that patients commonly experience neuromuscular complications following critical illness that impair physical functioning and quality of life after discharge. Literature reviewed supports the use of early mobilization during recovery in the ICU to address neuromuscular complications. Research shows that early mobilization improves patient functional mobility, endurance, and muscle strength and shortens ICU and hospital length of stay.	Neuromuscular dysfunction is prevalent in patients with critical illness who are on mechanical ventilation and bed rest for an extended period of time. Neuromuscular dysfunction may not be as prevalent in patients post cardiac surgery since patients are not typically on extended ventilation and participate in functional mobility within the day post surgery.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Newman et al., 2001	Sought to determine the course of cognitive change during five years after CABG and the effect of perioperative decline on long term cognitive function.	Level: III Design: Descriptive Longitudinal Setting: Duke Heart Center Participants: 261 patients undergoing elective coronary artery bypass grafting enrolled, 172 patients who completed follow up, 89 patients who did not complete follow up, & 197 patients who completed follow-up, had a stroke, or died Participant Characteristics: Average age 61, 71% of patients that completed the study were male, 89% were white race Inclusion Criteria: No history of cerebrovascular disease, psychiatric illness, renal disease, active liver disease, higher than 7th grade education, able to read	Intervention: Brief battery of neurocognitive tests was administered before CABG, on the day before discharge (7 days after CABG), six weeks and five years after CABG. Neurocognitive Assessments administered included; Short story module of the Randt Memory test, Digit Span Subtest of the Wechsler Adult Intelligence Scale, Benton Revised Visual Retention Test, Digit Symbol subtest of the Wechsler Adult Intelligence Scale, Trail Making test (Part B) Outcome measures: Factor analysis on baseline scores of the neurocognitive assessments (261 patients).Cognitive decline defined as 1 standard deviation in performance in any one of the four domains	The incidence of cognitive decline was 53 percent at discharge, 36 percent at six weeks, 24 percent at six months, and 42 percent at five years. The results also indicated that patients whose cognitive function decline immediately after surgery (approximately 50 percent of patients undergoing CABG) are at increased risk for long term cognitive decline and reduced level of overall cognitive functioning.	This study lacks generalizability because cognition was measured through the use of assessments. More information is needed to determine the implications of the results on real life occupations. The study is limited by the loss of 89 patients to follow-up that is inevitable in a longitudinal study.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Nordon-Craft, Moss, Quan, & Schenkman, 2012.	To review evidence that guides physical rehabilitation of people with ICU acquired weakness	Level: V Design: Expert opinion with review of literature Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to the participants. Outcome measures: Diagnostic criteria, medical management, prognostic indicators, and criteria for beginning physical rehabilitation.	Physical rehabilitation can be implemented safely in people who have ICU-acquired weakness when appropriate guidelines are followed. The article provides a protocol (flow chart) for determining readiness for physical rehabilitation intervention.	Articles cited in this paper do not specify what conditions the participants with ICU acquired weakness were diagnosed with. It is possible that ICU acquired weakness occurs more frequently among patients with common diagnoses.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Olbrecht et al., 2006	To retrospectively review patients that experienced noninfectious sternal dehiscence after a median sternotomy at The Johns Hopkins Hospital between 1994 and 2004 to identify risk factors for noninfectious sternal dehiscence and long-term functional outcomes of patients that underwent sternal reoperation from noninfectious causes.	Level: III Design: Retrospective review Setting: Johns Hopkins Hospital Participants: 12,380 patients that received a sternotomy prior to cardiac surgery at The Johns Hopkins Hospital between 1994 and 2004. 48 patients required additional surgery to treat noninfectious sternal dehiscence. 156 patients that did not experience noninfectious sternal dehiscence after sternotomy served as a control group for comparison. Participant Characteristics: Of the 48 patients that underwent additional surgery, the mean age was 58.8∓12.8 years and the male to female ratio was 45:3. Inclusion Criteria: Patients that received a sternotomy and experienced noninfectious sternal dehiscence	Intervention: No intervention was provided to the participants. Outcome measures: Diagnosis, demographics, concomitant medical conditions, and surgical outcomes were analyzed. Functional outcomes were assessed using the Short Form-12 questionnaire.	The incidence of noninfectious sternal dehiscence during the 10 year study period was 0.39%. The average age of the 48 patients that experienced noninfectious sternal dehiscence was 58.8, the male to female ratio was 45:3, and the average time between the initial operation and corrective reoperation was 5.4 months. Multivariate analysis identified obesity, chronic obstructive pulmonary disease, New York Heart Association class IV, obesity, and chronic obstructive pulmonary disease as preoperative risk factors for experiencing sternal dehiscence post cardiac surgery. Of the patients who underwent surgical correction to treat noninfectious sternal dehiscence, 72.2% of patients experienced no or mild limitation in physical activities and 90.5% of patients reported no or mild sternal pain at follow-up while 19% of patients continued to experience long term complications even after corrective surgery.	Since noninfectious sternal dehiscence is a rare complication after cardiac surgery, the sample size for this study was small. The results of the postoperative functional outcomes may be subjective since the Short Form-12 questionnaire is based on patient self reports.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Page, Hooke, & Morrison, 2007	The psychometric properties of Depression Anxiety Stress Scales (DASS) were examined in depressed psychiatric hospital samples.	Level: V Design: Literature review Setting: Hospital STUDY 1: Participants: 124 in-patients and day-patients with a primary diagnosis of a depressive disorder Participant Characteristics: 85 females, 39 males, average age 41 years Inclusion Criteria: Not specified STUDY 2: Participants: 816 in-patients with a diagnosis consistent with a mood disorder Participant Characteristics: 598 females, 218 males, average age 41 years Inclusion Criteria: Not specified STUDY 3: Participants: 501 in-patients with a diagnosis consistent of a mood disorder Participant Characteristics: 355 females, 146 males, average age 41 years Inclusion Criteria: Not specified	Intervention: No intervention was provided to the participants STUDY 1: Outcome measures: The study used multiple measures to examine different psychosocial concerns: (a) Depression, Anxiety, and Stress Scale to measure the level of depression, anxiety, and stress, (b) Beck Depression Inventory (BDI) to measure level of depression, and (c) The Locus of Control of Behavior Scale to assess control over themselves and their lives Rosenberg Self-Esteem Scale measured attitudes towards oneself STUDY 2: Outcome measures: The study used the Depression, Anxiety, and Stress Scale to measure the level of depression, anxiety, and stress STUDY 3: Outcome measures: The study used the Depression, Anxiety, and Stress Scale to measure the level of depression, anxiety, and stress with an expanded scale from 0-3 to 0-4	STUDY 1: The DASS demonstrated excellent internal consistency (Chronbach alpha = .97) and had higher reports of scores indicative of depression and anxiety when compared to other measures. However the DASS demonstrated ceiling effects, which decreases discrimination in upper ranges of depressive symptoms. The BDI demonstrated a larger effect size and was more sensitive to change than the DASS. STUDY 2 and STUDY 3: The DASS demonstrated internal consistency but demonstrated ceiling effects for the depression scale (Chronbach alpha = .96).	STUDY 1: The limitations of the study included a bias in discharge measure because those not discharged may have more severe symptoms. STUDY 2 and STUDY 3: The limitation of the study included a clinical context where levels of depression were high.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Paparrigopoulos et al.s, 2013	To investigate the long-term psychological impact of intensive care unit (ICU) hospitalization, as well as to establish risk factors which successfully discriminate patients at higher risk.	Level: Level III Design: Longitudinal study Setting: ICU of a general hospital Participants: 48 patients admitted to the ICU for at least 24 hours Participant Characteristics: 33 males and 15 females; 50% were married, while 33% were single, and 17% were divorced or widowed Inclusion Criteria: ICU admittance for at least 24 hours	Intervention: No intervention was provided to the participants Outcome measures: The study used multiple measures to assess different psychosocial factors: a) Medical Outcomes Study Short Form Survey to measure physical and mental health, b) the Center for Epidemiological Studies Depression (CED-D) to measure depression, and c) the Davidson Trauma Scale (DTS) to measure PTSD	The results of the study revealed an average ICU duration of 13 +/- 3 days. Depression was found in 31% of sample, while 25% of the sample alluded to presence of PTSD symptoms. Additionally, there was a high comorbidity was observed between depression and PTSD. The DTS scores demonstrated a strong correlated with traumatic events during adulthood, previous psychiatric morbidity, and stressful life events. The CES-D scores were strongly correlated with positive psychiatric history.	The study limitations included a relatively low response rate, creating a small sample size. This impacts the generalizability of the study. Additionally, the pre-ICU patient-related risk factors were self-reported creating a personal bias to the results. The study used assessments instead of a psychiatric interview, thus potentially creating more false positives. Lastly, the snapshot design does not account for variability in symptoms

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Pirraglia, Peterson, Williams-Russo, Gorkin, & Charlson, 1999	To assess the relationship of preoperative characteristics, life stressors, social support, major cardiac and neurologic outcomes, and other complications	Level: III Design: Longitudinal study with a pretest and posttest at six months after surgery Setting: Hospital Participants: 218 subjects undergoing CABG surgery Participant Characteristics: Not specified Inclusion Criteria: Participating in a prospective randomized trial, fluent in English, lack of a disability that would prevent them from completing questionnaires, exclusively participating in the present trial.	Intervention: No intervention was provided to the participants Outcome measures: The study used multiple measures to different psychosocial factors: a) the Center for Epidemiological Studies Depression Scale to assess depression symptomatology, b) any stressful life events documented through five questions to measure incidence and impact on patients, and c) perceived social support that was evaluation emotional support, having someone to share joys and sorrows with, and someone who cares about their feelings.	The results of the study demonstrated a 43.1 % prevalence of depression before surgery, which decreased to 23.4% at six months. Of the prevalence after six months, 17.9% the continue experiencing symptoms of depression and 5.5% developed new depressive symptoms. The study also indicated that postoperative depression was correlated with a longer length of stay. Additionally, postoperative depression was correlated with patient's' perception of little or no available help.	The limitations of the study included using an assessment instead of clinically evaluating the participants. Additionally, the self-report nature of the outcome measures can create biased results. Lastly, the study had a lack of statistical power to report negative results.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Preston & Flynn, 2010	To explore patient safety through a review of nursing knowledge, skills, and practices of recording observations in acute clinical settings. Explore what nurses need to know about physiological compensatory mechanisms in order to facilitate accurate detection and reporting of clinical deterioration in acute care.	Level: V Design: Expert opinion and review. Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Intervention: No intervention was provided to the participants. Outcome measures: Respiratory rate as a clinical indicator.	Respiratory rate was identified as a sensitive clinical indicator of clinical deterioration in patients. Based on the results of this study, it is recommended that nurses regularly updated to develop accurate acute illness assessment skills to identify patients at risk of an adverse clinical event.	This study focuses on the development of clinical assessment skills in nursing staff, which may not necessarily be applicable to occupational therapy practice. Furthermore, this article was not specific to the cardiac population.

Author/ Year	Study Objectives	Level/ Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Rosengart et al., 2005	Aimed to identify cognitive deficits in patients were preexistent before CABG or relates to the natural history of cognitive decline within this population.	Level: II Design: Prospective case control Setting: Not specified Participants: Percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG) (n= 82) & age-education matched control group that did not have coronary artery disease (n=41) Participant characteristics: Mean age of Control: 65, Mean age of PCI: 66, Mean age of CABG 66, 43% female in control group, 19% PCI, 18 % CABG, 36% of control group had a college degree, 38% of PCI group had a college degree, 29% of CABG group had a college degree Inclusion Criteria: no history of stroke or symptomatic carotid artery disease, dementia, substance abuse, renal dysfunction or hepatic dysfunction, language or physical deficiency not allowing test completion, score below 24 on MMSE	Intervention: CABG, PCI, and control patients underwent neurocognitive testing & a set of self-report questionnaires. The neurocognitive test battery was administered by experienced psychometricians. Outcome measures: The following domains were identified; immediate attention span: digit span forward; working memory: digit span backward; psychomotor speed: digit symbol from Wechsler Adult Intelligence Scale, Trail Making A& B, Stroop color word test; language: controlled oral word association & visual naming of the multilingual aphasia examination; verbal learning and memory: Hopkins Verbal learning test; nonverbal memory: digit symbol recall from the Wechsler Adult Intelligence Scale.	Test score means for 5 of 14 different measures were significantly greater (more impaired) in cardiac participants (PCI/ CABG) compared with control group subjects at baseline. These five measures included; Wechsler Adult Intelligence Scale, digit symbol (nonverbal memory deficit), the three components of the Hopkins Verbal Learning Test (verbal learning & memory deficit) and controlled oral word association(verbal fluency) component of the Multilingual Aphasia Examination.	One limitation mentioned by the researchers was that the control group was not matched for sex.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Savage, Toth, & Ades, 2007	The purpose of this study was to compare the generally accepted value of one Metabolic Equivalent of Task (MET) with the measured resting metabolic rate (RMR) of a group of participants with coronary heart disease (CHD).	Level: IV Design: Single-subject, exploratory design Setting: Not specified Participants: 109 participants, 60 men and 49 women, diagnosed with CHD for more than 6 months participated in this study. The average age was 66 years old and the average body mass index was 31.8 kg/m^2. Inclusion Criteria: Documented CHD for more than 6 months, body mass index ≥25 kg/m^2, nonsmoking and stable in weight and clinically	Intervention: No intervention was provided to the participants. Outcome measures: Participants' RMR, body weight, body height, and body composition including fat mass, fat free mass, percent body fat, and bone density.	Of the participants, the average value for 1-MET was 2.58 ± 0.4 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$, which is 23% to 36% lower than the standard 1-MET value of 3.5 $mL \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$. Fat free mass, age, and gender have the largest influence on RMR variance. Since the value of MET is significantly influenced by individual characteristics, the researchers noted that MET values should serve as a general guide to identify the energy demands of various activities.	A control group was not used in this study. The dosage and type of Beta-blocker therapy was not standard among the participants which may have impacted the study results. Since participants were overweight individuals with CHD, the results of the study cannot be generalized to healthy populations or those with other conditions.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Scherr et al., 2013.	The purpose of this study was to evaluate the validity of Borg's RPE scale by examining the association between Borg's RPE and physiological exercise parameters in a very large population.	Level: II Design: Cohort study Setting: Not specified. Participants: 2,560 Caucasian men and women Participant Characteristics: 1,796 male and 764 female; age range between 13-83 years, median age 28 years. Inclusion Criteria: Participants were referred to outpatient cardiovascular screening, including exercise testing and risk factor modification between 2005-2010.	Intervention: Incremental exercise tests on treadmills or cycle ergometers. Outcome measures: Heart rate, blood lactate concentration, and RPE (Borg scale 6-20) were measured at the end of each work load.	RPE was strongly correlated with heart rate and blood lactate, which indicates a high precision of the predictive value of exercise intensity using RPE. Borg's RPE appears to be a valid tool for monitoring and prescribing exercise intensity, independent of gender, age and exercise modality, physical activity level, and coronary artery disease (CAD) status. The researchers concluded exercising at an RPE of 11-13 ("low") may be recommended for less trained individuals, and an RPE of 13-15 may be recommended when more intense but still aerobic training is desired.	Nearly half of the participants included in this study were physically active more than 10 hours per week, and the median age of this cohort was relatively low. Therefore, the findings of this study may not be applicable to an older population that is less physically fit.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Sendelback, Halm, Doran, Miller, & Gaillard, 2006.	To compare the effects of music therapy versus a quiet, uninterrupted rest period on pain intensity, anxiety, physiological parameters, and opioid consumption after cardiac surgery	Level: I Design: Randomized control trial Setting: Cardiovascular units in 3 different hospitals in the Midwest Participants: 86 patients undergoing cardiac surgery Participant Characteristics: 60 males, 16 females, average age 63 years Inclusion Criteria: Scheduled for non-emergent CABG and/or valve replacement surgeries	Intervention: The study aimed to use music to help achieve a specific change in behavior or feeling. The music played must elicit a relaxing response and include (a) no dramatic changes, (b) consonance, (c) instrumental music, and (d) 60-70 beats per minute. The control group was advised to rest for 20 minutes. The intervention group received a brief script on relaxation given by the research assistant that advised them to clear their minds and allow their muscles to relax; this was followed by a music session of 20 minutes. There were two 20-minute sessions a day, one in the morning and one in the evening. Each participant received three relaxation sessions. Outcome measures: The study used multiple measures to examine different psychosocial concerns: (a) State Personality Inventory was used as an abbreviated measure to assess anxiety, anger, and curiosity and (b) State Anxiety Inventory to measure anxiety levels. The study also looked at physiological changes in heart rate (HR), blood pressure (BP), and pain.	The anxiety levels were significantly lower in the music group ($p < .001$), but there were no differences between groups in regard to systolic BP, diastolic BP, and HR ($p = .17$; $p = .11$; $p = .76$) Furthermore, there was not a difference in opioid use between the two groups.	The limitations of the study included the inability to constantly maintain a quiet environment. This was further complicated by the hospital's protocol of around the clock dosing as a nursing standard.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Sethares, Chin, & Costa, 2013.	Describe pain intensity, interference, and strategies used to manage pain in patients post CABG. Effective pain management is important in order to optimize physiological and psychological conditions for a successful recovery. Gain a greater understanding of the patient's pain experience and pain management strategies in order to develop interventions for controlling post-op pain in the recovery period.	Level: IV Design: Longitudinal, exploratory, descriptive study. Setting: Participants were recruited from a 40 bed step-down cardiac surgical unit in a community hospital in the Northeastern United States Participants: 80 older adults. Participant Characteristics: The majority of the participants was Caucasian and married. The mean length of time with cardiac disease ranged from 4 ± 8.4 years. The mean length of hospital stay was 4.2 ± 2.1 days. Inclusion Criteria: Participants were required to: a) be cognitively intact as assessed by research staff; b) be able to speak, read, and write in English; c) have underwent CABG surgery within 5 days of initial interview.	Interventions: The Modified Brief Pain Inventory was used to determine the level of pain intensity and extent of pain interference during participation in ADLs. Data collected included pain intensity, interference with activities, as well as sites and strategies used to manage pain in patients post CABG. Outcome measures: Pain intensity, interference with activities, sites and strategies used to manage pain in patients post CABG.	Pain levels and interference with ADLs were greatest during hospitalization and decreased over 12 weeks. Pain interfered the most with coughing and sleep. Activity modification below recommended levels was reported as a pain management strategy. Patients reported pain lasting longer than they expected and the need for more education about activity and pain management strategies. Patient education about recovery expectations and strategies to manage post-op pain are critical to preventing the development of chronic pain. The results of this study show there is a need for additional patient education regarding activity and pain management strategies. It is within the scope of occupational therapy practice to provide this information to benefit patients' recovery.	A number of patients in this study used pain medication such as opioids to manage pain and assist with sleep. The number of patients taking pain medication was reported, but the frequency with which these medications were taken was not reported. This may affect reports of pain control, as a patient who takes opioids once a day may be reporting more pain than a patient who takes opioids several times a day.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Shen & Zipes, 2014	Explore the role of the cardiac autonomic system and its influence on cardiac electrophysiology, including atrial fibrillation and ventricular arrhythmias..	Level: V Design: Expert opinion Setting: Not applicable Participants: Not applicable Participant Characteristics: Not applicable Inclusion Criteria: Not applicable	Interventions: No intervention was provided to the participants. Outcome measures: Various cardiac arrhythmias.	Autonomic activation can influence heart rate, conduction, and hemodynamics. Heart rate variability analysis is a safe method for studying cardiac autonomic activity.	The study does not address the role of the cardiac autonomic nervous system and cardiac arrhythmias in individuals who have undergone cardiac surgery.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Stoll et al., 2000	To investigate the occurrence of PTSD in a sample of patients after cardiac surgery and compare health-related quality of life and patient satisfaction between patients with and without evidence of PTSD	Level: II Design: Longitudinal comparative cohort study Setting: Department of Cardiac Surgery at the Ludwig-Maximilians University in Munich Participants: 80 participants admitted to the ICU after cardiac surgery; 51 undergoing CABG and 29 undergoing AVR Participant Characteristics: In the CABG group, there were 45 males and 6 females with an average age of 66 years. In the AVR group, there were 19 males and 10 females with an average age of 61.5 years. Inclusion Criteria: Patients who underwent CABG or AVR and were older than 16.	Intervention: No intervention was provided to the participants Outcome measures: The study used multiple measures to examine different psychosocial factors: a) the Medical Outcomes Study Short Forms 36 (SF-36) to measure health related quality of life, b) the Post-Traumatic Stress Syndrome 10-Questions Inventory to measure PTSD symptoms, and c) a patient satisfaction questionnaire to measure different levels of satisfaction of daily life	The results of the study yielded that there was no significant difference between patients post CABG and AVR. When comparing patients post cardiac surgery to patients post maxillofacial surgery, patients post cardiac surgery showed significantly higher PTSD scores ($p < .05$). Furthermore, patients that demonstrated evidence of PTSD symptoms reported significantly lower SF-36 scores ($p = .002$ and significantly lower satisfaction ($p < .001$)	The two major limitations of the study were the used of assessments instead of a diagnostic interview, creating the possibility of false positives. The small sample size makes the results harder to generalize to the population.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Storm-Versloot et al., 2014.	To explore the clinical significance of routinely measured vital signs in medically and surgically hospitalized patients in a systematic review.	Level: I Design: Systematic review Setting: Not applicable Participants: 42,565 participants total. Participant Characteristics: Medical, surgical, and combined patient populations at least 18 years of age in general hospital wards. Inclusion Criteria: Studies measuring vital signs (temperature, heart rate, blood pressure, oxygen saturation, and respiratory rate) on a routine basis.	Intervention: The researchers performed a three-phase selection process through electronic databases MEDLINE, Embase, CENTRAL, Cumulative Index to Nursing and Allied Health Literature, and MEDION. Outcome measures: The relationship between vital signs and adverse events of interest such as mortality, septic/circulatory shock, admission to the ICU, bleeding, re-operation, or infection.	The results revealed an association between vital signs and adverse medical events. Mortality was most commonly associated with changes in blood pressure or oxygen saturation. ICU admission was most commonly associated with changes in heart rate, blood pressure, or respiratory rate. Infection and septic shock were most commonly associated with abnormal body temperature.	Some of the studies included in the systematic review have methodological flaws (e.g. the inclusion of some high-risk populations, such as individuals with pneumonia). Inclusion criteria were surgical and medical patients admitted to general hospital wards. Patients admitted to specialized wards, such as the ICU and cardiac care unit, were excluded, so the results may not be applicable to this project.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Sturgess, Denehy, Tully, & El-Ansary, 2014.	To investigate whether thoracic exercises result in improved pain, range of movement, and health-related quality of life (HRQOL) following open heart surgery (OHS), and to evaluate patient perception of the role of thoracic exercises in recovery.	Level : I Design: Assessor blinded parallel group, randomized pilot trial. Setting: Tertiary public hospital in Australia. Subjects : 38 subjects allocated to either the experimental group (Group 1, n=23) or the control group (Group 2, n=15) Participant Characteristics: Average age was 63 years in Group 1 (experimental) and 59 in Group 2 (control). The majority of the participants were male (73.9% and 93.3%, respectively). Of the participants who had a CABG, 17 were in Group 1 and 14 were in Group 2. Inclusion Criteria: All patients who were scheduled for open heart surgery. Inclusion criteria was extended to include patients from a co-located private hospital due to slow recruitment.	Intervention: Both the control and experimental groups were prescribed a twice daily walking program. A progressive thoracic exercises program was also prescribed to the experimental group. The five thoracic exercises included resting sagittal thoracic posture, thoracic extension, shoulder flexion, trunk lateral flexion, and trunk rotation. The program was individually tailored to each patient by modifying exercises and/or the number of repetitions based on patient response, including quality and ease of movement, fatigue, and pain. Outcome measures : Measurements of shoulder and thoracic ROM, pain, and HRQOL taken at 3 times - preoperatively, 4 weeks following discharge, and 3 months post-operatively.	Thoracic exercises following open heart surgery (OHS) may be effective in reducing sternal pain. The reduction in sternal pain (0-6 weeks) for participants in the experimental group was statistically and clinically significant (p=0.03). Thoracic exercises may reduce post-operative pain by improving neuromuscular control and muscular activation patterns of the anterior thoracic cage and the abdominal muscles which can be inhibited in the presence of pain following OHS. Results indicate that patients undergoing OHS should routinely complete a post-operative thoracic exercise program as it positively impacts pain 4 weeks following discharge, and may facilitate patients to resume participation in life roles and occupations.	This study may be limited by a small sample size. No significant differences were noted between the control group and the experimental group with regards to shoulder and thoracic ROM and HRQOL.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Tully, Baker, Turnbull, & Winefield, 2008.	To determine the association between depression, anxiety, and general stress symptoms with hospital readmission after CABG	Level: Level III Design: Longitudinal study with a pretest and posttest design and follow up after six months. Setting: Flinders Medical Centre in South Australia Participants: 222 subjects undergoing first time CABG surgery Participant Characteristics: 184 males and 38 females with an average age of 63 years Inclusion Criteria: Age greater than 18, isolated CABG procedure with cardiopulmonary bypass, able to provide informed consent	Intervention: No intervention was provided to the participants Outcome measures: The study used the Depression Anxiety Stress Scale to measure depression, anxiety, and stress. To measure unplanned readmission, it used readmission outcomes.	The results of the study demonstrated that patients who had subsequent readmission had higher preoperative anxiety and postoperative depression scores when compared to patients who were not readmitted. Before surgery, there was a 20.1% prevalence of depression, which increased to 23.5% after surgery. Baseline anxiety scores increased from 31.4% before surgery to 45.5% after surgery. Stress levels decreased from 21.7% before surgery to 19.4% after surgery. Lastly, there was a 32% readmission rate with preoperative anxiety being associated with a 12% increase.	The limitations of the study include using the DASS as the primary outcome measure. The DASs may not capture all symptomology and did not measure symptoms of anger and hostility. Furthermore, the study did not gather information on non-pharmacological treatments such as seeing a psychologist or psychiatrist. Lastly, the study excluded patients with dementia and those undergoing emergency surgery, which decreases the generalizability to higher risk populations.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Tully et al., 2010.	To determine whether preoperative and postoperative anxiety, depression, and stress symptoms were associated with atrial fibrillation after cardiac surgery.	Level: Level III Design: Longitudinal study with a pretest and posttest design Setting: Flinders Medical Centre in South Australia Participants: 222 subjects undergoing first time CABG surgery Participant Characteristics: 184 males and 38 females with an average age of 63 years Inclusion Criteria: Age greater than 18, isolated CABG procedure with cardiopulmonary bypass, able to provide informed consent	Intervention: No intervention was provided to the participants Outcome measures: The study used an ambulatory electrocardiography to measure the incidence of atrial fibrillation, a transthoracic echocardiograph to measure the incidence of atrial fibrillation, and the Depression Anxiety Stress Scale (DASS) to measure depression, anxiety, and general stress	The results of the study identified that 24% of the patients were manifesting postoperative AF. Furthermore, on average, patients with AF spent more days in the hospital than patients without AF. The study also demonstrated an association between anxiety and AF. Anxiety elicits autonomic arousal, which increased the risk of AF. However, the study did show that no significant psychological variables were significantly associated with AF.	The limitations of the study included only postoperative measurement of AF. This prevents documentation of whether AF was paroxysmal or persistent. Additionally, preoperative and postoperative psychogenic stressors as AF classifiers cannot be determined. Furthermore, the study is limited in terms of generalizability.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Tuyl, Mackney, & Johnston, 2012.	Investigate and document the use of sternal precautions by physical therapists in the treatment of patients following median sternotomy in hospitals throughout Australia, from immediate post-surgery to discharge from the hospital.	Level: IV Design: Cross-sectional observational study Setting: All hospitals in Australia where cardiac surgery was performed using median sternotomy Participants: 30 senior cardiothoracic physical therapists. Participant Characteristics: Not specified. Inclusion Criteria: Senior cardiothoracic physical therapists from all hospitals in Australia where cardiac surgery was performed using median sternotomy were invited to participate.	Intervention: Analysis of the anonymous, Web-based survey. Outcome measures: The use of wound support, lifting restrictions, transfer restrictions, and mobility aid restrictions.	There was a significant variation in the sternal precautions and protocols used in the treatment of patients following a median sternotomy. Sternal wound support was used in most settings, and lifting, transfer, and mobility aid restrictions were also commonly enforced. Some weight restrictions were found to be illogical, e.g. opening and closing a door requires 12.5 lbs of force and many of the restrictions limit lifting to less than 5 lbs. Restricting upper limb movement and exercise may also be detrimental to recovery as it prevents functional limb use and the resumption of normal activities.	This study may be limited by selection bias. The type of sternal wound support was not specified. There was a statistical difference between the response rates of public and private hospitals and may be due to private hospitals contracting therapists who may not be based on site. Furthermore, the survey packs may not have reached the appropriate individual and other therapists may have provided responses that were different than those of the senior physical therapist.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Ullman et al., 2015.	To assess the effect of an ICU diary versus no diary on patients, and caregivers, or families during the patient's recovery from admission to an ICU.	Level: I Design: Systematic Review Setting: Not specified Participants: 3 Randomized controlled trials and clinical control trials of patient diaries in the ICU Participant Characteristics: Not applicable Inclusion Criteria: Randomized control trials and controlled clinical trials that evaluated the effectiveness of patient diaries and the impact on recovery after ICU admission	Interventions: The systematic review followed the Cochrane Systematic Review Protocol. The researchers searched Cochrane Central Register of Controlled Trials, Ovid MEDLINE, Ovid EMBASE, Published International Literature on Traumatic Stress, EBSCOhost, and Web of Science Conference Proceedings Citation Index-Science and Social Science and Humanities Outcome measures: The study examined the risk of PTSD, anxiety, depression, posttraumatic stress symptomatology, health-related quality of life, and costs	The researchers were unable to undertake a meta-analysis and there was minimal evidence to evaluate effectiveness of patient diaries to promote recovery from critical illness. Diaries do have the potential to reduce PTSD symptoms in family members, however there is Inadequate evidence to support effectiveness in improving psychological recovery after critical illness for patients and their family	The limitations of the study include choice validity of outcome measure, risk of bias, poor sample size, a low confidence in the quality of evidence obtained, and the study Did not encompass the multi-dimensionality of the patient diary intervention

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Wahab et al., 2015	The purpose of this study was to examine the effects of an early rehabilitation program in five ICUs on patient's ICU and hospital length of stay before and after a quality improvement project.	Level: II Design: Retrospective Review Setting: three medical, one cardiac, and one surgical ICUs in New York City Participants: 3,945 patients admitted amongst the five ICUs pre-program implementation and 4,200 patients admitted amongst the five ICUs post- program implementation. Participant Characteristics: The pre-implementation group consisted of 2152 male with a mean age of 63.1. The post-implementation group consisted of 3347 males with a mean age of 63.0. The majority of the medical diagnoses for both groups was cardio-cerebrovascular disease. Inclusion Criteria: Patients admitted into the five ICUs pre and post implementation	Intervention: The early rehabilitation program consisted of all patients receiving six days of therapy a week. Physical therapy interventions included passive range of motion, transfers, and ambulation. Occupational therapy interventions included training in feeding, grooming, and dressing. Outcome measures: Data was recorded for each patient admitted including age, sex, and primary diagnosis. Primary outcomes were hospital and ICU length of stay.	There was a statistically significant decrease in four of the five ICUs' total length of stay. Overall, the average ICU length of stay in all five of the ICUs decreased by 6.9% days, from 5.8 days pre-program implementation to 5.4 days post-program implementation ($p<0.001$). The average hospital length of stay in all five ICUs also decreased by 5.4%, from 14.7 days pre-program implementation to 13.9 days post-program implementation ($p<0.001$).	The study did not record or account for confounding variables, such as severity of illness or need for mechanical ventilation, which may have impacted patients' hospital and ICU length of stay. The generalizability of these results may be a limitation since all five of the ICUs included in the study were in a single hospital system, however the study did include medical, surgical, and cardiac ICUs in two locations. These limitations may be weak as the findings of this study are consistent with prior literature.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Wang & Gorenstein, 2013	To review the psychometric properties of the Beck Depression Inventory-II (BDI-II) as a self-report measure of depression in a variety of settings and populations.	Level: I Design: Systematic Review Setting: Not applicable Participants: 118 studies that utilized the BDI-II Participant Characteristics: Not applicable Inclusion Criteria: All of the articles used were published between 1996 and 2012.	Intervention: The criteria for the systematic review included a search of MEDLINE and PsycINFO. Psychometrics and depression were used to as a filter. Outcome measures: The aim of this study was to examine the reliability, concurrent validity, discriminant validity, content validity and construct validity of the BDI-II.	The review reported high levels of reliability (ranged .83 to .96) as well as good to excellent retest reliability (coefficient ranges from.73 to.96). The review also reported high convergent validity between the BDI-I and BDI-II (Pearson correlation ranges from .82 to .94). Furthermore, the construct measures of the BDI-II were significantly correlated with other widely used measures (Centers for Epidemiologic Studies of Depression, Hamilton Depression Rating Scale, Zung Self-Rating Depression Scale, Montgomery-Åsberg Depression Rating Scale, and Geriatric Rating Scale). The review reported significant correlations on convergent validity between BDI-II and anxiety measure. Lastly, the content validity of the BDI-II is narrower than the BDI-I. This may have an impact the sensitivity of the self-report measure.	The limitations of the study include a spectrum bias that can impact the generalizability of the results due to testing in different settings. Also, the self-report nature of the BDI-II can affect results is not as reliable as a diagnostic interview.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Waugaman, VanNortwick, Dionne, Whitmore, & Bradley, 2015.	The purpose was to assess the impact of early mobilization on patients post cardiac surgery.	Level: III Design: Single subject design Setting: Cardiothoracic intensive care unit of Rex Healthcare, Raleigh, NC Participants: Patients post cardiac surgery Participant Characteristics: Not specified. Inclusion Criteria: Not specified.	Intervention: Early mobilization and physical therapy Outcome measures: Over the course of 6 months, data including patient length of stay in the cardiothoracic intensive care unit and hospital, postoperative complications, and readmissions were collected.	The results of the study showed patients post cardiac surgery experienced an increase in mobility by 46% to 56%, postoperative complication of pneumonia decreased by 0.9% and deep vein thrombosis decreased 0.1%, readmission rates decreased by 4%, hospital length of stay decreased by 0.1 days, and patient surveys from before and after the early mobility program implementation reported improvement in quality and quantity of sleep.	The study does not specify whether the results are clinically or statistically significant.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Young et al., 2005.	To examine whether the intensive care unit population differ from an elective cardiac surgery group with regards to their anxiety and depression symptom reporting.	Level: II Design: Case control study Setting: ICU follow-up program Participants: 20 patients in the ICU and their partners; 15 patients undergoing elective cardiac surgery and their partners Participant Characteristics: ICU sample: 15 males, five females, average age 54; relatives of ICU sample: 15 females, five males, average age 53; elective sample: 12 males, three females, average age 60; relatives of elective sample: 12 females, three males, average age 60. Inclusion Criteria: Patients in the ICU; matched patients undergoing elective cardiac surgery.	Intervention: No intervention was provided to the participants Outcome measures: The Hospital Anxiety and Depression Scale (HADS) to assess symptoms of anxiety and depression. The cut off scores used in the study were broken into two groups. Possible clinical disorder was a score between 8-10 and the score for probable clinical disorder was between 11-21.	There was no significant difference found between patients in the ICU and patients undergoing cardiac surgery in their anxiety and depression symptoms ($p < .05$). However relatives reported a significantly higher number of anxiety symptoms than patients themselves in both groups. Furthermore, relatives were more troubled by the recovery period, finding the experience life altering and the impact was more profound.	The limitations of the study included a small number of participants, which limits the generalizability. Also, research HADS utilizes different cut off scores, making it harder to compare to other studies.

Author/ Year	Study Objectives	Level/Design/ Participants	Intervention and Outcome Measures	Results	Study Limitations
Ziyaeifard et al., 2016.	The purpose of this study was to evaluate the prevalence and risk factors of cognitive dysfunction in the ICU after heart surgery.	Level: II Design: Observational study Setting: ICU in Tertiary University Hospital Participants: 99 adult patients who underwent elective cardiac surgery(valve & coronary) Participant Characteristics: 46 male, 58 female, all had history of surgery, 64 higher than high school education Inclusion Criteria: Adult patients aged 18-70 years with left ventricular ejection fraction > 30% who underwent valve repair or replacement and coronary artery bypass grafting, elective operation, no history of cognitive disorders or dysarthria, and no intubation before surgery.	Intervention: Patients in the ICU 2 or 3 days after cardiac surgery were assessed using the MMSE scale. Outcome measure: cognitive dysfunction, factors affecting the incidence of cognitive dysfunction	Fifty-five percent had no cognitive impairment, while 39.4 % had MCI and 5.1% had moderate cognitive impairment. Cognitive dysfunction had a significant relationship with the following factors: age, cardiopulmonary bypass time, aortic cross-clamp time, and literacy. The results also showed cognitive dysfunction had no significant relationship with sex, previous history of surgery, preoperative and postoperative hemoglobin, blood glucose, diabetes, type of operation, and duration of operation.	This was a single center study and did not include emergent or complex cardiac procedures. The researchers only examined the early cognitive status of the patients and did not examine the cognitive status in mid- or long term follow ups to see if cognitive impairment was still present.

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Appendix D
Clinical Pathway Pocket Guide

Sutter Health
Mills-Peninsula Health Services

Occupational Therapy Evidence-Based Clinical Pathway for Patients Post Cardiac Surgery

Guidelines

1. Follow established vital signs parameters per orders from Cardio-Thoracic surgeon
2. Apply mobility safety screen and no therapy under these conditions:

Cardiovascular Measures:
- MAP goal > 60 on less than 3 vasoactive medications
- Resting HR < 50 or > 140 bpm
- New arrhythmia developed
- New onset angina-type chest pain

Pulmonary Measures:
- SpO2 < 88%
- Respiratory Rate > 35

Mental Status
- RASS > -3

Invasive Monitoring
- No IABP

Labs
- Hgb < 7.0
- Hct < 25%
- BS > 300mg/dl
- K+ < 3.2 mEq/L, > 5.5mEq/L
- Platelets <20,000
- INR> 5

Day 1

Educate:
- Sternal Precautions; refer to "Sternal Precautions" handout
- Heart Hugger/Sternal support bra (don/doff)
- Incentive Spirometer (10 reps/hr)

Early Mobilization:
- Modified log roll with HOB < 20°
- EOB exercises while contracting abdominal muscles
  - Marching in place
  - Ankle pump
  - Knee extension
- Level 4 Mobility-in room & hallway
  - Standing and balance exercises at bedside
  - 5 walks/day
  - Hygiene and grooming activities

Caregiver(s) Education*:
- Education primarily directed towards caregiver(s)

*Caregiver(s) should be educated throughout the recovery process

Day 2

Educate:
- Sternal precaution - Determine adherence to precautions
- Modified ADL techniques

Early Mobilization:
- Modified log roll or with regular log roll with HOB < 20°
- Contracting abdominal muscles while completing ADL
- Level 4 Mobility-in room & hallway
  - 5 Walks/day
  - Sinkside hygiene andd grooming
  - UB dressing with modified technique
  - Toilet transfer and simulated toilet hygiene

Caregiver(s) Education*:
- Caregiver(s) receives the same education as the patient

Day 3: Transfer to Step-Down Unit

Early Mobilization:
- Log Rolling
- Contracting abdominal muscles while completing ADL
- Do not exceed RHR+20 during activity
- Level 4 Mobility-in room and hallway
  - 5 walks/day
  - Sinkside hygiene and grooming
  - UB/LB dressing w/ modified technique
  - Toilet transfer and toilet hygiene

Cognition:
- Refer patient to "Tips to Feel More Focused in Your Daily Life" handout
- Administer MoCA© if:
  - No reliable caregiver(s)
  - Clinical observation warrants assessment
- MoCA© score below 18: May indicate Moderate Cognitive Impairment
  - All education and instructions should be directed to reliable caregiver(s)
  - Consider referral for additional services at discharge
- MoCA© score below 26: May indicate Mild Cognitive Impairment
  - Educate patient and consider environmental modifications
  - Consider referral for additional services at discharge

Caregiver(s) Education*:
- Refer caregiver(s) to "Tips for Caregivers" handout

Day 4 to Discharge

Educate:
- Start with low level activities and slowly progress to higher level activities.
- Refer patient to "How to Progress Back to Your Daily Routine" handout
- Instruct IADL with sternal precautions. Refer patient to "Sternal Precautions" handout

Early Mobilization:
- Log rolling
- Contract abdominal muscles while completing ADL
- Level 4 Mobility-in room and hallway
  - 5 walks/day
  - Sinkside ADL
  - Simulated standing shower and shower transfer
- Home management tasks - e.g. retrieving/ arranging clothing from closet
- Meal preparation - e.g. practice using microwave or make a sandwich

Psychosocial Functioning:
- Administer the HADS to patient
- HADS score of 8 and above in either the depression and/or anxiety category:
  - Refer patient to "Tips for Coping with Feeling Down" and "Tips for Coping with Stress and Feeling Anxious" handouts
  - Music/quiet time for two 20-minute sessions each day

Caregiver(s) Education*:
- Refer caregiver(s) to "Tips for Caregivers" handout

Appendix E
Evaluation Survey for the Clinical Pathway

Occupational Therapy in the Intensive Care Unit (ICU)

Kelsie Colombini, OTS, Kristen Henderson, OTS, Michelle Huie, OTS, Courtney Malachowski, OTS
Dominican University of California, Department of Occupational Therapy

1. I would use this evidence-based clinical pathway to guide my occupational therapy intervention with patients following cardiac surgery in the ICU.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2. This evidence-based clinical pathway is appropriate to use at MPMC and with MPMC's client population.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3. The evidence-based clinical pathway is consistent with my personal clinical reasoning.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4. I find the evidence-based clinical pathway to be beneficial.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

5. Which aspects of the clinical pathway do you find beneficial?
Comments:
_____
_____
_____

6. Which aspects of the clinical pathway do you not find beneficial?
Comments:
_____
_____
_____

7. Does the clinical pathway conflict with any of the current treatment approaches being implemented?
Comments:
_____
_____
_____

8. Is there any gap in the pathway that should be addressed?
Comments:
_____
_____
_____

Thank you for your time, we appreciate the feedback!