PROBLEM-SOLVING THERAPY TO REDUCE CHRONIC FATIGUE IN CARDIAC ARREST SURVIVORS

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Fatigue is prevalent in people with heart problems and negatively associated with physical and mental functions, and perceived performance and participation in activities of daily living. The two studies in this dissertation focused on chronic fatigue among post-cardiac arrest (CA) adults. The first study investigated fatigue-related problems in post-CA adults and energy conservation (EC) strategies used to resolve those problems. Using a qualitative descriptive design, it was found that CA survivors with moderate-to-severe fatigue, living in the community, more frequently reported problems in instrumental activities of daily living than basic activities of daily living. Also, the CA survivors used the EC strategy of "plan ahead" most frequently followed by seven other EC strategies. The second study examined the effectiveness of the clinical intervention strategies (Maximizing Energy [MAX] intervention) on reducing the severity and impact of fatigue, and the impact on activities and participation. A pre-post experimental study design was used. By participating in MAX intervention sessions, CA survivors with chronic fatigue learned EC strategies while solving two fatigue-related problems. The results showed that the MAX intervention was effective in significantly reducing the impact of fatigue and general fatigue of CA survivors. Future studies should include larger samples with a comparison group and random allocation, examine the effectiveness of different numbers of intervention sessions and different time intervals between tests, and include measures that are more sensitive to changes in fatigue, perceived performance and participation in daily activities.

Lastly, because of the low survival rate following a CA, and the strict eligibility criteria for chronic fatigue in our study, we recommend a multi-site study to increase the potential for reaching an adequate number of participants in a reasonable length of time.

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PREFACE

I would like to thank my dissertation chair and advisor, Margo B. Holm, PhD, OTR/L, for her patience and guidance throughout this process. I would also like to thank each of the members of my committee – Joan C. Rogers, PhD, OTR/L, Ketki D. Raina, PhD, OTR/L, Clifton W. Callaway, MD, PhD, and Jon C. Rittenberger, MD, MS – for their time, guidance, and answers to all of my questions. I would also like to acknowledge the financial support received to conduct this study: (a) The American Occupational Therapy Foundation Dissertation Research Grant, and (b) University of Pittsburgh School of Health and Rehabilitation Sciences Research Development Fund. Lastly, I would like to acknowledge Ji Sun Song and my parents and thank them for their support which helped me to achieve the goal.

1.0 INTRODUCTION

The definition of cardiac arrest (CA), updated in 2004 (Jacobs et al., 2004), is "the cessation of cardiac mechanical activity as confirmed by the absence of signs of circulation" (p. 3387). The American Heart Association (2009) has reported that annually 294,851 emergency medical service-treated out-of-hospital CAs occur in the United States. In addition, the incidence of CA is holding steady, and the survival rates after CA are low and vary by region (Eisenberg & Psaty, 2009). According to a study by Nichol et al. (2008), survival rates after out-of-hospital CA ranged from 1.1% to 8.1% across nine North American sites. CA survivors also experience after effects that prevent them from returning to their previous lives. These after effects include impaired cognitive ability, such as impaired memory, attention, and executive functioning; mood disorders, such as anxiety and depression; impaired physical mobility and participation in society; and decreased quality of life (de Vos, de Haes, Koster, & de Haan, 1999; Moulaert, Verbunt, van Heugten, & Wade, 2009; Raina, Callaway, Rittenberger, & Holm, 2008; Saner, Borner Rodriquez, Kummer-Bangerter, Schuppel, & von Planta, 2002; Wachelder et al., 2009).

Fatigue is one of the most debilitating symptoms after CA. According to Wachelder et al. (2009), 56% of subjects, with a mean time of 36 months since CA, experienced fatigue. In addition, patients with congestive heart failure (CHF) had a higher level of fatigue and eight times greater risk of having fatigue symptoms than healthy people (Smith, van den Broek, Renkens, & Denollet, 2008).

There is no universal definition of fatigue (Lou, 2009). However, "subjective fatigue" usually refers to "the general sensation of tiredness or of difficulty in initiating physical or mental activity experienced by a subject over several days to weeks" (Lou, 2009, p. 196). Specifically, subjective fatigue has two elements: physical fatigue and mental fatigue. Subjective physical fatigue is related to the effort needed to complete activities, whereas subjective mental fatigue is related to the effort needed to pay attention to tasks. Physical fatigue in patients with CHF is known to have multi-factorial causes, such as an impaired nutritive flow to the skeletal muscles, persistent changes in the function of skeletal muscles, and reduced blood flow through skeletal muscles (Lipkin & Poole-Wilson, 1986). Lee, Kohlman, Lee, and Schiller (2000) found that the patients who experienced myocardial infarction (MI) showed five patterns of change in fatigue (decreasing fatigue, increasing fatigue, unchanged low fatigue, high fatigue, and curvilinear pattern with low fatigue) over time and stressed that fatigue patterns in post-MI adults should not be assumed to be uniform over time. However, no clear etiology for chronic fatigue in CA survivors has been found and defined.

Fatigue negatively affects abilities of people with heart problems. Spijkerman, van den Brink, Jansen, Crijns, and Ormen (2005) found a significant relationship between pre-MI vital exhaustion (VE) and late-onset depressive symptoms. VE is a syndrome characterized by fatigue, increased irritability, and demoralization (McGowan et al., 2004; Smith, Gidron, Kupper, Winter, & Denollet, 2009). Also, McGowan et al. (2004) found significant correlations among VE, depression, and co-morbid illnesses in post-MI patients. Furthermore, fatigue and physical activity are known to be associated with various cardiac diseases, although such an association in post-MI women aged 65 and older was not found (Crane, 2005). In patients with CHF, fatigue was shown to be significantly correlated with depression, physical health, emotional health, and

quality of life (Evangelista et al., 2008). Patients with CHF were also likely to be dependent in instrumental activities of daily living, although they experienced less difficulty in personal activities of daily living (Norberg, Boman, & Löfgren, 2008). Lastly, according to the model suggested by Alsen, Brink, and Persson (2008), people who experience fatigue after MI are "being restricted" and "feeling defeated" because of "incomprehensible fatigue" (p. 462). In summary, fatigue is prevalent in people with heart problems including CA, and it negatively affects their physical and mental functions and abilities for daily activities and participation.

This dissertation study qualitatively and quantitatively characterized chronic fatigue of post-CA adults. Specifically, this study had two aims:

1. Investigate fatigue-related problems in post-CA adults and collaboratively generate energy conservation strategies to resolve those problems.
2. Examine the effectiveness of the clinical intervention strategies on reducing the severity and impact of fatigue, and the impact on activities and participation.

In Chapter 2 (Aim 1), fatigue-related problems that post-CA adults experienced in their daily lives are investigated. In addition, the strategies, including solutions and detailed plans, are described.

In Chapter 3 (Aim 2), the effectiveness of the clinical intervention strategies implemented by post-CA adults to reduce the fatigue and the impact of the fatigue on performance in activities and participation are examined.

In Chapter 4, summaries of both studies are reported, limitations are discussed, and directions for future research are suggested.

2.0 SOLVING FATIGUE-RELATED PROBLEMS IN CARDIAC ARREST SURVIVORS

2.1 BACKGROUND AND SIGNIFICANCE

2.1.1 Background

A broad definition of fatigue is "the reduction in performance with either prolonged or unusual exertion" (DeLuca, 2005, p. 320). Among the four components of fatigue that DeLuca (2005) defined, the behavioral and subjective components can be used as lenses through which to look at fatigue. When fatigue is viewed through the lens of behavior, fatigue or fatigability (Lou, 2009) can be defined as the "inability to sustain physical or mental activity over time" (DeLuca, 2005, p. 320). Physical behavioral fatigue can be measured by looking at the changes in performance in terms of physical manifestations (DeLuca, 2005). For example, a client could be asked to repeatedly bend and extend an elbow to see whether the force required to bend the elbow declines after a few repetitions. However, this type of test does not detect the subjective feelings of a client, namely the subjective component of fatigue (Lou, 2009). Subjective fatigue can be defined as "the general sensation of tiredness or of difficulty in initiating physical or mental activity experienced by a subject over several days to weeks" (Lou, 2009, p. 196). In particular, subjective physical fatigue refers to the feelings of tiredness that a client experiences upon physically completing activities, whereas subjective mental fatigue refers to the feelings of

tiredness that a client experiences when mentally paying attention to tasks. Whereas physical fatigue can be assessed with performance measures, subjective fatigue is usually assessed by self-report questionnaires (Lou, 2009).

Subjective fatigue is often described in qualitative research, which is used to understand an individual's perspective of the fatigue experience. In particular, qualitative methods often utilize individuals' words and narrative summaries to describe their experiences and perspectives (Portney & Watkins, 2009). Olsson, Lexell, and Söderberg (2005) described the meaning of fatigue for women with multiple sclerosis using semi-structured interviews. During the interviews, the researchers asked 10 women with multiple sclerosis to talk about their experience of fatigue in daily life. The researchers identified two main themes ─ "the body as a barrier" and "a different absence" (Olsson et al., p. 10) ─ and several subthemes. Many of the main themes and subthemes were about the characteristics of fatigue the participants experienced. In terms of activities, the participants reported that they felt fatigue "when performing the most common daily tasks such as peeling potatoes, doing laundry and ironing, hair washing, trying on clothes or just sitting down" (Olsson et al., p. 10). Also, they reported that it was difficult for them to participate in family activities. Flensner, Ek, and Söderhamn (2003) described the experience of fatigue in nine men and women with multiple sclerosis and used open-ended questions regarding their common daily life situations. During the interviews, participants reported restrictions in daily life caused by fatigue, such as restrictions in shopping, driving, participating in social gatherings, and traveling. To minimize the impact of fatigue, all participants "carefully planned their days" (Flensner et al., p. 712) and prioritized activities they would like to do during the day.

Holley (2000) and Magnusson, Möller, Ekman, and Wallgren (1999) investigated the experience and impact of fatigue and coping strategies to deal with fatigue in cancer patients. In

their qualitative studies using semi-structured interviews, the participants reported their experience of fatigue in terms of various kinds of distress and feelings of loss, need, or malaise. When asked about the impact of their fatigue, participants reported a discontinuation of leisure activities, such as dancing with their spouse, and a decreased number of religious and social activities, such as Sunday walks or dinner parties with friends. Lastly, the participants reported coping strategies including encouraging self-talk, energy conservation (EC) techniques, or relaxing self-help activities.

Fatigue in people with heart conditions also has been qualitatively described in several studies. Falk, Granger, Swedberg, and Ekman (2007) described the experience and consequences of fatigue in 15 people with congestive heart failure (CHF) and what they do to deal with their fatigue. The participants reported physical fatigue that was related to the CHF symptoms, such as shortness of breath and chest pain, as well as mental fatigue expressed as "difficulty concentrating" (Falk et al., p. 1023). Their lack of energy had a negative effect on their mood status and sometimes lasted until the next day. However, most participants accepted fatigue as an unavoidable symptom of their heart condition. The participants also reported restrictions in daily chores, such as food preparation or house cleaning, recreational activities, and social activities. The strategies to deal with their fatigue included saving or recharging energy by slowing down activities or resting, comforting themselves by fishing, gardening, or relaxing in the sunshine, and, interestingly, socially interacting with others. Bosworth, Steinhauser, Orr, Lindquist, Grambow, and Oddone (2004) reported the impact of fatigue and coping strategies used by 15 men with CHF. Fatigue was one of the most common symptoms in these participants. The participants reported that they were limited in their ability to do routine work, such as car maintenance, yard work, or household chores, and to do paid work, which they desired to do not

only for financial reasons, but also for their contentment. To overcome their fatigue and continue to perform daily activities, the participants used EC strategies, such as placing chairs at intervals for frequent rests, replacing some activities with less strenuous ones, and receiving social support. Myocardial infarction (MI) is also one of the heart conditions that frequently results in fatigue. Alsén, Brink, and Persson (2008) performed in-depth interviews to understand fatigue and its impact in 19 people with recent MI and how they managed their fatigue. The participants reported physical, cognitive, and emotional fatigue that unpredictably occurred for no apparent logical reason. Due to these various kinds of fatigue, the participants were restricted in performing daily activities, including housekeeping, gardening, driving a car, or working. In addition, they reported restrictions in social activities, such as birthday parties or other social events. The most common strategy used by the participants was to sleep or lie in bed during the day. Another strategy was to modify their lifestyle by evaluating their current capacity, adjusting daily activities, giving up exhausting activities, and planning their daily tasks in advance. Some participants reported that they tried to distract themselves by driving a car or doing physical activities. Other strategies included forcing themselves to do tasks, comparing their fatigue to that of others with MI, and eating a balanced diet. In summary, chronic abnormal fatigue experienced by people with various conditions negatively affects their performance and participation in basic activities of daily living, such as grooming, as well as more complex activities, such as household chores, yard work, social events, and work.

However, no study has qualitatively investigated fatigue in post-cardiac arrest (CA) adults. CA can be defined as "the cessation of cardiac mechanical activity as confirmed by the absence of signs of circulation" (Jacobs et al., 2004, p. 3387), and 294,851 out-of-hospital CAs annually occur in the United States (American Heart Association, 2009). Post-CA adults

frequently report experiencing chronic fatigue that is different from the common tiredness experienced after strenuous tasks. Wachelder et al. (2009) asked 63 adults who had an out-of-hospital CA to complete questionnaires investigating the level of functioning of post-CA adults. According to their results, 56% of the participants whose mean time since CA was 36 months were scored as 4 or greater in the Fatigue Severity Scale (FSS). Therefore, this study showed that more than half of the post-CA adults with a mean time of 36 months since CA still experienced moderate-to-severe chronic fatigue. Despite the high number of annual incidents of CA and high percentage of prevalence of chronic fatigue in post-CA adults, researchers have not studied the fatigue experience of post-CA adults or strategies they use to deal with their fatigue.

2.1.2 Significance

The incidence of CA is holding steady, and the survival rates after CA vary by region, ranging from 1% to 8%, but are gradually increasing (Eisenberg & Psaty, 2009; Nichol et al., 2008). Also, one study indicated that more than half of the adults still experienced moderate-to-severe chronic fatigue even 36 months after their cardiac arrest (Wachelder et al., 2009). Most importantly, no study has described the impact of fatigue on performance in daily activities of post-CA adults and the coping strategies used to alleviate the impact. Therefore, post-CA fatigue may be a major barrier to restoring survivors of CA to a good quality of life. The aim of this study was to investigate the fatigue-related problems of post-CA adults and the strategies used to resolve those problems.

2.2 RESEARCH DESIGN AND METHODS

2.2.1 Research design

This study used a qualitative descriptive approach. Qualitative descriptive designs are useful when "straight descriptions of phenomena are desired" (Sandelowski, 2000, p. 339) and for describing phenomena that have been investigated minimally. In this study, we interviewed the participants several times by telephone until they solved two of their fatigue-related problems or participated in eight sessions. The findings are described in case studies.

2.2.2 Participants

Inclusion criteria for the study required that participants: (a) were at least 3 months post-CA, (b) had an FSS score ≥ 4 (moderate to severe fatigue), (c) had access to a landline telephone or cell phone, (d) lived within 150 miles of the University of Pittsburgh, Oakland, (e) had functional English fluency and literacy, and (f) were community residents. Exclusion criteria were that participants (a) had a score of < 4 score on the FSS, and (b) had cognitive impairment, indicated by the inability to remember essential information about the study during the screening session. We selected the 3-month point as one of our eligibility criteria because it is the time when CA survivors are considered to be out of the acute stage, are discharged from acute care or rehabilitation facilities, and have returned to their homes. Therefore, by excluding people who were within 3 months of their CA events, we could target only people who had chronic, not acute, moderate-to-severe fatigue, as determined by the FSS.

2.2.3 Descriptive measures

After participants provided informed consent, their demographic information (age, gender, race, education, current living status, and current vocational status) and medical information (out-of- or in-hospital CA, presumed cardiac etiology, witnessed CA, bystander cardiopulmonary resuscitation, rhythm when CA, rescue shocks, hypothermia, duration of coma, duration of intubation, intensive care unit length of stay, total inpatient length of stay, and time from CA) were collected through chart review, interview, or both.

The FSS, used as a screening tool for inclusion in the study, is a self-report tool with a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). Participants were asked to what degree they agreed with nine statements about the severity of their fatigue symptoms. The total score is the mean of the nine items, and the higher the score, the more severe the fatigue. A total score of ≥ 4 indicates moderate-to-severe fatigue (Krupp, LaRocca, Muir-Nash, & Steinberg, 1989).

2.2.4 Intervention components

2.2.4.1 **Problem Solving Therapy (PST)** We used the steps in the Maximizing Energy (MAX) intervention to identify fatigue-related problems and solutions to those problems. The MAX intervention adopts the framework of PST as a vehicle of delivery to help people with chronic fatigue utilize EC strategies to solve their fatigue-related problems. The MAX intervention includes seven logical steps: (1) identifying and defining the performance problem, (2) establishing realistic and achievable goals for problem resolution, (3) generating multiple solution alternatives through brainstorming, (4) evaluating each solution by weighing potential

positive and negative consequences of each option in order to choose the ideal solution, (5) developing a detailed solution plan based on the results of the evaluation, (6) implementing the preferred solution plan, and (7) assessing the outcome and modifying the solution plan as needed.

2.2.4.2 **Energy conservation (EC)** The literature on EC solutions (Poole, 2009; Silver, 2001; Yasuda, 2008) was used to generate the lists of EC strategies (see Appendix A). General EC strategies with several examples were listed. In addition, the EC strategies were categorized by places or activities, such as home, office, dressing, and grocery shopping, so that the principal investigator could quickly retrieve relevant strategies. When participants requested advice on problem solutions and detailed solution plans, the investigator suggested appropriate strategies using the lists of strategies and the investigator's clinical knowledge.

2.2.5 Procedures

Following approval from the Institutional Review Board of the University of Pittsburgh, we received referrals from post-CA service physicians; rehabilitation therapists, including occupational and physical therapists; and cardiopulmonary rehabilitation specialists. Upon receiving the referrals, the investigator contacted potential participants by telephone or in person to determine their eligibility for this study. Once they were determined eligible for the study, the investigator visited participants to obtain informed consent, demographic and medical information, and further information on their fatigue level. At the end of this visit, the investigator provided them with a Participant Workbook. The Participant Workbook contained (a) logistical information regarding the MAX intervention, (b) factual information regarding

fatigue after CA, (c) EC strategies, (d) a fatigue problem list, and (e) problem solving worksheets (see Appendix B) containing the seven steps of the MAX intervention with space for the details of each step. Prior to the first interview session, the investigator asked the participants to read the sections of the Participant Workbook about factual information regarding fatigue after CA and to think about their fatigue-related problems. They were advised to use the fatigue problem list which listed several categories of activities as they wished.

All interviews were conducted via telephone. During the first interview, the participants identified their fatigue-related problems and selected two that they wanted to address. When the participants had difficulty identifying fatigue-related problems under their control, the investigator provided assistance by providing examples and by referring them to the fatigue problem list. During the remaining sessions, the participants went through the steps of the MAX intervention for each fatigue-related problem. The investigator provided guidance to help them stay on the appropriate steps, generate and evaluate solutions, and develop detailed solution plans.

All telephone interviews were recorded using a pre-installed sound recorder in *Windows 7 Enterprise*. During the interview, the investigator completed the problem solving worksheet by hand. Immediately after each interview, the details of each step were typed into an electronic version of the worksheet for the two fatigue-related problems, the goal for each problem, the chosen solution, and the detailed solution plan.

All interviews were performed by the investigator, who had expertise in administering the FSS and was trained in PST (University of Washington, 2011).

2.2.6 Data analyses

To ensure the quality and accuracy of the worksheet documentation, one of the co-investigators (MBH) reviewed 10% of the interviews and worksheets and summaries for those interviews using audio recordings to determine whether they were consistent. Any inconsistency among the recordings and documents was addressed and corrected. After this scrutiny, the PI reviewed all other recordings and documents and corrected any similar inconsistencies.

To enhance the reliability of the study, we used several strategies. First, the investigator was trained in the MAX intervention by its developers prior to participating in the current study. Through this process, the investigator obtained a deep understanding of the background and each step of the MAX intervention. Second, the investigator practiced all the steps of the MAX intervention with one of the co-investigators and several graduate students in occupational therapy, in person as well as by telephone, prior to initiating the study. These practices ensured the familiarity of the investigator with the MAX intervention steps. Third, the investigator developed rapport with the participants, in their homes, during the 2-hour home-visit that occurred prior to the interview sessions. Fourth, the interviews were conducted in multiple sessions, which prevented participants from being fatigued and allowed them ample time to think about their fatigue-related problems and solutions over time. Lastly, one of the co-investigators scrutinized the results from the interviews.

To categorize the fatigue-related problems experienced by the participants, we used the International Classification of Functioning, Disability and Health (ICF), which is a classification system for capturing human functioning (Reed et al., 2005). The main aim of the ICF is "to provide a unified and standard language and framework for the description of health and health-related states" (WHO, 2001, p. 3). Because the participants mostly stated their problems in terms

of activities and participation, only the codes in the activities and participation component in the ICF were used. In addition to the categorization of the problems, the strategies used by the participants were also categorized into one of the following general EC strategies: 1) plan ahead; 2) pace yourself; 3) delegate to others; 4) sit when possible; 5) simplify activities; 6) maintain good posture; 7) get organized; and 8) others.

2.3 RESULTS

Sixty-three post-CA patients were referred by physicians, therapists, and cardiopulmonary specialists. Among them, 38 people were not screened: 17 people reported no interest; eight could not be contacted either because they did not answer the telephone or the telephone numbers were not valid; four reported no fatigue; three were facility residents; three died; one reported leaving the area; one refused participation due to health problems; and one did not actually have CA. Therefore, 25 people who had a CA in the past and showed interest in the study were screened. Among the 25 CA survivors, 12 did not meet the eligibility criteria or did not respond to calls: 10 of the 12 did not have moderate-to-severe fatigue according to the FSS; one person showed potential cognitive impairment; and one person who met the eligibility criteria postponed the pre-interview home-visit and did not reply afterwards. Therefore, 13 CA survivors participated in this study. Among the 13 participants, one participant addressed only one problem during his enrollment due to a family emergency (see Figure 2.1).

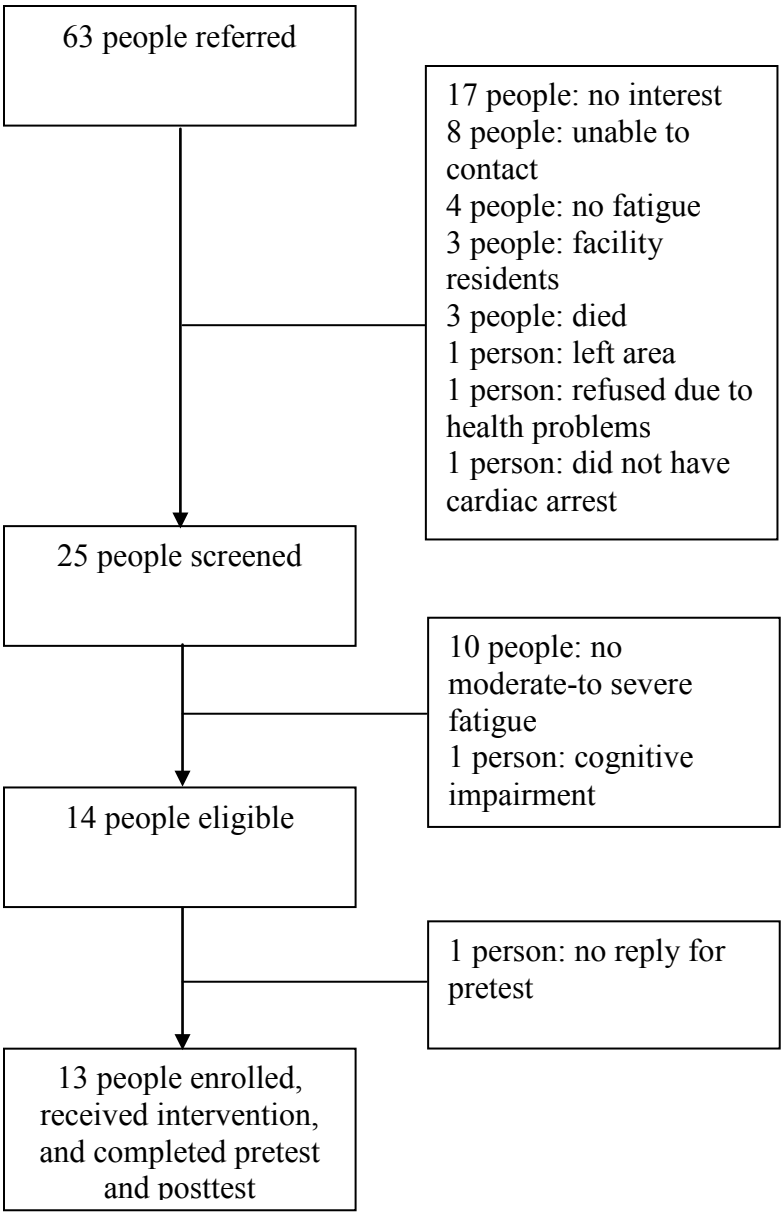

Figure 2.1: Numbers of people referred, screened, and included in the study

The mean age of the 13 participants was 52.3 (*SD* = 9.3) years, and all participants were White (see Table 2.1). The majority were male (n = 8) and living with someone (n = 11). All participants had at least a high school education, two participants had a partial college education, two participants completed college, and one participant completed graduate school. Only four

participants were engaged in paid employment. The median days since CA was 110 (range 96-2518). The majority had out-of-hospital CA, witnessed CA and received bystander cardiopulmonary resuscitation. The mean length of stay at the acute hospital was 10.9 days (*SD* = 6.6). The mean FSS score at the beginning of the study was 5.33 (*SD* = 1.12).

The participants received a median of four interview sessions (range 3-5), and the mean time for each interview session was 37 minutes. The basic information for each participant, including age, gender, race, education, living status, days since CA, vocational status, and FSS score, fatigue-related problems, solutions, and outcomes are provided in Table 2.2. In addition, the descriptive case studies are provided in Appendix C. Also, the ICF codes for fatigue-related problems and EC categorizations for problem solutions are provided in Table 2.3.

Table 2.1: Demographic, medical, and fatigue information of the participants

	Range	Participants (*N* = 13)
Age, years, *M (SD)*	39 – 66	52.31 (9.31)
White (%)	-	13 (100)
Male (%)	-	8 (61.5)
≥ High school graduate (%)	-	13 (100)
Living with someone (%)	-	11 (84.6)
Engaged in paid employment (%)	-	4 (30.8)
Days since CA, *Mdn*	96 – 2518	110
Out-of-hospital CA (%)	-	9 (69.2)
Cardiac etiology (%)	-	13 (100)
Witnessed CA (%)	-	9 (69.2)
Bystander CPR (%)	-	8 (61.5)
Ventricular fibrillation / tachycardia rhythm (%)	-	13 (100)
Rescue shocks achieved (%)	-	11 (84.6)
Hypothermia achieved (%)	-	7 (53.8)
Duration of coma, days, *M (SD)* (*n* = 8)	1 – 5	2.75 (1.17)
Duration of intubation, days, *M (SD)* (*n* = 10)	2 – 26	5.7 (7.42)
Length of stay		
Intensive care unit, days, *M (SD)*	1 – 17	5.54 (4.22)
Total inpatient, days, *M (SD)*	2 – 28	10.92 (6.61)
Fatigue Severity Scale, *M (SD)*	-	5.33 (1.12)

Note. CA = cardiac arrest; CPR = cardiopulmonary resuscitation.

Table 2.2: Problems, solutions and outcomes of the MAX intervention with cardiac arrest survivors experiencing chronic fatigue

Case	Descriptives	Fatigue-related problems	Problem Solutions	Outcomes
1	• 43-year-old white male • Completed partial college • Living with wife and three children • 172 days since CA • Worked full time • FSS = 4.00	**Problem 1** Poor compliance with CPAP machine use at night--fell asleep on couch each night and did not use CPAP because it was not clean. Believed that not using CPAP contributed to poor sleep patterns and increased fatigue.	**Solution 1** Clean CPAP each morning before work so that it was ready to use each evening.	**Outcome 1** Reported that his fatigue had decreased with the use of the CPAP machine.
		Problem 2 Procrastinated starting necessary tasks because they seemed mentally overwhelming.	**Solution 2** List all tasks that needed to be done on a dry erase board. Break down some tasks into multiple steps. Set priorities and complete five tasks by himself and delegate some to his employees.	**Outcome 2** By keeping tasks visible to all and setting priorities, he was motivated to complete the tasks and delete them off the board.

Table 2.2 (continued).

Case	Descriptives	Fatigue-related problems	Problem Solutions	Outcomes
2	• 50-year-old white male • Completed college • Living with wife and two children • 166 days since CA • Worked full time • FSS = 3.22	**Problem 1** Did not socialize with friends as often as prior to CA. Had often spent time with friends at the bar before CA. However, no longer able to due to late night fatigue and medical prohibition on driving and drinking.	**Solution 1** Watch football with neighbors once a week.	**Outcome 1** The solution was very effective because: 1) neighbor's house was located within walking distance; 2) he could easily drink soda instead of alcohol; and 3) football games were broadcast during weekends.
		Problem 2 Felt tired when walking up hills while working. As a land surveyor, had to walk up hills at least once every day.	**Solution 2** Walk up a hill side to side in a Z configuration.	**Outcome 2** By planning ahead, having a detailed action plan, and consciously putting effort into following the action plan, he reported decreased fatigue when walking up hills.

Table 2.2 (continued).

Case	Descriptives	Fatigue-related problems	Problem Solutions	Outcomes
3	• 62-year-old white male • Completed high school • Living with wife and mother-in-law • 226 days since CA • Worked part time • FSS = 5.33	**Problem 1** Not exercising regularly. Believed that this was one of the causes of fatigue at work and wanted to prepare for upcoming ski season.	**Solution 1** Create an exercise plan based on the one from his previous cardiac rehabilitation program.	**Outcome 1** By planning in advance, successfully implemented solution with high satisfaction.
		Problem 2 Felt fatigue after work. Pay was dependent on output and time; therefore, needed to maintain productivity but reduce fatigue.	**Solution 2** Rest after 4 hours of work and carry water bottle while working to save energy from going to the water fountain.	**Outcome 2** By resting and carrying water bottle at work, he easily implemented solutions, which built up energy and reduced fatigue.

Table 2.2 (continued).

Case	Descriptives	Fatigue-related problems	Problem Solutions	Outcomes
4	• 65-year-old white male • Completed graduate school • Living with wife • 109 days since CA • Retired • FSS = 6.22	**Problem 1** Felt fatigue after playing piano for 15 minutes. Liked to play piano every day.	**Solution 1** Select pieces that require little effort to play and gradually increase the playing time.	**Outcome 1** By playing easy pieces and gradually increasing playing time, he successfully reduced fatigue from playing piano for 20 minutes.
		Problem 2 Did not take out the trash, which was his responsibility.	**Solution 2** Sort trash by type, and take small amounts of garbage out to back porch each day	**Outcome 2** By taking out sorted trash types on different days rather than altogether, he eliminated fatigue almost entirely.

Table 2.2 (continued).

Case	Descriptives	Fatigue-related problems	Problem Solutions	Outcomes
5	• 39-year-old white male • Completed high school • Living with wife and one child • 107 days since CA • Unemployed • FSS = 6.56	**Problem 1** Felt fatigue after shopping, which was considered as family time. Went shopping at least twice a week.	**Solution 1** Split up the list with wife, and gather different items at the same time.	**Outcome 1** By creating a detailed shopping list and splitting items into two groups, it took a shorter time for him to complete shopping with a small decrease in fatigue level.

Table 2.2 (continued).

Case	Descriptives	Fatigue-related problems	Problem Solutions	Outcomes
6	• 43-year-old white female • Completed high school • Living with one child • 105 days since CA • Unemployed (on disability) • FSS =6.78	**Problem 1** Rarely left apartment. Not motivated to go outside due to fatigue.	**Solution 1** Attend party and go to park with granddaughter.	**Outcome 1** Despite changing original plans for days' activities, she did manage to get outside and, therefore, reported high satisfaction with less fatigue.
		Problem 2 Felt extreme fatigue after doing dishes. Did dishes every other day without dish washer.	**Solution 2** Use paper plates instead of regular dishes.	**Outcome 2** Because of decreased number of dishes to clean, she reported great decrease in fatigue with high satisfaction.

Table 2.2 (continued).

Case	Descriptives	Fatigue-related problems	Problem Solutions	Outcomes
7	• 66-year-old white male • Completed partial college • Living with wife • 110 days since CA • Retired • FSS = 4.00	**Problem 1** Had low motivation to start activities in the morning due to fatigue.	**Solution 1** Go to bed earlier to have full 9-hours of sleep and walk to church instead of getting a ride.	**Outcome 1** By going to bed early and walking to church, he had more energy and felt refreshed, which decreased fatigue in the morning.
		Problem 2 Did few household chores and enjoyable activities during free time.	**Solution 2** Plan ahead for household chores and enjoyable activities.	**Outcome 2** By learning importance of rest periods, planning ahead, and the advantages of Solution 1, he reported no fatigue after implementing solution.

Table 2.2 (continued).

Case	Descriptives	Fatigue-related problems	Problem Solutions	Outcomes
8	• 56-year-old white female • Completed high school • Living alone • 2518 days since CA • Unemployed (on disability) • FSS = 5.89	**Problem 1** Reported high level of fatigue while cleaning her condominium. Tried to clean her condo every day, but often had to stop in the middle due to fatigue.	**Solution 1** Clean one section at a time and take frequent rests.	**Outcome 1** Due to sudden arthritis pain, she cleaned only two of the three sections planned with the same fatigue level; however, she would like to keep the solution because she was able to slow down her pace due to small quota of activities for the day, and frequent rests helped her to keep going.
		Problem 2 Reported high level of fatigue during bathroom cleaning. Tried to organize items on shelves which had many unnecessary items.	**Solution 2** Remove unnecessary items from bathroom shelves.	**Outcome 2** She felt only moderate fatigue from removing unnecessary items on shelves with frequent rests. She reported extreme satisfaction with the solution.

Table 2.2 (continued).

Case	Descriptives	Fatigue-related problems	Problem Solutions	Outcomes
9	• 52-year-old white female • Completed high school • Living with boyfriend • 215 days since CA • Unemployed • FSS = 5.89	**Problem 1** Felt extreme fatigue from grocery shopping. Went grocery shopping at least once a week with boyfriend. Her boyfriend easily felt fatigue due to his own medical conditions.	**Solution 1** Make grocery list and plan the order in which she would collect items.	**Outcome 1** Solution helped her to be more organized and keep grocery shopping load small with less fatigue.
		Problem 2 Felt fatigue from cooking. Cooked 4 times a week with no plan or help.	**Solution 2** Plan ahead for meals and ingredients.	**Outcome 2** By deciding what to cook, she was able to rest in advance or finish some parts earlier in the day. Also, by gathering and positioning items before beginning first step of cooking, she reported decreased fatigue.

Table 2.2 (continued).

Case	Descriptives	Fatigue-related problems	Problem Solutions	Outcomes
10	• 53-year-old white male • Completed high school • Living with one child and mother • 108 days since CA • Unemployed (on disability) • FSS = 6.22	**Problem 1** No longer able to do horse management. Had three horses fed by daughter twice a day.	**Solution 1** Ask daughter to do part of feeding tasks and take frequent rests during feeding.	**Outcome 1** By having a small goal to achieve and frequent rests, he was not overwhelmed and was able to manage his fatigue.
		Problem 2 Not able to vacuum his living room. Wanted to take over the activity from his mother because his living room easily became dirty due to his smoking.	**Solution 2** Vacuum one section a day when he had the most energy.	**Outcome 2** By vacuuming small section with full energy in the morning and taking frequent rests, his fatigue from vacuuming decreased with satisfaction.

Table 2.2 (continued).

Case	Descriptives	Fatigue-related problems	Problem Solutions	Outcomes
11	• 45-year-old white male • Completed high school • Living with wife and four children • 189 days since CA • Worked full time • FSS = 4.89	**Problem 1** Doing few household chores. Cooked dinner for family. However, delegated household chores to others, but wanted to gradually take over those activities.	**Solution 1** Wash dishes with frequent rests.	**Outcome 1** By choosing simple menus, soaking pots and pans, and receiving help from family members, he completed dishwashing with high satisfaction.
		Problem 2 Did no pleasurable activities for himself after coming home from work.	**Solution 2** Ride a bike with one of his children in the evening.	**Outcome 2** By planning the duration and break times of bike riding, bringing cold water, and picking up dinner on bike ride day, he completed bike riding with his daughter. Although he reported extreme fatigue due to high heat and humidity of the day, he was very satisfied with his effort and solution.

Table 2.2 (continued).

Case	Descriptives	Fatigue-related problems	Problem Solutions	Outcomes
12	• 66-year-old white female • Completed college • Living alone • 97 days since CA • Retired • FSS = 5.89	**Problem 1** Had not gone bike riding after CA. Used to go bike riding every weekend before CA. Had regular bike and Jeep.	**Solution 1** Ride bike during the highest energy period of the day.	**Outcome 1** By planning out in advance, she knew what to expect and completed bike riding with very high satisfaction.
		Problem 2 Felt fatigue after a trip involving a 2-hour drive. Was exhausted after visiting friend's house 1 hour away.	**Solution 2** Start trip during the highest energy period of the day.	**Outcome 2** She reported high fatigue on the way back and after the trip was over because it took longer than expected (2 hours one way). However, she did not feel any fatigue upon arrival at the place. She realized that she stayed too long but was very satisfied with her efforts.

Table 2.2 (continued).

Case	Descriptives	Fatigue-related problems	Problem Solutions	Outcomes
13	• 53-year-old white female • Completed high school • Living with boyfriend • 96 days since CA • Unemployed • FSS = 4.44	**Problem 1** Felt severe fatigue after doing dishes. Generally made two meals a day and left dishwashing until the evening.	**Solution 1** Ask boyfriend to clean the stove-top and counter.	**Outcome 1** Because cleaning the stove-top and counter had taken too much energy for her to do, delegating the task to her boyfriend was very helpful in decreasing the fatigue level from dishwashing. She reported extreme satisfaction with this solution.
		Problem 2 Felt severe fatigue after grocery shopping. Went grocery shopping with someone else once a week.	**Solution 2** Make a list of groceries and plan a route map.	**Outcome 2** By making a list and route map, she walked much less than usual. She successfully decreased the fatigue level with extreme satisfaction.

Note. MAX = Maximizing Energy; CA = cardiac arrest; FSS = Fatigue Severity Scale; CPAP = continuous positive airway pressure; EC = energy conservation.

Table 2.3: ICF code for fatigue-related problems and EC categorizations for problem solutions

Case	ICF code for problem 1	ICF code for problem 2	EC categorization for solution 1	EC categorization for solution 2
1	d570 looking after one's health	d850 remunerative employment	Plan ahead	Plan ahead, delegate to others, set priorities
2	d920 recreation and leisure	d850 remunerative employment	Plan ahead, pace yourself, sit when possible	Plan ahead, lower the level of the activity
3	d920 recreation and leisure	d850 remunerative employment	Plan ahead, pace yourself	Plan ahead, pace yourself, sit when possible
4	d920 recreation and leisure	d640 doing housework	Plan ahead, pace yourself	Plan ahead
5	d620 acquisition of goods and services	-	Plan ahead, delegate to others	-
6	d460 moving around in different locations	d640 doing housework	Plan ahead, pace yourself	Plan ahead, use tools
7	d570 looking after one's health	d640 doing housework, d920 recreation and leisure	Plan ahead, pace yourself	Plan ahead, pace yourself
8	d640 doing housework	d640 doing housework	Plan ahead, pace yourself	Plan ahead, pace yourself, simplify activities
9	d620 acquisition of goods and services	d640 doing housework	Plan ahead	Plan ahead, simplify activities

Table 2.3 (continued).

Case	ICF code for problem 1	ICF code for problem 2	EC categorization for solution 1	EC categorization for solution 2
10	d650 caring for household objects	d640 doing housework	Pace yourself, delegate to others	Plan ahead, pace yourself, simplify activities
11	d640 doing housework	d920 recreation and leisure	Plan ahead, pace yourself, delegate to others	Plan ahead, pace yourself
12	d920 recreation and leisure	d475 driving	Plan ahead, pace yourself	Plan ahead, pace yourself
13	d640 doing housework	d620 acquisition of goods and services	Plan ahead, delegate to others	Plan ahead

Note. ICF = International Classification of Functioning, Disability and Health; EC = energy conservation.

Among the 25 fatigue-related problems reported by the participants, the most frequently reported problem (9 times) was difficulty or inability to do household tasks (d640 doing housework), followed by six problems with leisure activities (d920 recreation and leisure). One problem was coded using both codes (d640 and d920) because it included both leisure and household tasks. Furthermore, three problems were related to work and employment (d850 remunerative employment), three problems were related to grocery shopping (d620 acquisition of goods and service), and two problems were related to self-care (d570 looking after one's health). Lastly, one problem was related to animal care (d650 caring for household objects), one was related to going outside (d460 moving around different locations), and one was related to driving (d475 driving). For those 25 fatigue-related problems, eight different EC strategies were

used: plan ahead, pace yourself, delegate to others, simplify activities, sit when possible, set priorities, lower the level of activities, and use tools. “Plan ahead” was the most frequently used EC strategy by the participants, being adopted for 24 solutions. The second most frequently used EC strategy was “pace yourself,” adopted for 15 solutions. The EC strategies of “delegate to others,” “simplify activities,” and “sit when possible” were used for five, three, and two solutions, respectively. The EC strategies included as others were “set priorities,” “lower the level of activities,” and “use tools.”

2.4 DISCUSSION

In this study, each of 13 CA survivors living in the community with chronic moderate-to-severe fatigue identified two major fatigue-related problems, generated strategies to solve the problems, implemented the strategies, and evaluated the effectiveness of their solutions. The fatigue-related problems ranged from simply moving around to self-care, work, and leisure activities. Among the problems identified, problems in household tasks and leisure activities, followed by work, grocery shopping, and self-care, were most frequently reported. Although no study investigating the impact of fatigue in CA survivors was found, similar results have been reported in studies targeting different populations with fatigue. People with CHF reported that they refrained from house cleaning, food preparation, personal hygiene activities, and exercise as a consequence of fatigue (Falk et al., 2007). Also, people with MI had difficulty doing housekeeping and gardening, reading a newspaper, and returning to work (Alsen et al., 2008). People with multiple sclerosis felt fatigue while doing laundry, ironing, hair washing, and trying on clothes (Olsson et al., 2005). Lastly, people with rheumatoid arthritis reported inability to cook, participate in weekly bridge evenings, and playing with grandchildren due to fatigue (Repping-Wuts, Uitterhoeve, van Riel, & van Achterberg, 2008).

Most problems reported by the participants were experienced during performance of instrumental activities of daily living (IADLs), which can be defined as activities carried out in the home and community to support daily life and require more complex interactions than basic activities of daily living (BADLs) such as dressing and bathing (American Occupational Therapy Association, 2008). In this study, we recruited only CA survivors who lived in the community because community dwellers have more opportunities to encounter fatigue-related problems. Also, because our participants lived in the community, rather than institutions, they had

recovered a certain level of independence in their daily activities.

For the EC strategies, the participants showed a high preference for the "plan ahead" strategy by adopting it for all solutions except one. Also, the strategy of "pace yourself" was adopted for more than half of the solutions. In addition, the participants used other general EC strategies, including "delegate to others," "simplify activities," "sit when possible," "set priorities," "lower the level of activities," and "use tools" for the solutions and action plans. These results are in accord with the findings from other studies investigating the coping strategies used by people with abnormal fatigue. Alsen et al. (2008) reported that people with MI used strategies such as planning tasks in advance, sleeping during the day (pacing yourself), and giving up exhausting activities (setting priorities). Also, Bosworth et al. (2004) reported that people with CHF used strategies of taking frequent rests (pacing yourself) and receiving social support (delegating to others). Lastly, people with RA reported that they used pacing and rest as their first intervention, but also used strategies of planning activities as well as making choices (Repping-Wuts et al., 2008).

Clinically, the findings of this study are important to those who provide care to CA survivors. First of all, health care providers should be aware that there is 56% chance of experiencing chronic fatigue among CA survivors. During the course of hospitalization, it is important to educate CA survivors on use of EC strategies when performing BADLs so that they can be familiar with the application of the general EC strategies. At hospital discharge, health care providers can provide the information on general and specific EC strategies for frequently reported fatigue-related problems. Also, it is important to inform CA survivors about therapies available for their fatigue-related problems after discharge from the hospital. When treating CA survivors in the community, health care providers should be aware that CA survivors may have

more difficulty performing IADLs than BADLs due to their fatigue. Although care plans should be individualized, the EC strategies utilized by our participants, such as planning ahead and pacing yourself, hold promise for helping CA survivors perform and participate in daily activities with less fatigue.

There were several limitations in this study. We could not perform data saturation due to difficulty recruiting participants, given the low survival rate of CA (4.6%) (Nichol et al., 2008). Also, we may have missed enrolling CA survivors whose fatigue was too severe to allow participation in this study. Furthermore, we did not include CA survivors with fatigue living in institutions; therefore, the results may not be generalized to people in institutions. Lastly, although participants reported high satisfaction with their efforts and solutions and a decrease in the experience of fatigue, we did not examine the quantitative effectiveness of the EC strategies. Therefore, in future studies, a quantitative measure of fatigue levels before and after each solution should be used to examine the effectiveness of EC strategies in decreasing the severity and impact of chronic fatigue for post-CA survivors.

2.5 CONCLUSION

CA survivors with moderate-to-severe fatigue, living in the community, reported various fatigue-related problems which limited simple mobility, work and leisure activities. Problems performing IADLs were more frequently reported than problems with BADLs, which indicated that CA survivors with fatigue in the community often experienced difficulty doing more complex daily activities. To solve those problems, eight types of EC strategies were used, namely (1) plan ahead, (2) pace yourself, (3) delegate to others, (4) simplify activities, (5) sit

when possible, (6) set priorities, (7) lower the level of activities, and (8) use tools. Among those, the strategy “plan ahead” was adopted for most solutions. Clinically, health care providers should be fully aware of chronic fatigue among CA survivors and subsequent difficulties in performing daily activities due to fatigue. The EC strategies used by our participants may be useful in developing care plans for CA survivors being discharged to the community. To obtain exhaustive information on fatigue-related problems and coping strategies in post-CA adults with chronic fatigue, we recommend recruiting participants from multiple sites. Future studies also should focus on the use of a quantitative measure of fatigue reduction for each solution implemented.

3.0 THE EFFECTIVENESS OF AN INTERVENTION FOR SURVIVORS OF CARDIAC ARREST WITH CHRONIC FATIGUE

3.1 BACKGROUND AND SIGNIFICANCE

3.1.1 Background

Sudden cardiac arrest (CA) is the leading cardiovascular disease that causes death in the United States. In particular, about 800 people in the United States die from CA every day, and only 1-8% of people who experience out-of-hospital CA survive (Nichol et al., 2008). Even after their survival, the survivors experience numerous problems in terms of memory, attention, mood, physical ability, participation, and quality of life (de Vos, de Haes, Koster, & de Haan, 1999; Moulaert, Verbunt, van Heugten, & Wade, 2009; Raina, Callaway, Rittenberger, & Holm, 2008; Saner, Borner Rodriquez, Kummer-Bangerter, Schuppel, & von Planta, 2002; Wachelder et al., 2009). Among these problems, fatigue is known to be prolonged in post-CA adults. Wachelder et al. (2009) identified that more than half of their participants still experienced moderate-to-severe fatigue according to the Fatigue Severity Scale (FSS) an average of 3 years post CA. The fatigue that the participants experienced could be considered chronic, considering that many of CA survivors are out-of-acute stage within a month (Rittenberger, Raina, Holm, Kim, & Callaway, 2011).

Due to the unknown etiology of chronic fatigue in CA survivors, no intervention to "cure" fatigue is currently known. However, energy conservation (EC) is known to help people with chronic fatigue manage their fatigue and eventually improve their performance in daily activities (Mathiowetz, Matuska, Finlayson, Luo, & Chen, 2007). The goal of EC is "to improve task efficiency and reduce energy expenditure during all occupational tasks and roles" (Fasoli, 2008, p. 855). EC incorporates various strategies, such as taking additional rest periods, controlling the pace of work, sliding objects rather than lifting, and arranging supplies within normal reach (Barsevick et al., 2004; Sabara, Shamberg, & Williams, 2004). EC strategies have been used with numerous patient populations, including various cancers, multiple sclerosis, chronic obstructive pulmonary disease, rheumatoid arthritis, and fibromyalgia, and have been shown to be effective in improving performance in daily activities by managing fatigue (Barsevick et al., 2004; Furst, Gerber, Smith, Fisher, & Shulman, 1987; Mathiowetz et al.; Sim & Adams, 2003; Theander, Jakobsson, Jorgensen, & Unosson, 2009).

To efficiently deliver EC strategies to post-CA survivors with chronic fatigue, we used the Maximizing Energy (MAX) intervention program which was developed based on the framework of Problem Solving Therapy (PST). According to a study by Nezu (2004), PST includes four problem-solving skills: problem definition and formulation, generation of alternatives, decision making, and solution implementation and verification. Detailed steps of those four skills have been adapted and re-organized into seven steps yielding the MAX intervention program: (1) identifying and defining the problem, (2) establishing realistic and achievable goals for problem resolution, (3) generating multiple solution alternatives through brainstorming, (4) evaluating each solution by weighing potential positive and negative consequences to choose the ideal solutions, (5) developing detailed solution plan based on the

results of evaluation, (6) implementing the preferred solution plan, and (7) assessing the outcome and modifying the solution plan as needed. Occupational therapists (OTs) are often responsible for educating patients about EC strategies, and embedding that education into the MAX intervention program is appropriate for several reasons. OTs have expertise in activity analysis, which is used to analyze the component tasks constituting an activity and identify skills needed to do the activity (Latham, 2008). Also, OTs frequently help people compensate for their impairments by teaching them new skills or strategies, which is consistent with EC techniques. By using the MAX intervention along with their clinical expertise, OTs can guide CA survivors through the structured steps of the MAX intervention, incorporating appropriate EC strategies. Lastly, each MAX intervention plan can be individualized, which increases the fit between the client and the plan and increases the probability of goal achievement.

3.1.2 Significance

This study has significance for several reasons. Survivors of CA still experience fatigue even 3 years after the event (Wachelder et al., 2009). Also, fatigue is frequently associated with depression, physical and emotional health and in turn, negatively affects performance in basic and instrumental activities of daily living, quality of life, and overall survival rates (Diaz et al., 2008; Evangelista et al., 2008; Hardy & Studenski, 2008; Moreh, 2009; Norberg et al., 2008). Importantly, fatigue in post-CA adults has not been adequately addressed. According to Wachelder et al. (2009), information about prognostic factors for functioning and quality of life in CA survivors is scarce. Although many studies investigating fatigue in people with other cardiac disorders, such as congestive heart failure (CHF) or myocardial infarction, can be found, little is known regarding fatigue and functional outcomes in survivors of CA. In addition, no

cognitive intervention that mainly focuses on managing fatigue or improving functional abilities in people with cardiac conditions was found. Although exercise is frequently prescribed for people with cardiac conditions, the training tends to focus more on physical abilities, not on fatigue or performance in daily activities, and has failed to significantly improve functional abilities (Dracup et al., 2007; Prescott et al., 2009). Therefore, an intervention that can be used to improve functional abilities, by means of fatigue management in post-CA adults, is urgently needed. This study tested one intervention for post-CA fatigue.

3.2 STUDY AIMS AND HYPOTHESES

The aim of this study was to examine the effectiveness of the MAX intervention for reducing the impact and severity of fatigue, improving perceived performance in daily activities, and increasing participation in daily activities in post-CA adults.

We hypothesized that

a) (Ha) at posttest, participants would show significantly lower fatigue severity, fatigue impact, and overall fatigue compared to their pretests; and
b) (Hb) at posttest, participants would show significantly better perceived performance and higher participation in daily activities compared to their pretests.

3.3 RESEARCH DESIGN AND METHODS

3.3.1 Research design

A prospective, experimental, pre-post cohort design was used for this study. With this design, all participants benefited from the MAX intervention, while researchers gained insights into the effectiveness of the MAX intervention for reducing fatigue. Participants were assessed two times: pretest and posttest. After the pretest, participants received the MAX intervention for 4 weeks. The posttest occurred at Week 5 (see Figure 3.1).

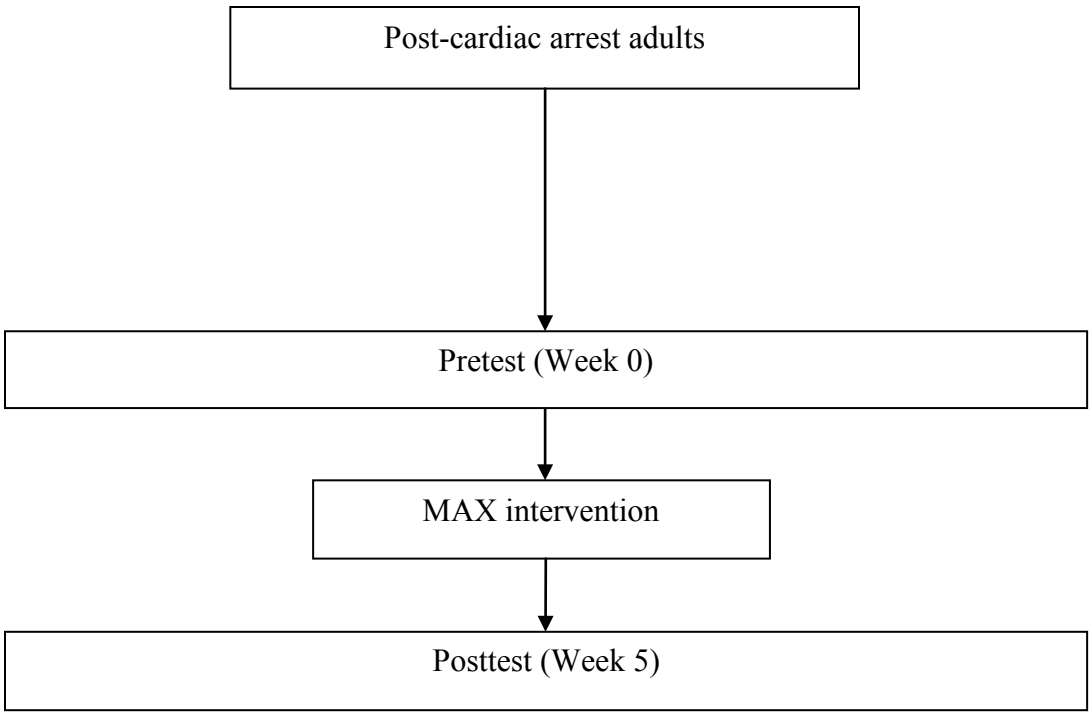

Figure 3.1: Flow of the study design

3.3.2 Participants

Individuals who were at least 3 months post-CA were eligible to participate in the study. Clinical staff referred potential participants from the University of Pittsburgh Medical Center Emergency Departments, follow-up clinics, inpatient and outpatient hospital units, or rehabilitation centers based on the study criteria. The inclusion and exclusion criteria are provided in Table 3.1.

Table 3.1: Inclusion and exclusion criteria and measures

Criteria	Rationale for the Criteria
	Inclusion Criteria
At least 3 months post-CA	At 3 months post-CA, fatigue is considered "chronic."
Presence of moderate-to-severe fatigue: ≥ 4 score of FSS	Because of the nature of the intervention, participants had to have moderate-to-severe fatigue. A score ≥ 4 on the FSS was considered as having moderate-to-severe fatigue.
Availability of landline telephone or cell phone	Because the intervention would be provided by telephone, individuals needed access to any type of telephone.
Living within 150 miles of the University of Pittsburgh, Oakland	Because all pretest assessments were conducted in participants' homes, individuals needed to live no further than 150 miles from the Oakland campus of the University of Pittsburgh.
Functional English fluency and literacy	To understand the content of consultations and information in the Participant Workbook, individuals had to have functional English fluency and literacy.
Community resident	Individuals living in the community had the opportunity to encounter more problems from chronic fatigue than those in institutions.
	Exclusion Criteria
No presence of fatigue: < 4 score on the FSS	To benefit from the MAX intervention, participants had to experience at least moderate fatigue.
Cognitive impairment	To understand the Participant Workbook and follow the procedures of the MAX intervention, participants could not have cognitive impairment.

Note. CA = cardiac arrest; FSS = Fatigue Severity Scale; MAX = maximizing energy.

3.3.3 Descriptive measures

3.3.3.1 **Demographic and medical information** After participants gave informed consent and were determined to meet inclusion and exclusion criteria, their demographic information, including age, gender, race, education, current marital status, current living environment, current living status, vocational status pre- and post-CA, and medical information (out-of- or in-hospital CA, presumed cardiac etiology, witnessed CA, bystander cardiopulmonary resuscitation, rhythm when CA, rescue shocks, hypothermia, duration of coma, duration of intubation, intensive care unit length of stay, total inpatient length of stay, and time from CA) were collected from the medical record. If there was any missing information in the medical record, participants were interviewed about it during the pretest. At pretest, participants were scheduled for standardized descriptive and outcome measures. The results from these measures were used to characterize the participants and to establish baseline status.

3.3.3.2 **The Computer-based Assessment of Mild Cognitive Impairment (CAMCI)** The CAMCI is a self-administered and computerized assessment for testing cognitive impairment. It is comprised of seven subtests modified from standard neuropsychological tests and a virtual reality shopping trip. These two approaches of the CAMCI measure attention, executive function, processing speed, verbal memory, nonverbal memory, functional memory, and incidental memory. Individuals go through the assessment using a touch screen on a tablet computer. Once the test is done, the CAMCI automatically calculates and interprets the scores. The results are reported using percentile scores: 0 to 9 indicating high risk of mild cognitive impairment; 10 to 20 indicating moderately high risk; 21 to 30 indicating moderate risk; 31 to 40 indicating moderately low risk and; 41 to 100 indicating low risk. It has shown high test-retest reliability,

sensitivity, and specificity (Nieto, Albert, Morrow, & Saxton, 2008; Saxton et al., 2009). The estimated time to administer the CAMCI is 25 minutes.

3.3.3.3 **The Center for Epidemiologic Studies Depression Scale (CES-D)** The CES-D is a self-report scale measuring the level of depressive symptomatology of the preceding 7 days. It has 20 items that examine perceived mood and individuals' level of functioning. Scoring is done on an ordinal scale ranging from 0 (rarely or none of the time) to 3 (all of the time). The total score ranges from 0 to 60, with higher scores indicating more depressive symptoms. If a person scores ≥ 16, the person is considered as showing clinical symptoms of depression. This scale has been found to be reliable and valid (Radloff, 1977; Shinar et al., 1986). The estimated time to administer the CES-D is 10 minutes.

3.3.3.4 **The Keitel Functional Test (KFT)** The KFT is a performance-based test with 24 items. It evaluates the active range of motion of the upper and lower extremities and the spinal column. Each item is scored based on a different scale, and the total score ranges from 4 to 100. The higher the score, the more restricted the active range of motion and strength (Eberl, Fasching, Rahlfs, Schleyer, & Wolf, 1976). The estimated time to administer the KFT is 10 minutes.

3.3.3.5 **The Modified Rankin Scale (MRS)** The MRS measures global disability. On the MRS, an individual's disability is rated using a 7-point scale ranging from 0 (no symptoms at all) to 6 (death). Therefore, the higher the score, the more severe the disability. The MRS scores can be obtained by interviewing individuals or by reviewing medical records (Salgado, Ferro, & Gouveia-Oliveira, 1996; van Swieten, Koudstaal, Visser, Schouten, & van Gijn, 1988; Wilson et al., 2005). The MRS has been shown to have high reliability and validity (Kwon, Hartzema,

Duncan, & Lai, 2004; Quinn, Dawson, Walters, & Lees, 2009). The estimated time to administer the MRS is 5 minutes.

3.3.3.6 **The Cerebral Performance Scale (CPC)** The CPC assesses neurological status after CA. The CPC has five categories: CPC 1 = conscious with good cerebral performance; CPC 2 = conscious with moderate cerebral disability; CPC 3 = conscious with severe cerebral disability; CPC 4 = persistent vegetative state; and CPC 5 = brain death or clinical death (Edgren, Hedstrand, Kelsey, Sutton-Tyrrell, & Safar, 1994; Jennett & Bond, 1975). Therefore, the higher the score, the more impaired the neurological status. The CPC has been shown to be reliable and has fair to good correlations with the Health Utilities Index Mark 3 and the MRS (Raina et al., 2008). The estimated time to administer the CPC is 2 minutes.

3.3.3.7 **The Health Utilities Index Mark 3 (HUI 3)** The HUI 3 is a generic instrument measuring health-related quality of life (HRQL). The HUI 3 assesses eight health attributes, including vision, hearing, speech, ambulation, dexterity, emotion, cognition, and pain, with 41 items and can be obtained either by self-report or proxy-report. Single- and multi-attribute utility functions are used to score the HUI 3 and convert descriptive information into utility scores. As a result, we can obtain two kinds of scores: single-attribute scores indicating a score for each attribute, and a multi-attribute score, indicating the overall HRQL score. These scores range from 1.00 to -0.36. In this range, 1.00 indicates perfect health, 0 indicates dead, and negative scores indicate worse than being dead (Feeny et al., 2002; Furlong, Feeny, Torrance, & Barr, 2001). Differences of 0.03 or greater in mean overall HRQL scores can be considered as clinically important (Horsman, Furlong, Feeny, & Torrance, 2003). The HUI 3 has been shown to possess adequate reliability and validity (Kavirajan, Hays, Vassar, & Vickrey, 2009; Lovrics, Cornacchi,

Barnabi, Whelan, & Goldsmith, 2008) and has been used in CA survivors (Nichol et al., 1999; Stiell et al., 2003; Stiell et al., 2009). The estimated time to administer the HUI 3 is 10 minutes.

3.3.4 Outcome measures

To examine the effectiveness of the intervention, we collected data on fatigue, activities, and participation using six assessments. Among the outcome measures, the Modified Fatigue Impact Scale (MFIS) was our primary outcome because chronic fatigue often negatively impacts individuals' performance in general functional activities. The MAX intervention allows participants to select everyday activities that are hindered due to fatigue and generate solutions that allow participation in those activities.

3.3.4.1 **The Modified Fatigue Impact Scale (MFIS)** The MFIS, modified from the Fatigue Impact Scale (Fisk et al., 1994), is a self-report instrument which asks about how fatigue has affected performance in functional activities. The MFIS has 21 items in three subscales: physical subscale with nine items, cognitive subscale with 10 items, and psychosocial subscale with two items (National Multiple Sclerosis Society, 1997). The MFIS has been used in various populations, including multiple sclerosis, traumatic brain injury, and congestive heart failure (Hugos et al., 2010; Sendroy-Terrill, Whiteneck, & Brooks, 2010; Stroud & Minahan, 2009; Tsai, 2008), and reliability, reproducibility, and validity of the MFIS have been established (Kos et al., 2005). The estimated time to administer the MFIS is 5 minutes. A 5-point scale ranging from 0 (never) to 4 (almost always) is used for rating, and the maximum MFIS score is 84, which is the sum of all item scores. In addition, the total scores of the subscales are the sum of the subscale item scores and range from 0 to 36 for the physical subscale, 0 to 40 for the cognitive subscale,

and 0 to 8 for the psychosocial subscale. The higher the total scores, the greater the impact of fatigue.

3.3.4.2 **The Fatigue Severity Scale (FSS)** The FSS is a reliable and valid questionnaire for measuring fatigue. First, the assessor reads nine items, and then responses are made on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). The FSS has been used in people with systemic lupus erythematosus, multiple sclerosis, sleep-wake disorder, Parkinson's disease, chronic hepatitis C as well as stroke, and CA (Goulart et al., 2009; Kleinman et al., 2000; Lerdal, Wahl, Rustoen, Hanestad, & Moum, 2005; Mattsson, Moller, Lundberg, Gard, & Bostrom, 2008; Valko, Bassetti, Bloch, Held, & Baumann, 2008). The estimated time to administer the FSS is 5 minutes. The total score of the FSS is the mean of scores from the nine items, and a higher score indicates having more severe fatigue (Krupp, LaRocca, Muir-Nash, & Steinberg, 1989).

3.3.4.3 **The Patient-Reported Outcomes Measurement Information System Fatigue Scale (PROMIS FS)** The PROMIS FS is a computerized adaptive test measuring the experience and impact of fatigue. The pool of items related to fatigue in PROMIS was developed through several steps. First, PROMIS investigators developed an item bank by gathering items from well-established instruments. Then, the investigators sorted the items and chose the most representative and informative ones. Lastly, through qualitative item review, items were added or modified. There are 95 items for fatigue in PROMIS. However, individuals are usually given 5-10 items because the PROMIS FS utilizes a computerized adaptive system. At pretest and posttest the principal investigator assessed participants using a tablet PC equipped with a mobile broadband card. The estimated time for answering the 5-10 questions is 2 minutes ("Patient-Reported Outcomes Measurement Information System," n.d.). The total score ranges from 10 to

90. The average score of the US general population is 50, and the higher the total score, the worse the fatigue.

3.3.4.4 **The Performance Assessment of Self-Care Skills – Self-report (PASS-SR)** The PASS-SR— a self-report version of the PASS—contains 26 daily living tasks in four domains: functional mobility with 5 tasks; personal care with 3 tasks; cognitively oriented instrumental activities of daily living with 14 tasks; and physically oriented instrumental activities of daily living with 4 tasks. Individuals are asked what they routinely do (habit) and what they could do (skill) for each task. The estimated time to administer the PASS-SR is 10 minutes. Each task is scored using a 4-point scale ranging from 3 (do without difficulty and any type of help) to 0 (do not do). Scores for habit and skill are calculated separately as means for all 26 tasks. Also, domain scores can be calculated by taking means of tasks included in each domain (Rogers et al., 2003). The total mean score ranges from 3 to 0, and the higher mean score indicates less difficulty in performing activities of daily living.

3.3.4.5 **The Functional Activities Questionnaire (FAQ)** The FAQ is an instrument that examines the higher level instrumental activities of daily living (IADL) functions of older adults using an informant, such as a spouse or close friend. The developers of the FAQ included instrumental activities that were thought to be universal to the subjects of their study. In the original FAQ, there were 10 items related to instrumental activities, such as handling business affairs, keeping track of current events, and remembering appointments, and these activities were scored using a 4-point scale from 0 (independence) to 3 (dependence). Also, if an individual does not perform an activity in his or her daily life, it could be scored either as 0 (could do if required) or 1 (would not be able to do if required). The FAQ is shown to have strong correlations with the

IADL scale, the Mini-Mental State Exam, the Symbol Digit Modalities test, and the Mental Status Questionnaire (Pfeffer, Kurosaki, Harrah, Chance, & Filos, 1982; McDowell, 2006). Although the authors modified the original FAQ by adding four activities of daily living and one item on initiative (McDowell, 2006), the original version was be used here because the FAQ will be used here to measure participants' performance of instrumental activities. Also, participants self-reported their level of IADL functions instead of using reports of proxies. The estimated time to administer the FAQ is 10 minutes. A total score can be calculated by summing the scores of the 10 questions, ranging from 0 to 30, and a higher total score indicates having more difficulty performing daily activities.

3.3.4.6 **The Participation Objective, Participation Subjective (POPS)** The POPS is a reliable and valid assessment consisting of two measures: an objective measure of participation and a subjective measure of participation. POPS consists of 26 items in 5 subscales: domestic life with eight items; interpersonal interactions and relationships with eight items; major life areas with three items; transportation with two items; and community, recreational, and civic life with five items. In the Participation Objective (PO) portion of the POPS, an individual is asked about items in different ways based on the subscale: for items in domestic life, the proportion of the activity which the individual performs (all, most, some, or none); for items in major life areas and transportation, number of hours per month; for items in interpersonal interactions and relationships, and community, recreational and civic life, frequency of occurrence per month. In the Participation Subjective (PS) portion of the POPS, individuals are asked two types of questions for each item. The first question is how important to an individual's satisfaction the item is. An individual answers this question with values ranging from 4 (most) to 0 (not important). The second question is "Would you like to change your current level of

engagement?" Responses are scored as follows: "more" or "less" = -1 and "same" = +1. Scores for the PO and the PS are calculated separately. For the PO scores, standardized z scores are calculated, which range from -3 (the least proportion, frequency, or hours) to +3 (the greatest proportion, frequency, or hours). The PS scores can range from +4, indicating participating in the most important area with satisfaction, to -4, participating in the most important area, but wanting to engage either more or less (Brown et al., 2004). The estimated time to administer the POPS is 10 minutes.

3.3.4.7 **8-item Client Satisfaction Questionnaire (CSQ-8) and Understanding of Materials Scale (UMS)** In this first implementation of the MAX intervention in persons with post-CA fatigue, we assessed the acceptability and usability of the intervention. At the completion of the intervention, participants were asked to rate the CSQ-8. Each item is scored on a 4-point ordinal scale ranging from 1 to 4. Individual item scores are summed to provide a total score ranging from 8 - 32. Higher scores are indicative of greater satisfaction (Larsen, Attkisson, Hargreaves, & Nguyen, 1979). To assess the clarity of the Participant Workbook, all participants completed the UMS (Dumas & Derish, 1999). The scale consists of 10 items, and each item is scored on a 5-point ordinal scale (0 = very difficult to understand; 5 = easy to understand). Individual items scores are summed to provide a total score ranging from 0 to 50, with higher scores indicating greater understanding of the materials.

3.3.5 Procedures

3.3.5.1 **Recruitment and informed consent procedures** Following approval of the study by the University of Pittsburgh Institutional Review Board, subjects were recruited through cardiac care clinicians, researchers, and/or advertisement in clinics. The flyer used for the advertisement included information about the purpose of this study, the potential benefits of participation, eligible ages for participation, and contact numbers for the investigator who also served as the pretest assessor and interventionist. If there were individuals who were at least 3 months post-CA and showed interest in this study, clinicians or researchers referred them to the research team members or asked the individuals to contact research team members. If there were individuals who showed interest in this study, but were not at least 3 months post-CA, clinicians or researchers obtained contact information so they could be contacted at a later date. Sign-up sheets were kept in a locked file cabinet so no confidential information would be disclosed.

3.3.5.2 **Screening procedure** Inclusion and exclusion criteria were used to screen participants. After obtaining verbal consent to be screened for study eligibility, the investigator first asked questions about the date of their last CA, availability of landline telephone or cell phone, distance from their house to University of Pittsburgh in Oakland, their functional English fluency and literacy, and type of residence. Then, the investigator assessed the individuals with the FSS to check the presence of fatigue. If individuals obtain a score ≥ 4 in the FSS, they were considered as having moderate-to-severe fatigue, and screening continued to rule out the second criterion, impaired cognition. Individuals were deemed to have appropriate cognitive abilities if, after explaining the study to potential participants, they correctly identified (a) the purpose of the study, (b) their role in the study, (c) the number of times they would be assessed, and (d) how the

intervention would be delivered (by telephone). If all these criteria were met, research staff set the time with the participants to obtain the informed consent form and conduct pretest measures. However, if individuals did not meet all the criteria, the screening process was discontinued, and they were told that they were not eligible to participate in the study and thanked for their interest in CA research. For those who were not eligible to participate initially (< 3 months post-CA), but expressed interest in the study and provided telephone numbers, the investigator contacted the individuals at 3 months post-CA. If the individuals still had an interest in the study, the investigator obtained verbal consent to screen them for study eligibility.

3.3.5.3 **Follow-up procedures** All participants were assessed at two time points: pretest and posttest (Week 5). At pretest, descriptive and outcome measures were administered by the investigator. Posttest assessments, the CSQ-8 and the UMS were administered by an OT or occupational therapy graduate students who were masked to the purpose of the study. All assessors were trained and competent in all assessment used for descriptive and outcome measures. All descriptive and outcome measures were conducted in person or by telephone (see Table 3.2).

Table 3.2: Assessment times for descriptive and outcome measures

Measures	Time to Administer	P	PT
Descriptive measures			
Computer-based Assessment of Mild Cognitive Impairment	25 min	X	-
Center for Epidemiologic Studies Depression Scale	10 min	X	-
Keitel Functional Test	10 min	X	-
Modified Rankin Scale	5 min	X	-
Cerebral Performance Category	2 min	X	-
Health Utilities Index Mark 3	10 min	X	-
Outcome measures			
Fatigue Severity Scale	5 min	X	X
Modified Fatigue Impact Scale	5 min	X	X
PROMIS Fatigue Scale	2 min	X	X
Performance Assessment of Self-Care Skills – Self-report	10 min	X	X
Participation Objective, Participation Subjective	10 min	X	X
Functional Activities Questionnaire	10 min	X	X
8-item Client Satisfaction Questionnaire	5 min	-	X
Understanding of Materials scale	5 min	-	X

Note. P = p retest; PT = p osttest; PROMIS = Patient-Reported Outcomes Measurement Information System.

3.3.5.4 **MAX intervention procedures** With the pre-post cohort design, all subjects received the MAX intervention immediately. The MAX intervention procedures were administered by the investigator trained in PST and having expertise in EC. The intervention was delivered "live" by telephone. Each MAX intervention session was planned to last approximately 45 minutes and occur twice a week for up to 4 weeks. However, if participants missed a session or fell behind due to scheduling issues, the MAX intervention was planned to be provided to the participants until they participated in eight sessions or solved two fatigue-related problems. Therefore, the MAX intervention was planned to be terminated when the participants identified and solved two fatigue-related problems or had participated in the intervention for eight sessions. If a participant was unable to solve two fatigue-related problems by the end of the eighth session of the MAX intervention, the intervention ended. Also if participants could not tolerate intervention sessions, they could choose to discontinue participation. Lastly, if participants did not participate in the telephone call appointments for 4 times without any notice, they could be eliminated from the study.

At the end of the pretest session, the investigator introduced several topics to the participants and asked them to read three sections (fatigue and cardiac arrest, fatigue – a vicious cycle, and budgeting and banking energy) in the Participant Workbook before Session 1. Participants were also asked to identify fatigue-related problems that prevented them from participating in everyday life prior to Session 1, which was typically held within one week of the pretest. During Session 1, the investigator answered questions that the participants had from the pretest. The fatigue-related experiences and problems identified by participants were discussed, and participants prioritized the two most critical fatigue-related problems that they wanted to solve during the MAX intervention.

Of the two fatigue-related problems identified during Session 1, participants chose which problem they wanted to address at the next session. During Session 2, participants practiced the steps of the MAX intervention with Problem 1. At the end of Session 2, a clearly defined action plan for solution implementation was identified. Participants were then asked to implement the solution over the next few days. Session 3 took place within a week of Session 2. The investigator and participant reviewed the problem, the identified solution, and its implementation. Facilitators and barriers to the implementation of the action plan were also reviewed. If participants reported that the solution did not help with problem resolution, the investigator again implemented the intervention steps to either modify the solution or facilitate the generation of a new solution. If participants felt that they had an acceptable and implementable solution for the current problem, the next problem was addressed. A Participant Workbook was an integral part of the MAX intervention and was reorganized and modified from the original version to be appropriate for the current study (see Table 3.3). It was organized to contain: (a) logistical information regarding the intervention, (b) factual information regarding fatigue after CA, (c) information regarding EC techniques, and (d) worksheets to develop skills to recognize and solve fatigue-related problems. The Participant Workbook was provided to the participants at the end of the pretest and used throughout the intervention. The participants were also able to keep and reference the Workbook once their participation in the study ended.

Table 3.3: Table of contents for the Participant Workbook

Contents
1. Contact information for research team with pictures
2. Introduction of the MAX intervention
3. Structure of the participant manual
4. Ground rules for sessions
5. Facts regarding fatigue after cardiac arrest
6. Fatigue - a vicious cycle
7. Budgeting and banking energy Making active choices about activities you are going to do
8. Max intervention steps Modifying activities MODE (Method, Objective, Device, Environment) method The importance of rest Communicating with family and friends about fatigue
9. Balancing your schedule
10. Work sheets for use during sessions

3.3.5.5 **MAX process assessments** To assess the participants' adherence to protocol, we collected data on the number of not-completed homework assignments and reasons for the non-completion. During appropriate sessions, the investigator examined whether the participant had completed the homework from the previous sessions on a 4-point ordinal scale (1 = not

completed, 2 = completed, unsatisfactory, 3 = partially completed, satisfactory, 4 = completed, satisfactory). Reasons for non-completion of the homework were sought from the participants. In addition, we collected data on the number of sessions engaged in by the participants and reasons for missed appointments and reasons for dropping out of the study.

To assess treatment fidelity, we assessed the extent to which the investigator performed the intervention according to the protocol. One of the co-investigators (MBH) audited randomly selected sessions (10%) using the study protocol. Any protocol drift was discussed with the investigator. Reasons for deviations from the protocol and strategies to avoid deviations in the future were discussed.

3.3.6 Statistical analyses

3.3.6.1 **Sample size calculation** This study was the first to examine the effectiveness of a cognitive intervention for cardiac arrest survivors with chronic fatigue. The variability in fatigue scores and potential effect sizes were unknown. Therefore, we aimed to recruit 20 participants in 1 year, to estimate variability and to test the feasibility of a cognitive intervention for reducing fatigue.

3.3.6.2 **Data management** All collected data were entered into IBM SPSS Statistics 19. ID numbers instead of participants' names were used in this database. The linking file that contained both participants' names and ID numbers was created separately and stored on a password protected computer.

3.3.6.3 **Data analysis** Descriptive statistics were used to document the demographic and medical information of the participants as well as for the following clinical measures: CAMCI, CES-D, KFT, MRS, CPC, and HUI 3.

We performed crosstabulations to examine whether changes in outcome measures were influenced by pretest-descriptive measure, CES-D, and MFIS scores. Specifically, we first divided the participants into two groups using the results of the MFIS or CES-D: participants who improved in fatigue impact [≤ 0 for (posttest MFIS total scores – pretest MFIS total scores)] or those who showed no change or worsened in fatigue impact; participants who showed depressive symptoms (≥ 16 on the CES-D) and those who did not. Then participants were divided into two groups for each descriptive and outcome measure using the median-split, and the participant with the median value was included in the better group. Lastly, crosstabulations

were generated for the two groups in each descriptive and outcome measure by the two CES-D-referenced groups and by the two MFIS-referenced groups.

Hypotheses were tested using dependent t-tests with the study outcome measures (PROMIS FS, FSS, MFIS, PASS-SR, FAQ, and POPS). We performed exploratory data analyses to test the assumptions required for dependent t-tests prior to our main analyses. If the assumption of "normal data distribution" was violated, data transformation was performed. If any of the assumptions for dependent t-tests were still violated, Wilcoxon Signed Rank tests were used instead. For all analyses, the alpha level of $p < .05$ was used to determine significance. Lastly, effect sizes (r) were also calculated for all outcomes measures. To calculate effect size r, effect size d can be calculated first. The formula to calculate effect d is $d = (Mpre - Mpost)/SD$ where $Mpre$ is the mean of the pretest result and $Mpost$ is the mean of the posttest result. Then, effect size r can be calculated using formula $r = \sqrt{\frac{d^2}{d^2+4}}$. The r value between .10 and .23 is considered as a small effect; the r value between .24 and .36 is considered as a moderate effect; the r value between .37 and .70 is considered as a large effect; and the r value greater than .71 is considered as a very large effect. For the MFIS, dimension scores were analyzed in addition to the total scores. However, we decided not to use a Bonferroni correction for these sub-analyses considering the small number of participants and possible valuable information from these sub-analyses. Lastly, means and standard deviations of the results of the CSQ-8 and UMS were calculated.

3.4 RESULTS

Recruitment began on August, 2010, and the last participant for this phase of the study received the posttest in October, 2011. The numbers of people referred and the numbers of CA survivors who went through the screening process, were determined eligible and participated in and completed the study are provided in Figure 3.2. Also, the reasons for exclusion from the study are provided. Lastly, the frequency histogram showing the number of CA survivors in each range of the FSS scores for 25 CA survivors screened is provided in Figure 3.3.

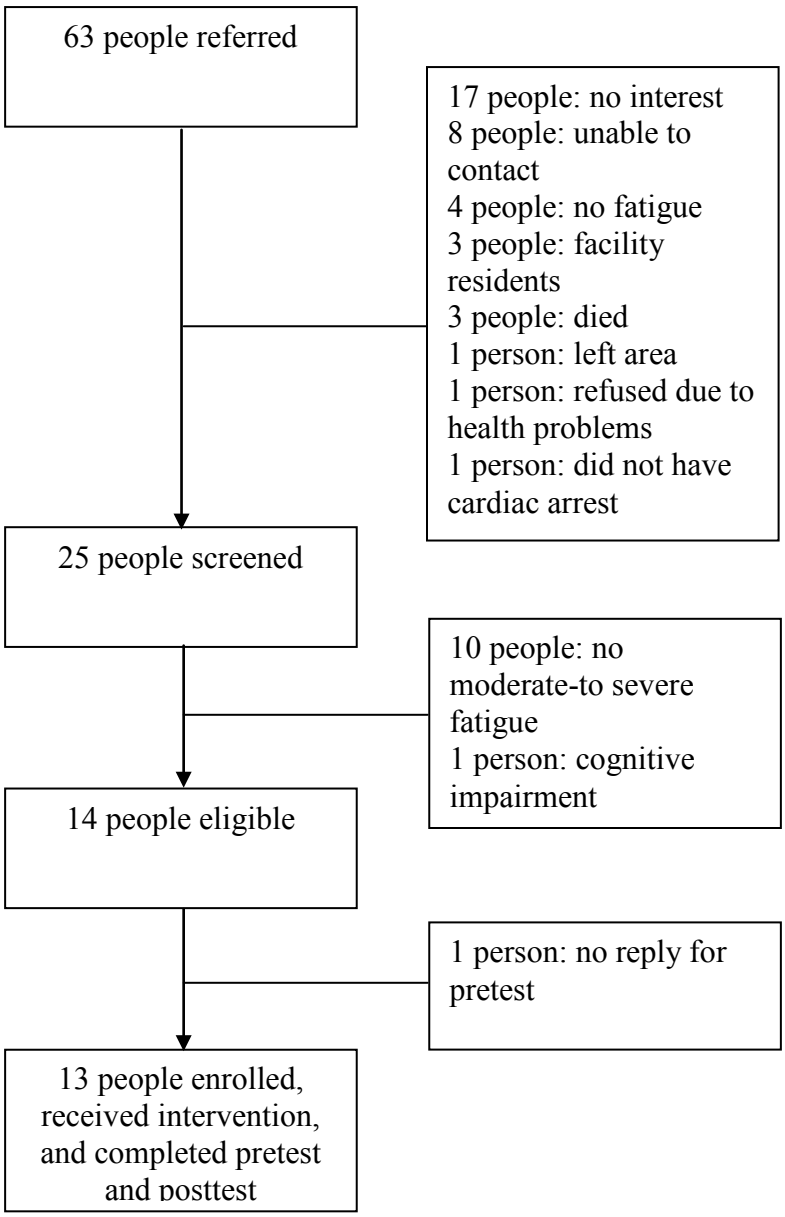

Figure 3.2: Flow of screening process and study completion

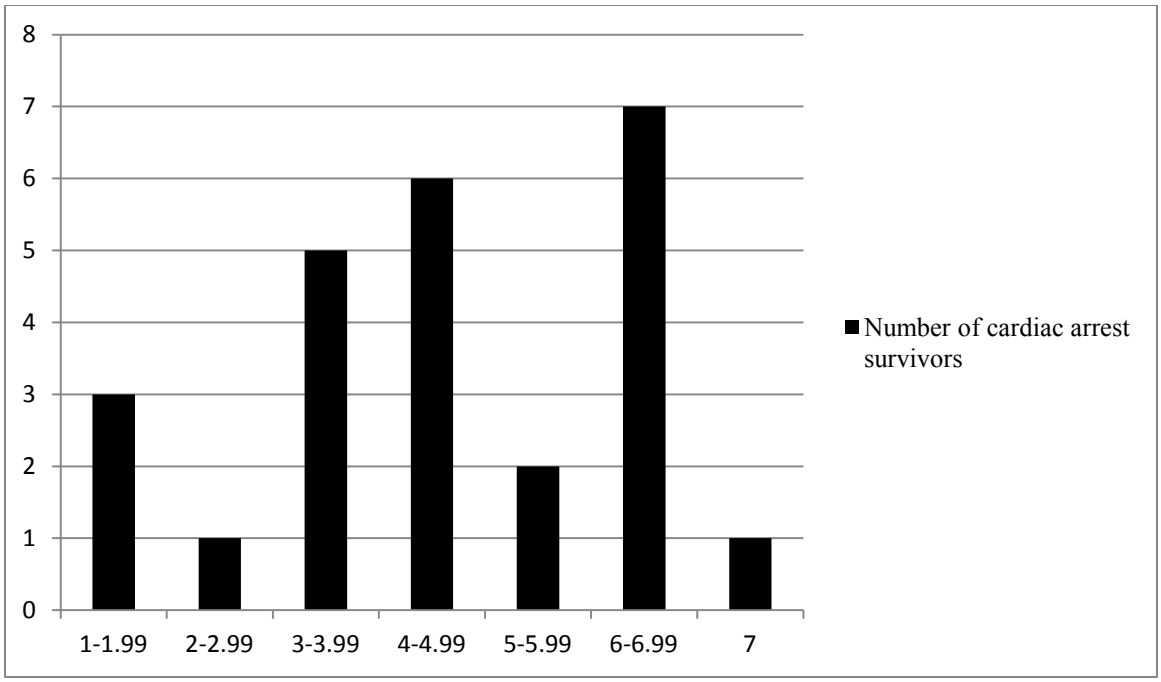

Figure 3.3: Fatigue Severity Scale scores for 25 cardiac arrest survivors at screening

3.4.1 Results of descriptive measures

A total of 13 CA survivors participated in this phase of the study. The mean age in years was 52.31 (*SD* = 9.31), and the majority were white males. All participants had at least a high school education and lived with someone, except for one participant. The majority had an out-of-hospital CA and cardiac etiology. All participants had a CA less than 8 months (226 days) before their participation in this study, except for one participant, who had a CA approximately 7 years before her participation. All participants had a cardiac etiology, and the majority had a witnessed CA with bystander cardiopulmonary resuscitation (see Table 3.5). According to the CAMCI, all participants were at low risk for mild cognitive impairment except three: the first had a moderate risk, the second a moderately high risk and the last a high risk. Also, 9 of 13 participants scored

16 or greater on the CES-D, which indicated that those nine participants reported depressive symptoms. The participants' baseline characteristics in terms of descriptive measures are provided in Table 3.4.

Table 3.4: Demographic and medical information and baseline characteristics of the participants

	Range	Participants (*N* = 13)
Age, years, *M (SD)*	39 – 66	52.31 (9.31)
White (%)	-	13 (100)
Male (%)	-	8 (61.5)
Highest education completed (%)		
High school	-	8 (61.5)
Partial college	-	2 (15.4)
Full college	-	2 (15.4)
Graduate/professional training	-	1 (7.7)
Engaged in paid-work		4 (30.8)
Before CA (%)	-	7 (53.8)
After CA (%)	-	4 (30.8)
Married (%)	-	7 (53.8)
Living alone (%)	-	2 (15.4)

Table 3.4 (continued).

	Range	Participants (*N* = 13)
Living environment		
House (%)	-	9 (69.2)
Apartment or condominium (%)	-	3 (23.1)
Mobile home (%)	-	1 (7.7)
Out-of-hospital CA (%)	-	9 (69.2)
Cardiac etiology (%)	-	13 (100)
Days since CA	96 – 2518	110
Witnessed CA (%)	-	9 (69.2)
Bystander CPR (%)	-	8 (61.5)
Ventricular fibrillation/tachycardia rhythm (%)	-	13 (100)
Rescue shocks achieved (%)	-	11 (84.6)
Hypothermia achieved (%)	-	7 (53.8)
Duration of coma, days, *M (SD)* (*n* = 8)	1 – 5	2.75 (1.17)
Duration of intubation, days, *M (SD)* (*n* = 10)	2 – 26	5.7 (7.42)
Length of stay		
Intensive care unit, days, *M (SD)*	1 – 17	5.54 (4.22)
Total inpatient, days, *M (SD)*	2 – 28	10.92 (6.61)
MRS, *M (SD)*	-	1.92 (0.95)
CPC, *M (SD)*	-	1.85 (0.90)
CAMCI, *M (SD)*	-	52.15 (23.17)
CES-D, *M (SD)*	-	22.54 (10.63)
KFT, *M (SD)*	-	13.62 (8.21)
HUI-3, *M (SD)*	-	0.47 (0.36)

Note. CA = cardiac arrest; CPR = cardiopulmonary resuscitation; MRS = modified Rankin Scale; CPC = C erebral Performance Category; CAMCI = Computer Assessment of Mild Cognitive Impairment; CES-D = Center for Epidemiologic Studies Depression Scale; KFT = Keitel Function Test; HUI-3 = Health Utilities Index Mark 3.

3.4.2 Procedural results

The participants received a median of four MAX sessions (range 3-5), and the mean time for each MAX session was 37 minutes and 50 seconds. Two men participated in only three MAX sessions: 1) one participant had a family emergency that prevented him from attending more sessions, and 2) the other solved one problem by himself and could not identify any additional problems. Also, one man participated in five MAX sessions because he fell asleep during one of the sessions due to fatigue. Other than those three participants, all participants attended four MAX sessions. Lastly, all participants successfully completed homework, including reading Participant Workbook chapters, having time to think about fatigue-related problems, and implementation of action plans.

3.4.3 Results of crosstabulations among fatigue impact, depressive symptoms, and descriptive and outcome measures

At the pretest, more participants who improved in the MFIS at the posttest had better outcomes than worse outcomes for four of six descriptive measures (mRS, CPC, KFT, and HUI-3). Also, more participants who improved in the MFIS at the posttest had better outcomes than worse outcomes for six of seven outcome measures (FSS, PROMIS-FS, PASS-SR habit and skill, and POPS objective and subjective). In contrast, more participants who showed depressive symptoms at the pretest had better outcomes than worse outcomes for only one of five descriptive measures (mRS, CAMCI, KFT, and HUI-3). However, more participants who showed depressive symptoms at the pretest had better outcomes than worse outcomes in the seven of eight outcome

measures (MFIS, FSS, PROMIS-FS, PASS-SR habit and skill, FAQ, and POPS objective and subjective) (see Table 3.5).

Table 3.5: Changes in function based on pretest status

Descriptive or outcome measures	Improved in the MFIS (%) (n = 9)	No change or worsened in the MFIS (%) (n = 4)	No depressive symptoms (%) (n = 4)	Depressive symptoms (%) (n = 9)
mRS				
Better	7 (77.8)	1 (25)	4 (100)	4 (44.4)
Worse	2 (22.2)	3 (75)	0 (0)	5 (55.6)
CPC				
Better	7 (77.8)	2 (50)	4 (100)	5 (55.6)
Worse	2 (22.2)	2 (50)	0 (0)	4 (44.4)
CAMCI				
Better	4 (44.4)	3 (75)	3 (75)	4 (44.4)
Worse	5 (55.6)	1 (25)	1 (25)	5 (55.6)
CES-D				
No depressive symptoms	3 (33.3)	1 (25)	-	-
Depressive symptoms	6 (66.7)	3 (75)	-	-
KFT				
Better	7 (77.8)	1 (25)	4 (100)	4 (44.4)
Worse	2 (22.2)	3 (75)	0 (0)	5 (55.6)
HUI-3				
Better	5 (55.6)	2 (50)	4 (100)	3 (33.3)
Worse	4 (44.4)	2 (50)	0 (0)	6 (66.7)
MFIS				
Improved	-	-	3 (75)	6 (66.7)
No change or worsened	-	-	1 (25)	3 (33.3)
FSS				
Better	7 (77.8)	0 (0)	1 (25)	6 (66.7)
Worse	2 (22.2)	4 (100)	3 (75)	3 (33.3)
PROMIS-FS				
Better	6 (66.7)	1 (25)	2 (50)	5 (55.6)
Worse	3 (33.3)	3 (75)	2 (50)	4 (44.4)

Table 3.5 (continued).

Descriptive or outcome measures	Improved in the MFIS (%) (n = 9)	No change or worsened in the MFIS (%) (n = 4)	No depressive symptoms (%) (n = 4)	Depressive symptoms (%) (n = 9)
PASS-SR, habit				
Better	7 (77.8)	2 (50)	3 (75)	6 (66.7)
Worse	2 (22.2)	2 (50)	1 (25)	3 (33.3)
PASS-SR, skill				
Better	7 (77.8)	1 (25)	3 (75)	5 (55.6)
Worse	2 (22.2)	3 (75)	1 (25)	4 (44.4)
FAQ				
Better	3 (33.3)	4 (100)	3 (75)	4 (44.4)
Worse	6 (66.7)	0 (0)	1 (25)	5 (55.6)
POPS-Objective				
Better	5 (55.6)	2 (50)	1 (25)	6 (66.7)
Worse	4 (44.4)	2 (50)	3 (75)	3 (33.3)
POPS-Subjective				
Better	5 (55.6)	2 (50)	1 (25)	6 (66.7)
Worse	4 (44.4)	2 (50)	3 (75)	3 (33.3)

Note. MFIS = Modified Fatigue Impact Scale; mRS = modified Rankin Scale; CPC = Cerebral Performance Category; CAMCI = Computer-based Assessment of Mild Cognitive Impairment; CES-D = Center for Epidemiologic Studies Depression Scale; KFT = Keitel Function Test; HUI-3 = Health Utilities Index Mark 3; FSS = Fatigue Severity Scale; PROMIS-FS = Patient-Reported Outcomes Measurement Information System Fatigue Scale; PASS-SR = Performance Assessment of Self-care Skills; FAQ = Functional Activities Questionnaire; POPS = Participation Objective, Participation Subjective.

3.4.4 Results of outcome measures

All participants completed all pretest and posttest measures. Because the data from the PASS-SR habit scores violated the assumption of normal distribution, data transformation, using log transformation, was performed only for those data. After transformation, the data for the PASS-SR habit scores showed a normal distribution. Therefore, dependent t-tests were performed for the results of all outcome measures. The results of dependent t-tests are provided in Table 3.5. There were significant differences in the MFIS total scores (p = .006) and PROMIS-FS total scores (p = .022) between pretest and posttest with participants showing less fatigue at posttest. In addition, significant differences in the physical subscale of the MFIS between pretest and posttest were identified (p = .011). No significant changes were detected in the other outcome measures.

The effect size of the changes in the MFIS total scores were small (r = 0.23), and the changes in the physical subscale scores of the MFIS were moderate (r = 0.26). The changes in PROMIS-FS total scores were also moderate (r = 0.34). In addition, the effect sizes of the changes in the cognitive subscale of the MFIS (r = 0.18) and POPS PO scores (r = 0.21) were small. All other effect sizes were negligible. The means of total scores of CSQ-8 and UMS were 28.73 (SD = 3.13) and 35.55 (SD = 3.24), respectively, indicating high satisfaction with the intervention, and excellent participant understanding of the Participant Workbook.

Table 3.6: Comparison of fatigue, perceived-performance, and participation in daily activities between pretest and posttest (N = 13)

Measures	Pretest *M (SD)*	Posttest *M (SD)*	*t*	*r*	*p*
MFIS total	47.00 (13.00)	40.69 (13.91)	3.32	0.23	.006
Physical	23.15 (6.67)	19.85 (5.71)	3.00	0.26	.011
Cognitive	19.31 (5.84)	16.69 (8.20)	2.12	0.18	.055
Psychosocial	4.54 (1.39)	4.46 (1.81)	0.29	0.02	.776
FSS	5.33 (1.12)	5.10 (1.33)	0.87	0.09	.776
PROMIS-FS	60.85 (6.34)	55.85 (7.68)	2.63	0.34	.022
PASS-SR					
Habit	2.50 (0.40)	2.54 (0.27)	0.73	0.06	.477
Skill	2.69 (0.29)	2.69 (0.23)	0.00	0.00	1.000
FAQ	4.23 (4.30)	4.46 (3.33)	-0.27	0.03	.792
POPS					
Objective	0.00 (0.50)	0.19 (0.37)	-1.27	0.21	.229
Subjective	0.30 (1.04)	0.41 (0.96)	-0.54	0.05	.598

Note. MFIS = Modified Fatigue Impact Scale; FSS = Fatigue Severity Scale; PROMIS-FS = Patient Reported Outcomes Measurement Information System Fatigue Scale; PASS-SR = Performance Assessment of Self-care Skills Self Report; FAQ = Functional Activities Questionnaire; POPS = Participation Objective Participation Subjective.

3.5 DISCUSSION

We examined the effectiveness of the MAX intervention for reducing fatigue and improving perceived performance and participation in activities of daily living in CA survivors with chronic fatigue. We hypothesized that 1) at posttest, participants would show significantly lower fatigue severity, fatigue impact, and overall fatigue compared to their pretests and 2) at posttest, participants would show significantly better perceived performance and higher participation in daily activities compared to their pretests. We found that the participants showed significantly lower fatigue impact and overall fatigue at posttest compared to pretest. However, fatigue severity was not significantly lower at posttest, and perceived performance and participation in daily activities at posttest were not significantly higher at posttest.

According to the results from the MFIS and PROMIS-FS, participants showed significantly less fatigue impact and overall fatigue at the posttest compared to their pretests. The effect sizes (r), or the magnitudes of the intervention effect, for the differences in MFIS and PROMIS-FS between the two tests were small and moderate, respectively. Also, the differences in the physical subscale of the MFIS between the two tests were moderate. Our primary outcome measure, the MFIS, asks how frequently a person is affected by fatigue physically (nine items), cognitively (10 items), and psychosocially (two items). According to the results of the MFIS, it appears that the MAX intervention positively affected the physical fatigue of our participants, which can be understood by looking at the problems and solutions chosen by the participants. Thirteen participants reported a total of 25 problems. Among those 25 problems, at least 21 problems were related to physical fatigue. For example, problems from physical fatigue were related to housework, recreation, leisure, or grocery shopping. Consequently, many of the solutions generated during the sessions aimed to decrease physical energy required by the

problem activities. Examples included planning ahead so as to avoid wasting energy, taking frequent rests, splitting work into small pieces, and delegating to others.

The PROMIS-FS uses a computer adaptive system with which it selects items more relevant to a person's fatigue level. Although a person is asked only 5-10 questions, the fatigue scale item bank has 95 items. Those 95 items include questions about physical and cognitive fatigue experience and impact with scales for frequency or severity. Therefore, the PROMIS-FS scores represent the general fatigue level of participants assessed in exhaustive detail. Considering that 50 is the average score in the general population, our participants' fatigue levels decreased significantly to approximate that of the general population, from 60.85 (SD = 6.34) to 55.85 (SD = 7.68). Also, the effect size was moderate, approaching high (r = 0.34).

Only negligible non-significant differences in the FSS between the two tests were found. Although the sensitivity of the FSS has been reported (Krupp et al., 1989), the study only included eight people, with differing diagnoses and interventions, and a mean of 16.9 weeks (SD = 9.3) between the pretest and posttest. No other study that examined the sensitivity of the FSS was found. Furthermore, only three of the nine items in the FSS ask about physical fatigue, using terms such as exercise or physical functioning. Therefore, the FSS may not have been sensitive enough to detect changes in the physical fatigue level of CA survivors following a cognitive intervention.

According to the results from the PASS-SR, FAQ, and POPS, there were no to negligible changes in perceived performance in daily activities and negligible to small changes in subjective and objective participation levels between the pretest and posttest. These results can be interpreted in several ways. First, our participants received three to five MAX sessions solving one or two problems. With most participants, the sessions were provided for 2 to 3

weeks. Generalization of skills occurs when a person performs a task that is similar to the tasks that the person learned (Berkeland & Flinn, 2005), which is very desirable as the outcome of rehabilitation treatment. According to Berkeland and Flinn (2005), it is important to vary the tasks and environments during the learning process to allow generalization. Although our participants were in the community and solved their own fatigue-related problems, they only solved two of their problems, which could not be considered as "various tasks." In addition, although participants mastered the MAX steps for two problems, we were unable to determine whether they were able to generalize the EC strategies for their other problems due to the small number of sessions. Moreover, the posttest was done 4 weeks after the pretest; therefore, they may have not had enough time to generalize the learned strategies to other problems and contexts.

The results can be also interpreted as the effects of the assessments. Considering that the possible best scores of the PASS-SR and FAQ are 3.0 and 0, and the possible worst scores of each are 0 and 30, respectively, our participants had very high function from the start according to those two assessments: 2.50 (*SD* = 0.40) and 2.69 (*SD* = 0.29) for the habit and skill scores of the PASS-SR, and 4.23 (*SD* = 4.30) for the FAQ. Also, those assessments ask whether a person has any "difficulty" doing "specific activities." Although our participants learned how to perform certain activities while using less energy, they may have experienced "some difficulty" because the cause of the fatigue was not resolved. However, it is more likely that there was a ceiling effect, because participants did not report difficulty with the skills or habits necessary to complete daily activities; rather, the fatigue may have been associated with task completion. Also, it is possible that the degree of difficulty in "daily activities as a whole" rather than "specific activities" was not changed. In other words, the saved energy from doing one or two

activities using energy conservation may not have impacted the performance of other activities. For these reasons, the PASS-SR and FAQ may have not been sensitive enough to detect the changes in the overall perceived-performance of our participants.

People with chronic fatigue have elsewhere been educated on EC strategies; however, the methods of education, such as content, duration, and the method of delivery, were different in our study. Packer, Brink, and Sauriol (1995) developed a 6-week community-based EC course in which people with chronic fatigue participated in a weekly 2-hour session. The course was used in several studies adopting the recommended protocol for people with multiple sclerosis (Mathiowetz, Finlayson, Matuska, Chen, & Luo, 2005; Mathiowetz, Matuska, Finlayson, Luo, & Chen, 2007; Mathiowetz, Matuska, & Murphy, 2001). In these studies, the course was provided by occupational therapists to groups of 8 to 10 people. The six sessions addressed "the importance of rest throughout the day, positive and effective communication, proper body mechanics, ergonomic principles, modification of the environment, priority setting, activity analysis and modification, and living a balanced lifestyle" (Mathiowetz, Matuska, & Murphy, p. 451). The course incorporated various methods, including lectures, discussions, long- and short-term goal setting, activity stations, and homework activities, to educate people with multiple sclerosis on EC strategies. Mathiowetz, Matuska, and Murphy reported that the impact of fatigue measured by the Fatigue Impact Scale significantly decreased after their 54 participants completed the course. Also, this effect was maintained at 6 weeks post-course. With a more rigorous study design, Mathiowetz, Finlayson et al. reported that 78 people with multiple sclerosis in an intervention group showed significantly less impact of fatigue compared to 91 people in the delayed group. Furthermore, the decrease in fatigue impact was maintained at 1 year post-course (Mathiowetz, Matuska, Finlayson et al.).

Vanage, Gilbertson, and Mathiowetz (2003) used a modified version of Packer's course. Due to the severity of disability in their participants with multiple sclerosis, they provided shorter sessions (eight 1-hour sessions) and had fewer participants in each group (three to eight). Also, course content was modified to compensate for the disability level of their participants. At the end of the course, 21 people with multiple sclerosis in the intervention group showed significantly less fatigue impact than the 16 in the delayed group. In the pilot study by Finlayson (2005), Packer's course was modified to be delivered by teleconference. There was a total of six teleconference sessions, each of which lasted 45 to 60 minutes. The intervention was delivered to a group of four to seven participants with multiple sclerosis. Also, content not appropriate for the teleconference method was removed. According to the results, participants' fatigue severity and fatigue impact significantly decreased with small to moderate effect sizes.

Tsai (2008) provided an 18-week internet-based fatigue management program to people with CHF. The participants had access to the modules developed based on the Packer's course. The modules had information on fatigue in CHF, EC concept, EC strategies, and applications of those strategies to daily life. Also, the program had an online support group led by an occupational therapist. However, participants in the intervention group visited the program website with different frequencies. Also, it was not reported how long the participants used the website during each visit. No significant differences between the intervention and control groups or within the intervention group overtime were found.

There were several differences between our MAX intervention and the EC courses in the studies discussed above. First, the MAX intervention was delivered individually, rather than in a group. Consequently, each session was personalized for each participant in terms of times and duration of sessions, and fatigue-related problems addressed during the sessions. Second, instead

of teaching our participants about EC, and letting them apply the concepts on their own, our participants actively generated their own fatigue-related solutions using the PST infrastructure. Third, our MAX intervention focused more on the application of the EC strategies than learning general EC strategies. Factual information regarding fatigue and general EC strategies was provided using a Participant Workbook. We asked participants to read the chapters in the Participant Workbook and answered any questions from participants regarding the workbook contents. During the sessions, participants learned how to apply general EC strategies to their specific problems by transforming those general strategies to specific solutions and plans. Fourth, the MAX intervention had fewer sessions with shorter durations for each. Although we planned a maximum of eight sessions solving two fatigue-related problems, most of our participants solved their problems in four sessions with high satisfaction with the solutions, resulting in a smaller number and duration of sessions than those in the previous studies. Lastly, the MAX intervention was delivered by telephone, unlike most of the previous studies. To prevent additional fatigue to our participants and to increase convenience of participation, our participants received the sessions at home or in their offices, by telephone. However, even though for our study the method of delivery (group versus individual; face-to-face versus telephone); method of learning (lecture/discussion versus individual problem-solving); focus on learning EC strategies versus application of EC strategies; and number and duration of sessions (more sessions of longer duration versus fewer sessions of shorter duration) differed from previous studies, the outcomes were similar. After implementing the MAX solutions, participants reported that their overall levels of fatigue were significantly reduced, especially their physical fatigue. These findings were confirmed with moderate to small effect sizes. Also, the magnitude

of change in their objective perceptions of increased “participation” was reflected in a small effect size.

According to our crosstabulations among fatigue impact, depressive symptoms, and descriptive and outcome measures, more participants who improved in the MFIS at posttest had better outcomes in the majority of descriptive and outcome measures. These results indicated that CA survivors with less global disability, and better neurological status, range of motion, and health-related quality of life may more positively respond to the MAX intervention in terms of fatigue impact. The results also indicated that CA survivors who improve in fatigue impact after receiving the MAX intervention may also show better changes in the fatigue severity, overall fatigue, perceived-performance, and participation in daily activities. Moreover, more participants who showed depressive symptoms had better outcomes in the majority of the outcome measures, which could be attributed to the PST methodology (Nezu, 2004; University of Washington, 2011) or the fact that their pretest scores were worse.

According to the results from the CSQ-8 and UMS, the MAX intervention and Participant Workbook were very acceptable. The means of the CSQ-8 and UMS rated by our participants were close to the maximum scores, which indicated that our participants were satisfied with the intervention and able to easily understand the Participant Workbook.

There were, however, some limitations in our study. First, we did not have any comparison groups and, accordingly, were not able to implement randomization. We chose to conduct a pre-post experimental study without a comparison group and randomization for several reasons. Although the effectiveness of the EC strategies in reducing fatigue delivered in tandem has been examined in other populations, nothing was known about their effectiveness for CA survivors. This feasibility study was the first one in which the effectiveness of individualized EC

strategy education in CA survivors with chronic fatigue was tested. Also, half of CA survivors experience chronic fatigue (Wachelder et al., 2009). Considering the urgent need for intervention studies addressing chronic fatigue in CA survivors and this study being the first step to addressing this need, it was more appropriate to select the pre-post experimental design over the stronger randomized controlled trial design. In addition, it was determined to be more feasible to have one intervention group, rather than one intervention group and one control or delayed group, when taking into account the low survival rate following CA and strict eligibility criteria of our study.

Second, including a generalization component in the MAX intervention and/or having a greater number of MAX sessions and/or booster sessions may have helped our participants to become accustomed to the MAX steps and EC strategies. In this study, we did not discuss other possible applications of the EC strategies with the participants. If we asked the participants to think about other possible applications of EC strategies they used during the sessions and reviewed them together, it may have helped the participants generalize the strategies to other tasks and problems. Also, the end point of the MAX sessions was either to resolve two fatigue-related problems or to participate in eight sessions for 4 weeks. Because this was the participants' first trial to tackle their fatigue-related problems and go through the MAX intervention, we expected that the participants would experience some failures during the sessions. However, this was not the case. Most participants met their goals immediately and solved their two problems in four sessions. As a result, they did not have many opportunities to repeat the MAX steps. Also, after the participants completed all MAX sessions, we did not provide them with any booster sessions, which may have given them opportunities to practice the MAX steps by themselves and receive feedback from the investigator on their trials. In addition

to the greater number of MAX sessions and/or booster sessions, having a longer period of time between the tests may have allowed more time for our participants to implement the EC strategies with other problems. Lastly, the use of a perceived-performance measure of daily activities, which has a more sensitive scale and focuses on the impact of fatigue on task initiation, duration, and completion, may be more helpful in detecting change in level of fatigue.

3.6 CONCLUSION

In conclusion, the MAX intervention was shown to be highly acceptable to CA survivors with chronic fatigue, as was the ability to understand the Participant Workbook. Also, the effectiveness of the MAX intervention in reducing the impact of fatigue and general fatigue of CA survivors was shown on two of our fatigue outcome measures. Although no to negligible effects on perceived-performance and negligible to small effects on participation in daily activities were identified, addition of a generalization component, an increase in the number of sessions, addition of booster sessions, and/or use of more appropriate outcome measures may be helpful in improving those outcomes. Because some treatment effect was detected in this study, future studies should be multi-site, include a comparison group, use randomization to allocate participants into different groups, examine the effectiveness of the different numbers of sessions, and include more sensitive outcome measures to better address the high functioning level of this population. Lastly, because of the low survival rate following a CA, and the strict eligibility criteria for chronic fatigue in our study, we recommend a multi-site study to increase the potential for reaching an adequate number of participants in a reasonable length of time.

4.0 SUMMARY AND CONCLUSION

The purpose of this dissertation was to qualitatively and quantitatively investigate chronic fatigue among post-cardiac arrest (CA) adults. It had two aims:

1. Investigate fatigue-related problems in post-CA adults and collaboratively generate energy conservation (EC) strategies to resolve those problems.
2. Examine the effectiveness of clinical intervention strategies on reducing the severity and impact of fatigue and its impact on activities and participation.

In the first study, fatigue-related problems reported by CA survivors experiencing chronic fatigue were investigated using a qualitative descriptive approach. In addition, the EC strategies selected by the participants and used to solve those problems were investigated. To obtain this information, we used the steps in the Maximizing Energy (MAX) intervention, which adopted the framework of Problem Solving Therapy and the knowledge of EC strategies. Thirteen CA survivors who lived in the community with moderate-to-severe fatigue participated in this study. When all reported problems were categorized using the International Classification of Functioning, Disability and Health (WHO, 2001), the most frequently identified problems were difficulty doing household tasks and leisure activities, accounting for one third and one fourth of the problems, respectively. Those two problems were followed by ones related to work and employment, grocery shopping, self-care, animal care, going outside, and driving. Most problems were related to instrumental activities of daily living, which was expected considering

that all our participants lived in the community. To solve the fatigue-related problems, eight different kinds of EC strategies were generated and implemented: (1) plan ahead, (2) pace yourself, (3) delegate to others, (4) simplify activities, (5) sit when possible, (6) set priorities, (7) lower the level of activities, and (8) use tools. Among those, the strategy "plan ahead" was adopted for 24 of 25 solutions, followed by the strategy "pace yourself" adopted for 15 solutions. Although no study on fatigue-related problems and EC strategies for those problems was found, our results were in accord with those of other studies on different populations with chronic fatigue. However, there could be other fatigue-related problems in post-CA adults not identified in this study due to the lack of data saturation and exclusion of post-CA adults in institutions.

In the second study, we examined the effectiveness of the MAX intervention for reducing the impact and severity of fatigue, improving perceived performance and participation in daily activities in post-CA adults with chronic fatigue. The specific hypotheses were:

a) at posttest, participants would show significantly lower fatigue severity, fatigue impact, and overall fatigue compared to their pretests.
b) at posttest, participants would show significantly better perceived performance and higher participation in daily activities compared to their pretests.

A prospective, pre-post experimental feasibility study design was used, and the participants were assessed at two time points: before receiving the MAX intervention (pretest) and 1 month after the Pretest (posttest). Between the tests, participants received the four MAX intervention sessions in general. Each session lasted for 37 minutes on average. During the MAX intervention sessions, the participants identified two fatigue-related problems in general, set the goals, generated solutions, developed detailed action plans for selected solutions, implemented the solutions with action plans, and evaluated the effectiveness of the solutions. As a result, the

first hypothesis – that fatigue would decrease – was supported except fatigue severity, and the second hypothesis – that perceived performance and participation would improve – was rejected. Specifically, fatigue impact and overall fatigue significantly decreased at posttest compared to pretest with small and moderate effect sizes, respectively. In particular, physical fatigue impact significantly decreased over time with a moderate effect size. However, no significant changes in fatigue severity, perceived performance and participation in activities of daily living were found, although small effect sizes for objective participation and cognitive fatigue impact were identified. The negligible non-significant changes in fatigue severity may have resulted from the lack of sensitivity of the measure. Also, the no to small non-significant changes in perceived performance and participation may have been due to the small number of MAX sessions, short period of time between pretest and posttest, ceiling effects from the measures, or low sensitivity of the measures.

In summary, post-CA adults with chronic fatigue had the most difficulty in implementing instrumental activities of daily living and used different EC strategies to deal with those problems. Those EC strategies effectively and significantly reduced fatigue impact and overall fatigue in post-CA adults. To identify more diverse fatigue-related problems and solutions for them, future studies should include a larger sample of post-CA adults with chronic fatigue for data saturation by recruiting post-CA adults from multiple sites. Also, to accurately examine the effectiveness of EC strategies for reducing fatigue and impact of fatigue on performance and participation in activities, future studies should use a stronger study design with a comparison group and random allocation, examine the effectiveness of different numbers of intervention sessions and different time lapses between tests, and include measures that can better detect changes in fatigue and perceived performance and participation in daily activities.

APPENDIX A

THE LIST OF ENERGY CONSERVATION STRATEGIES

1. General strategies

Principles	Strategies
Plan ahead	• Spread heavy and light tasks throughout the day and week • Group errands by geographic location • Make lists for the grocery store or the mall • Gather all items needed before an activity • Use available delivery services for groceries, dry cleaning, or pharmacy • Use the internet to shop from home • Use the telephone to comparison shop

Pace yourself	• Plan the day to balance rest and activity
	  o Perform energy-demanding tasks earlier in the day
	  o Break activities into smaller units that can be done over a number of days
	• Pace yourself during activities, and do not rush
	  o Working at a moderate pace consumes the least energy
	  o Playing slow music can help you maintain your pace
	• Take frequent rest breaks
	  o A 10 minute rest each hour will help prevent fatigue
	• Take scheduled rest breaks
	  o Listen to music
	  o Listen to relaxation tapes
	  o Watch television
	  o Read a book magazine
	  o Meditate and/or pray
	  o Sit down and talk to someone in person or on the phone
	  o Perform deep breathing and relaxation exercises
	  o Play a game on the computer or with a friend
	  o Sit in your favorite chair with a warm drink
	  o Lie down and take time to reflect
	  o Go for a scenic drive

(Continued)

Principles	Strategies

Prioritize	• Decide activities that are important to be completed and ones that can be completed later or eliminated
	  o Allows you to select only those that are necessary or particularly enjoyable
	  o e.g.) buy permanent-press clothes, precut vegetables
	  o Choose a simple wardrobe without unnecessary accessories, buttons, or snaps
	  o Shave every other or every third day
	• Learn to limit the steps of a job
	• Delegate tasks to other family members

Sit when possible	• You save 25% more energy by sitting down • Use a seat in the shower • Sit on the bed or a chair to get dressed • Consider using a high stool
Use work simplification techniques	• Work in a well-lit and well-ventilated environment • Make enough dinner to have leftovers for the next night • Have your mail and newspapers delivered to the door rather than left at the street level
Maintain good posture	• Avoid prolonged stooped posture • Avoid excessive reaching and bending by prearranging work centers to be at an appropriate height and keeping frequently used items at comfortable heights.
Get organized	• Get rid of clutter (physical space)

2. Techniques by places or activities

Place or activity		Strategies
Home	General	• Ask the mail and newspapers delivery persons to drop off these items at your door • Create your own paper management center at home to pay bills, organize coupons, etc. • On a conveniently located bulletin board, post important dates, menus for food delivery services, and phone numbers • Use commercial organizers to save space and improve organization
Home	Bathing	• Ease toileting and bathing by using adapted bathroom o i.e., elevated commode, safety rails, tub bench, hand-held shower and grab bars • Sit in the bath or shower (use a nonskid tub bench or shower chair) • Keep all bathing products on a shelf within easy reach • Use a bath brush for feet and back -- get one with a long handle • Use shampoo with built-in conditioner, to save a step • Put on a terry cloth bathrobe if you can't dry your back

(Continued)

Place or activity		Strategies
Home	Dressing	• Sit for dressing • Select simple clothing without a lot of buttons, snaps, or hooks • Select clothing with large flat buttons • Select larger clothing than usual, as it is easier to put on and take off • Select clothing that opens in front and opens all the way so that you do not have to step into it • Buy pants with elastic waistbands • Buy sturdy but lightweight shoes • Wear simple shoes with laces, straps, or buckles • Sit down and use a long-handled shoehorn to put on shoes
Home	Grooming	• Sit for grooming • Lay out grooming products and makeup in the order you want to use them • Use an electric toothbrush • Use multipurpose products to save steps (e.g. moisturizer with sunscreen) • Use an overhead hair dryer rather than a hand-held blow dryer • Choose combs, brushes, etc. with large handles -- they are easier to grip
Home	Grocery Shopping	• Order groceries by phone, fax, or computer and have them delivered • Always use a grocery list and develop a standard shopping list to avoid writing a new one each time • Ask that perishables be bagged separately so all groceries don't have to be put away at once • Use a wheeled cart to bring groceries that are not delivered from the car to the house • Buy smaller cartons and packages to avoid excessive lifting (e.g. buy a quart or half-gallon milk rather than a gallon) • Ask friends or neighbors to pick up extra items when they go shopping • Shop consistently in a store you know well, to find items easily • Check the supermarket directory to avoid hunting for obscure items

(Continued)

Place or activity		Strategies
Home	Cooking	• Gather all supplies and position them where they are to be used before starting the first step of the job o Keep items most frequently used within easy reach • Sit down to prepare meals • Plan one dish meals • Prepare extra food so that you have leftovers for the next day • Slide or roll heavy items toward you before lifting them • Use prepared foods and mixes, frozen foods, or packaged foods whenever possible • Place refrigerated items most often used at a level to avoid reaching and bending • Wear an apron with pockets in order to carry things more easily • Use a wheeled cart to bring items from the refrigerator to the stove or table where they are needed • Use paper plates and napkins and plastic utensils for easy cleanup • Use paper dinner napkins instead of linen ones • Use placemats instead of tablecloths • Use wide-handled cooking utensils (which require less strength to grip) for chopping vegetables, etc. • Use an electric blender for mixing and chopping • Use an electric can opener • Use a jar opener • Instead of using the oven (which requires a lot of bending and reaching), use a table-size toaster oven, crock-pot, or electric skillet • Line cooking pans with foil and discard when finished to avoid messy cleanup • Use the front burners on the strove to avoid excessive reaching • Use a timer to avoid getting up and down to check whether the meal is done • Soak dishes first to avoid scrubbing • Let dishes air dry • Use a dishwasher if possible
Home	Cleaning	• If possible, hire someone to clean your home regularly • Decorate your home simply to avoid unnecessary dusting around small decorative items • Use a long-handled duster • Use a long-handled dust pan to avoid stooping when sweeping the floor (use tongs to pick up objects from the floor) • Use a squeegee mop or long-handled sponge to wipe down the shower or bath • Use a self-propelled vacuum cleaner • Use tea cart to transport cleaning equipment • Use a wheeled cart to take out the trash • Avoid buying economy-size cleaning products; stick with smaller sizes that are more manageable • When shower curtain gets dirty, throw it in the washing machine with a towel

(Continued)

Place or activity		Strategies
Home	Laundry	• Use a dry cleaning service that delivers to your home • Avoid lifting boxes of detergent or bleach; instead, use a cup or measuring utensil to dispense what you need • Use multipurpose laundry products such as detergents with bleach • Do small laundry loads to avoid excessive lifting and carrying • Use a wheeled cart or hamper on casters if you live in a single-level home • Buy permanent-press (wrinkle free) clothing to avoid unnecessary ironing • Use a high-quality, lightweight travel iron for all your ironing • Don't iron items such as sheets, towels, pajamas, etc. • Sit down when ironing (this can be done at the kitchen table with a towel protecting the table) • Use fabric softener to avoid wrinkles • Use a rubber plunger for hand washables to prevent finger and hand overuse • Wash a many hand washables as feasible in the machine, using delicate cycle and special detergent • Place a table in the laundry area from which clothes can be loaded and unloaded from a top-loading washer or dryer o Sort clothes on a table, never on the floor • Pin socks together before washing • Use three baskets to collect dirty clothes: to avoid sorting light, medium, and dark colors
Home	Yard work	• Keep your yard simple and avoid excessive gardening • Ask a friend or hire someone to mow your lawn and trim your hedges • Ask a friend or hire someone to plow your driveway and shovel your walkway in winter
Office		• Sit in a chair with firm back and arm supports • Plan your workstation so as to avoid getting up excessively or constantly having to reach for items • Keep papers and documents at eye level without holding them, by using a copy stand or document holder • Consider using a track ball instead of a mouse for your computer • Be sure your arms are supported when writing or keyboarding at your workstation (special forearm rests are available commercially) • Consider using voice-activated software for your computer, rather than typing
Leisure		• Use a book stand or copy stand to read books, magazines, and other documents • Use a speaker phone or telephone headset to avoid holding the phone receiver • Use a remote control to change channels on the television or stations on the radio • Avoid low chairs

(Continued)

Place or activity	Strategies
Errands	• Combine errands to avoid extra trips • Use cruise control for long distances • Use an automatic garage door opener • Obtain a handicapped license plate or placard an routinely use parking spaces designated for people with disabilities • Use a manual wheelchair only when someone else is doing the pushing • Use a motorized scooter or wheelchair, particularly in malls, airports, amusement parks, etc. • Use a pack that attaches around your waist (fanny pack) to carry personal items • If you need to carry a purse or briefcase, make it as light as possible and use a shoulder strap • Use a car phone and call ahead to see if your order is ready; ask if someone is available to bring it to your car • Call ahead for appointments in order to limit the amount of time you have to wait • Call ahead and find out if the place you are going is accessible (e.g. are there stairs to climb?) • Ask friends and family when they are going to the post office, etc. And arrange to have them drop off your packages or help you with errands • Ask for prescriptions to be called in to the pharmacy by someone at the doctor's office • Schedule appointments either first thing in the morning or right after lunch, to avoid waiting
Travel	• When taking longer trips, use a standard packing list • Pack a small bag with just the essentials • Use luggage with wheels and arrange for a porter whenever possible • If your flight is cancelled, use a pay phone at the airport to arrange for a new flight instead of standing in a long line at the counter
Communication (reading, writing, etc.)	• Use book stand or music stand to hold books • Use large print books and magazines, or use a magnifying glass • Use writing aids with large handles (that are built up with firm tape) • Use a card holder which is commercially available, or use a scrub brush • Ease telephone speaking by using a phone holder
Storage	• Store items where they are used • Use pull-out storage bins for vegetables, etc. to avoid reaching • Install pull-out or swing-out shelving • Hang pots on wall, if dust is not a problem • Keep measuring utensils in containers where they are used
Shopping	• Keep memo pad and pencil in all rooms to keep shopping list up to date • Shop at non-peak hours • Call department store ahead of time and reserve a wheelchair • Call ahead and make sure items you want are available • Have grocery store deliver groceries

(Continued)

Place or activity	Strategies
Correct body mechanics save energy	• Sit and stand correctly by using good posture. • Lift with your legs while keeping your back straight • Avoid reaching • Push, don't pull • Use both hands to carry items when possible • Slide, don't lift • Hold objects close to your body when carrying

Pace	• Work and move at a moderate pace
	  o Fast walking takes 1-1/2 times as much energy as slow walking
	  o Walking up stairs takes 7 times as much energy as walking on level ground
	• Take frequent short rest periods while you are walking to avoid getting tired, instead of a long rest period after you get tired
	• Use slow, flowing motions rather than fast, jerky movements
	• Plan ahead to avoid rushing. This allows you to work at a relaxed pace
	• Alternate light and heavy work throughout the day and week
	• Avoid sudden bursts of activity

Work heights	• Use work surfaces that are at a level that allows you to work without bending or raising your hand above the elbow • Adapt counter space or use a lapboard for wheelchair patients Order desk arms on a wheelchair to allow an individual access to appropriate tables

The strategies were adapted from Poole (2009), Silver (2001), and Yasuda (2008). The references are provided below.

1. Poole, J. L. (2009). Musculokeletal factors. In E. B. Crepeau, E. S. Cohn, & B. A. Boyt Schell (Eds.), *Willard & Spackman's occupational therapy* (11th ed.). Philadephia: Lippincott Williams & Willkins.

2. Silver, J. K. (2001). *Post-polio syndrome: A guide for polio survivors and their families*. New Haven, CT: Yale University.

3. Yasuda, Y. L. (2008). Rheumatoid arthritis, osteoarthritis, and fibromyalgia. In M. V. Radomski & C. A. T. Latham (Eds.), *Occupational therapy for physical dysfunction* (6th ed.). Baltimore: Lippincott Williams & Wilkins.

APPENDIX B

PROBLEM-SOLVING WORKSHEET

Name & participant #:_____

Problems

Potential Problems
1.
2.
3.
4.
5.
☺**2 selected problems** 1. 2.

Problem Analysis

Steps and details of problem 1	**Steps and details of problem 2**

Problem 1

(1) Problem: _____

(2) Goal:_____

Rate how fatigued you are after doing the activity on a scale of 0 – 10 (0 = Not at all fatigued, 10 = Extremely fatigued) _____

(3) Solutions and (4) advantages & disadvantages

Solutions	**Advantages** **(What would make this a good choice for you?)**	**Disadvantages**			
a)			A little	Moderate	A lot
		Effort	[ ]	[ ]	[ ]
		Time	[ ]	[ ]	[ ]
		Money	[ ]	[ ]	[ ]
		Emotional impact	[ ]	[ ]	[ ]
		Involving others	[ ]	[ ]	[ ]
		ETC:			
b)			A little	Moderate	A lot
		Effort	[ ]	[ ]	[ ]
		Time	[ ]	[ ]	[ ]
		Money	[ ]	[ ]	[ ]
		Emotional impact	[ ]	[ ]	[ ]
		Involving others	[ ]	[ ]	[ ]
		ETC:			
c)			A little	Moderate	A lot
		Effort	[ ]	[ ]	[ ]
		Time	[ ]	[ ]	[ ]
		Money	[ ]	[ ]	[ ]
		Emotional impact	[ ]	[ ]	[ ]
		Involving others	[ ]	[ ]	[ ]
		ETC:			

			A little	Moderate	A lot
d)		Effort	[ ]	[ ]	[ ]
		Time	[ ]	[ ]	[ ]
		Money	[ ]	[ ]	[ ]
		Emotional impact	[ ]	[ ]	[ ]
		Involving others	[ ]	[ ]	[ ]
		ETC:			
e)			A little	Moderate	A lot
		Effort	[ ]	[ ]	[ ]
		Time	[ ]	[ ]	[ ]
		Money	[ ]	[ ]	[ ]
		Emotional impact	[ ]	[ ]	[ ]
		Involving others	[ ]	[ ]	[ ]
		ETC:			

(5) Choice of solution:_____

(6) Action plan (steps to achieve solution) **Write down the tasks you completed**

a)	
b)	
c)	
d)	

(7) Review and evaluate progress

Rate how satisfied you feel with your effort on a scale of 0 – 10. 0 = Not at all satisfied 10 = Extremely satisfied ⇨ _____ Rate how fatigued you were after doing the activity on a scale of 0 – 10. 0 = Not at all fatigued 10 = Extremely fatigued ⇨ _____
Why was this solution effective?
What prevented this solution from being effective?

Problem 2

(1) Problem: _____

(2) Goal:_____

Rate how fatigued you are after doing the activity on a scale of 0 – 10 (0 = Not at all fatigued, 10 = Extremely fatigued) _____

(3) Solutions and (4) advantages & disadvantages

Solutions	**Advantages** **(What would make this a good choice for you?)**	**Disadvantages**			
a)			A little	Moderate	A lot
		Effort	[ ]	[ ]	[ ]
		Time	[ ]	[ ]	[ ]
		Money	[ ]	[ ]	[ ]
		Emotional impact	[ ]	[ ]	[ ]
		Involving others	[ ]	[ ]	[ ]
		ETC:			
b)			A little	Moderate	A lot
		Effort	[ ]	[ ]	[ ]
		Time	[ ]	[ ]	[ ]
		Money	[ ]	[ ]	[ ]
		Emotional impact	[ ]	[ ]	[ ]
		Involving others	[ ]	[ ]	[ ]
		ETC:			
c)			A little	Moderate	A lot
		Effort	[ ]	[ ]	[ ]
		Time	[ ]	[ ]	[ ]
		Money	[ ]	[ ]	[ ]
		Emotional impact	[ ]	[ ]	[ ]
		Involving others	[ ]	[ ]	[ ]
		ETC:			

			A little	Moderate	A lot
d)		Effort	[ ]	[ ]	[ ]
		Time	[ ]	[ ]	[ ]
		Money	[ ]	[ ]	[ ]
		Emotional impact	[ ]	[ ]	[ ]
		Involving others	[ ]	[ ]	[ ]
		ETC:			
e)			A little	Moderate	A lot
		Effort	[ ]	[ ]	[ ]
		Time	[ ]	[ ]	[ ]
		Money	[ ]	[ ]	[ ]
		Emotional impact	[ ]	[ ]	[ ]
		Involving others	[ ]	[ ]	[ ]
		ETC:			

(5) Choice of solution:_____

(6) Action plan (steps to achieve solution) **Write down the tasks you completed**

a)	
b)	
c)	
d)	

(7) Review and evaluate progress

Rate how satisfied you feel with your effort on a scale of 0 – 10. 0 = Not at all satisfied 10 = Extremely satisfied ⇨ _____ Rate how fatigued you were after doing the activity on a scale of 0 – 10. 0 = Not at all fatigued 10 = Extremely fatigued ⇨ _____
Why was this solution effective?
What prevented this solution from being effective?

APPENDIX C

FATIGUE-RELATED PROBLES, COPING STRATEGIES, AND OUTCOMES AMONG POST-CARDIAC ARREST ADULTS: CASE STUDIES

Case 1: Self-care, Work and Employment

Case 1 was a 43-year-old white male living with his wife and three children. He went into cardiac arrest 172 days before he began study participation. He returned to his job full-time, which required him to meet with clients frequently and was mentally rather than physically demanding. He had been experiencing sleep apnea and was prescribed a continuous positive airway pressure (CPAP) machine to mitigate its symptoms.

He decided to address his sleep apnea first because he believed that his poor compliance with the CPAP machine use was aggravating his fatigue. He was advised to use the CPAP machine every night; however, he was using it only 3 times a week. To improve his compliance with the directions, he set his goal to use the CPAP machine every night between sessions. During the problem analysis stage, two main causes of his non-compliance were identified: his habits of sleeping in the living room and of waiting till nighttime to clean the CPAP machine and parts. He decided to clean the machine in the morning, which would allow him to use the CPAP machine even if he fell asleep in the living room. Then a detailed action plan for the exact time and place for cleaning was developed. He performed all steps of the action plan and experienced

less fatigue. During the review, he discovered that identifying causes and following a detailed action plan was responsible for the decrease in his fatigue.

The second fatigue-related problem was his tendency to pile up tasks due to the lack of motivation from mental fatigue. In turn, the pile of tasks caused more stress, less motivation, and ultimately more fatigue. In addition, his wish to prioritize the tasks was reported during the problem analysis stage. Prior to the first session to address this second problem, he created his own solution and successfully performed it using the knowledge obtained from the first two intervention sessions. The solution was to write down all tasks on a marker board and decrease the number of the tasks by delegating to others. During the first session for this problem, he identified the next step of the solution: completion of five tasks by himself per day. A detailed action plan taking account of his schedule for the following few days and difficulties of tasks was developed and tried. He successfully performed all steps in the plan and was very satisfied with his effort. During the review of the solution, he reported that keeping tasks visible to him helped him see what needed to be done, and breaking down the problem into small pieces allowed him not to be overwhelmed.

Case 2: Recreation and Leisure, and Work and Employment

Case 2 was a 50-year old white male who was living with his wife and two children. At the beginning of his participation in the study, he was 166 days post-cardiac arrest and had returned to his previous job as a land surveyor. Although excused from heavy work at his job at the time of his participation in the study, his boss told him that soon after that, he would need to return to heavy work.

He identified his first fatigue-related problem as listlessness while in the commuter van on the way to work. Because he was not allowed to drive for 6 months due to his cardiac arrest and was taking prescribed beta-blockers in the morning before he left for work, he used a commuter van to and from work as well as for moving from one job site to another due to feelings of tiredness. Although he wiggled his fingers and his toes to stay alert in the van, he would have liked to be more active in the van. However, this problem was not addressed in the intervention session because he had successfully come up with his own solution (doing crossword puzzles) before the first session. Therefore, the second problem he stated was addressed first in the intervention session, namely that he did not socialize with his friends as often as he had prior to his cardiac arrest. He had often spent time with friends at the bar on Friday and Saturday nights before he had the cardiac arrest. However, afterwards, he was no longer able to do so due to late night fatigue and a medical prohibition on driving and drinking. His solution was to watch a football with neighbors once a week. This was very appropriate because 1) he could come back home any time from a neighbor's house located within walking distance, 2) he could easily drink soda instead of alcohol, and 3) football games were broadcast during weekends. For this solution, we created a detailed action plan, from selecting a host neighbor to determining a time to come back home. He successfully performed all the steps of the action plan and was satisfied with his solution and efforts to solve the second problem.

The third fatigue-related problem was that he felt tired when walking up hills while working. At the time of his participation in this study, he walked up hills at least once every day as a part of his job requirements. In addition, soon after his participation in this study, he would have only one co-worker instead of two due to an increase in the workload and wanted to be able to shoulder his share of the workload. Therefore, the goal for this problem was that after

finishing work that required him to walk up hills, he would feel less fatigue than before. To achieve this goal, four potential solutions were created: 1) walking up a hill side to side, 2) taking frequent rests, 3) carrying equipment weighing less than 5 pounds, and 4) drinking water before walking up the hill. The first solution (walking up a hill side to side) was selected and then a detailed action plan was created. The principal investigator (PI) allowed him to use the other three solutions as he wanted because the PI determined the other three solutions to be good boosters that required little effort. After a successful trial of the three optional solutions in addition to the selected one, he achieved the goal with high satisfaction. He considered the solution for the third problem effective because 1) by planning ahead, he had a detailed action plan that was easy to follow, and 2) he consciously put effort into following the steps in the action plan.

Case 3: Recreation and Leisure, and Work and Employment

Case 3 was a white male aged 62 years. He lived with his wife and mother-in-law at the time he participated in this study. He was 226 days post-cardiac arrest and employed as a part-time inventory worker. His pay was dependent on output and time. In addition, he has become a member of the board of directors in his ski club and planned to actively participate in the meetings.

He selected his first problem as “not exercising regularly” because he thought that this was one of the causes of fatigue at work. He also believed he needed to exercise to prepare for the upcoming ski season. He selected one solution among four potential solutions mainly about the types of exercise, and created a detailed action plan reflecting a proper amount of exercise

from his previous cardiac rehabilitation program and integrating energy conservation techniques. He had no difficulty implementing the solution with high satisfaction.

The goal for his second work-related problem was that he would feel less fatigued after work. Three solutions utilizing energy conservation techniques were created: 1) he would take a rest after 4 hours of work; 2) he would sit on a step stool rather than kneeling or sitting on the floor; and 3) he would carry a water bottle while working. Of these 3 solutions, he selected the first and the third solutions because they would not decrease his productivity or pay. In addition, carrying a water bottle would save energy from going to the water fountain. Then he created and implemented a detailed action plan preparing an alarm watch, obtaining an empty water bottle, and identifying a place to take a rest. After his trial, he reported high satisfaction with the solution and less fatigue after work. He thought the solutions were effective because they helped with his desire for building up energy, and the detailed action plans helped him to easily try out the solutions.

Case 4: Recreation and Leisure and Household Tasks

Case 4 was a 65-year-old white male, who lived with his wife. He had cardiac arrest 109 days before he began participating in this study. He was a retired microbiologist and did not plan to return to work. He liked to play the piano every day and was doing one household chore (carrying folded laundry from the first to second floor) for his wife. At the time of participation, he was somewhat limited in walking due to a fractured ankle.

The first problem he decided to address was his fatigue related to playing the piano. He reported that he felt fatigue after playing the piano for 15 minutes. However, he would have liked to play the piano at least for 30 minutes. Therefore, considering that this was the first problem

we addressed, the target after which he would not feel fatigue, was set at 20 minutes. He created several solutions, such as a gradual increase of playing time and frequent rests during playing time, and chose one solution: selection of pieces that he could play without much effort. He created a detailed action plan for the solution, utilizing the idea of another solution (gradual increase of playing time). After his trial, he reported that he felt less fatigue after playing the piano for 20 minutes than before he tried the solution. Although the gradual increase of playing time was helpful, he stated that a flexible, rather than fixed, playing time would be better for him due to his daily fluctuating condition.

For the goal of the second problem, he would have liked to do one additional household chore. He thought of several activities including vacuuming, washing dishes, picking up after the dog in the backyard, and taking garbage out to the back porch. Among them, he chose the last task, taking into consideration his foot condition and his wife's preference. Because there were three garbage cans for different purposes, he set three different schedules for those cans. After his trial, he reported high satisfaction and almost no fatigue from the task.

Case 5: Acquisition of Necessities

Case 5 was a 39-year-old white male who lived with his wife and one son. At the time of participation, he was 107 days post-CA, receiving cardiopulmonary rehabilitation, and waiting for his physician's approval to return to work. Before his CA, he worked in a manual labor position that required heavy lifting.

The first problem he addressed in our sessions was his feeling of fatigue after shopping. The participant thought this activity important because he considered it "family time." At the time of participation, he and his wife and son went shopping at least twice a week. Although they

created a shopping list before going out, they tended to stop in other aisles or even stores that were not included in their plan. To decrease the fatigue from shopping, the participant generated five solutions, including not going shopping; staying in the car; riding an electric cart; strictly adhering to the plan created in advance; and he and his wife splitting up to gather different items at the same time. By comparing the advantages and disadvantages of each solution, the participant chose the last solution because it would not require much effort and money and, his wife would not be "pissed off" in his words. To more easily implement the solution, the participant made a detailed plan, which included creating a shopping list and splitting the items into two groups by stores and locations of the items. Between the MAX sessions, the participant successfully implemented the solution with high satisfaction and a small change in the fatigue level. The participant indicated that it took a shorter time for them to complete shopping. Due to family circumstances (a death in the family), he was only able to address one problem by the time of his posttest.

Case 6: Walking and Moving and Household Tasks

Case 6 was a 43-year-old white female who lived with her younger daughter. Her older daughter and granddaughter lived in the same apartment complex. She had cardiac arrest 105 days before she began participating in this study and had no plan to return to work due to her heart condition.

Her first problem addressed during sessions was how rarely she left her apartment. According to her report, she went outside only twice in the week before the first session. She reported that she was not motivated to go outside due to her fatigue. Therefore, her goal was set as going outside two times in 3 days. To achieve this goal, several solutions were generated, from simple activities, such as walking around the parking lot and taking small bags of garbage

out, to more complex activities, such as walking to the park and decorating her yard for Easter. Of these, two solutions (decorating her yard and walking to the park) and one back-up solution (taking out garbage) were selected. Action plans for the two main solutions were then created, including a plan for preparing decoration materials, the number of decoration materials used, deciding on a person who would walk to the park with her, and the schedule for each solution. Also, the participant was advised to try the back-up solution if it would be difficult for her to implement one of the main solutions. However, between our sessions, she changed one of the solutions and modified an action plan according to her situation. First, she was informed that she needed to attend a party on the day scheduled for decoration and decided to use this social event as one of her solutions. Second, she went to the park with a different person due to the unavailability of the planned person. Despite the changes in plans, she achieved the goal with high satisfaction and feeling less fatigue.

Her second fatigue-related problem was the extreme fatigue she felt after doing dishes. At the time of participation, the participant did the dishes once every other day, which caused her to do dishes for a long time at once. To solve this problem, five solutions were generated: using paper plates, doing dishes once a day, buying a dishwasher, lining pans with foil, and wrapping dishes with plastic wrap. Among these solutions, the participant selected the first solution, considering the low demand of effort, time, and money. In the action plan, the participant decided the number of paper plates she and her younger daughter would use and where to put the paper plates. Between the sessions, the participant successfully implemented the solutions and reported using more than three paper plates each day. She showed high satisfaction with her effort and reported a great decrease in her fatigue from doing dishes.

Case 7: Self-care, Household Tasks and Recreation and Leisure

Case 7 was a 66-year-old white male who was a retired restaurant manager and lived with his wife. His wife was working every day at the time of his participation in this study. Because the participant liked to cook and do household chores, he was taking care of cooking and cleaning. He had his CA 110 days before his participation in this study.

For his first fatigue-related problem, he reported his feeling of fatigue in the morning. Before having CA, he started his morning routine with activities, such as feeding his dog, checking his blood sugar level, and walking his dog, immediately after he got up. However, after his CA, he had a lack of energy when he woke up in the morning and had "pausing time" before he started his routine due to the low motivation. Before we addressed this problem in our sessions, the participant created solutions and implemented them. The solutions were 1) going to bed earlier to allow him full 9-hour sleep and 2) walking to his church instead of taking a ride. These solutions were very successful in terms of his high satisfaction and decrease in fatigue. Also, he reported that the full 9-hours of sleep gave him more energy and walking to church in the morning refreshed him.

The second fatigue-related problem was that he was not doing any chores and enjoyable activities during his free time. Although there were several activities he should have done and would have liked to do in his mind, he never wrote them down or did them. The goal was set as doing one chore and two enjoyable activities in a day for 2 days. To achieve this goal, the participant generated one solution: planning a day. The participant then created detailed steps for this solution, such as choosing the days he would do activities, making a list of chores and enjoyable activities, scheduling the activities using a time table, and taking rests between activities. In the next session, the participant reported the successful implementation of all the

steps with high satisfaction and no fatigue. In addition, he reported that he had more energy due to the effect of the solution for his first problem (going to bed early) and taking rests between activities was very helpful. Lastly, he commented that before he participated in the study he thought he had to push himself hard without rests, which made him feel exhausted.

Case 8: Household Tasks

Case 8 was a 56-year-old white female who had her CA approximately 7 years before her participation in this study. She lived alone in a one-bedroom condominium. Although she received help from her son to go grocery shopping and to doctor's appointments, she took care of her condominium by herself.

Her first problem was her high level of fatigue during cleaning. She reported that she tried to clean her condominium every day, but she often had to stop in the middle due to fatigue. During cleaning, she used a light vacuum, a regular duster, and a cloth to polish her furniture. To clean her condominium with less fatigue, she generated three solutions: cleaning her whole condominium every other day, cleaning one section of her condominium a day, and taking frequent rests. Of these, the participant selected the second and third solutions (cleaning one section at a time and taking frequent rests). To help her easily implement the solutions, we divided her condominium into five sections and decided where she would clean each day and how often she would take a rest. Also, her son gave her a disposable duster that attracts dust and could save her energy, but she had forgotten to use it for a long time. Therefore, she was advised to look for the disposable duster. After the implementation of the solutions, she cleaned two sections of her condominium among three sections planned due to pain from her arthritis. In addition, the participant reported the same level of fatigue as she reported before the

implementation, although she was moderately satisfied with her effort and the solutions. The participant thought that the solutions worked very well because she could slow down due to the small quota of the day, and frequent rests helped her keep going. The only condition that prevented her from implementing solutions as planned and meeting the goal was her worsened pain. Therefore, the participant decided to keep the solutions and address her second fatigue-related problem.

Her second problem was her high level of fatigue during bathroom cleaning. She tried to clean it every day by mopping the floor, wiping the sink, and organizing items on shelves of the stand. To solve this problem, three solutions were created: cleaning one section of her bathroom a day, taking frequent rests, and getting rid of unnecessary items in the stand. She reported that she would feel bad if she could not clean her bathroom every day; therefore, the last solution was selected. She then generated detailed steps for the solution, such as how long she would work on it in a day and what she would need to do it. She successfully implemented the solution and met the goal (removing unnecessary items on the first and second shelves of the stand). The participant was extremely satisfied with the solution reporting moderate fatigue. She also reported that she took rests every 20 minutes while performing the tasks.

Case 9: Acquisition of Necessities and Household Tasks

Case 9 was a white female aged 52 years and lived with her boyfriend at their two-story house. She had CA 215 days before her participation in this study. She did not plan to return to work due to physical and cognitive deconditioning and was waiting for the results of her social security disability application.

Her first fatigue-related problem was the severe fatigue from grocery shopping. She went with her boyfriend to the grocery store near their house at least once a week. Either she or her boyfriend pushed a shopping cart because her boyfriend easily felt fatigue, too. Her fatigue level from grocery shopping before she participated in this study was 10 (extremely fatigued). Her goal was to feel less fatigue when returning home from grocery shopping. The solutions generated for this problem were to1) use an electronic cart; 2) make a list of groceries and plan the order in which she would collect items; 3) divide the list between each person; and 4) put perishables in separate bags so that if she was too tired, these could be taken into the house immediately and the rest left in the car. Because the second solution had several advantages and fewer disadvantages over the other solutions, this was selected. The action plan was then generated for details, such as deciding the day of grocery shopping and time for creating a list and planning retrieval of items aisle by aisle. After implementation of the solution, the participant reported that the solution was very effective because it helped her to be more organized and keep the grocery shopping load small. She was very satisfied with the solution and with feeling less fatigue.

Her second fatigue-related problem was her fatigue from cooking. At the time of participation, she cooked dinner 4 times a week. Most of the time, she did not plan what to cook. She did not receive help from her boyfriend for cooking except for using a grill. Her fatigue level after cooking was 8 before she participated in this study. To cook dinner with less fatigue, five solutions were generated: planning ahead for what to cook and what is needed; cooking extra food for the next day; keeping pots and pans on the stove; preparing some parts of the menu earlier in the day; and sitting during cooking. By comparing advantages and disadvantages of the solutions, she selected the first solution – planning ahead. Then she decided what days she would

cook dinner and when she would decide what to cook. Once she decided what to cook, she would think what items she needed and categorize them by locations. Lastly, she would gather items and position them before beginning the first step of cooking. After implementation, her fatigue level decreased with high satisfaction. She reported that deciding what to cook in advance helped her avoid being fatigued because she could either take a rest before heavy cooking or plan a light meal if she did not have time for rest. Also, for heavy cooking, she finished some parts earlier in the day when she had more energy.

Case 10: Caring for Household Objects and Assisting Others and Household Tasks

Case 10 was a 53-year-old white male living with his mother and daughter. He had CA 108 days before his participation in this study. In addition to his CA, he had surgery on his knee due to a patella bone fracture and was using a crutch.

His first fatigue-related problem was his inability to do horse management. He had three horses, and they were fed two times a day. At that time, his daughter gave water, grain, and hay to the three horses before she left for school and after she came back from school. The goal was set to give water and/or grain to the three horses once a day for 2 days. To achieve this goal, three solutions were generated: moving the grain buckets near the horses, asking his daughter to drain the water hose in the afternoon, and taking frequent rests. After comparing the advantages and disadvantages of the solutions, the participant selected the second and third solutions. Although the first solution could save some energy for him, he only had grain buckets without lids, which would attract mice. For the action plan, the participant decided which days to do watering and/or grain and planned to tell his daughter about this plan so that his daughter would not feed the horses on those days. He also asked his daughter to drain the water in the hose so

that he did not have to use up energy to drain the water. Lastly, he decided to take frequent rests between tasks and even during the tasks if he felt fatigue. After the implementation of the solutions, the participant reported his successful completion of steps in the action plan with high satisfaction and moderate fatigue. He also reported that a small goal to achieve and frequent rests helped him not be overwhelmed and manage his fatigue.

The second problem was that he could not vacuum his living room due to his fatigue. Because he often smoked in the living room, it easily became dirty with ash and cigarette butts. The participant's mother usually vacuumed the living room every day, but the participant wanted to take over this task. To meet his needs, the participant created four potential solutions: vacuuming one section in a day, vacuuming when he had the most energy, asking his daughter to move chairs while he was vacuuming, and asking his daughter to do vacuuming. The participant did not want to receive any help from his daughter for this task because his daughter was already taking care of many other tasks. Therefore, he selected the first and second solutions. During the session, he divided his living room into two sections and planned to vacuum one section in a day for 2 days. He was advised to drag chairs rather than lifting them and keep the vacuum in the living room after use. After the successful implementation of the solution, he reported great decrease in fatigue with moderate satisfaction with the effort and solution. He reported that vacuuming a small section with full energy in the morning and taking frequent rests during the task helped him successfully complete the task.

Case 11: Household Tasks and Recreation and Leisure

This 45-year-old white male lived in his house with his family, consisting of his wife and four children. He had CA 189 days before his participation in this study. At the time of the study, he

was working for 40 hours a week as a hospital technician. The participant enjoyed cooking, gardening, and spending time with his family.

For the first fatigue-related problem, he would have liked to do more household chores. Due to his fatigue, he had to delegate his household chores, such as yard work, painting, car maintenance, and dishwashing, to others. However, he wanted to gradually take over those activities. Therefore, the goal set for this problem was to do one additional household chore between our sessions. The participant listed five potential chores, namely washing dishes, washing his car, rotating the tires on his van, cutting grass, and rebuilding his gas grill. After comparing the advantages and disadvantages of the chores, he decided to wash dishes because it requires the least energy, and his wife and children wanted him to take over that chore. Because he was working full-time during the day, he decided to wash dishes after dinner. Also, to reduce the number of items to be washed and the workload, he would choose a simple menu for the dinner, have the pots and pans soaked in advance, and ask his children to put their dishes in the dishwasher. Lastly, he would take frequent breaks while doing the dishes. After implementing the solution, the participant was very satisfied with his effort, although he experienced high fatigue. However, considering his inability to wash dishes due to fatigue before the sessions and his successful completion of this household chore, the participant solved his first problem.

His second fatigue-related problem was that he was not doing any pleasurable activities after coming home from work. During the session, the participant listed five pleasurable activities: biking around the neighborhood, working out and swimming at the athletic club, weight training at home, and playing catch with his children. Among the activities, the participant chose biking because he enjoyed this activity, did not have to drive, and had a nice place for biking in mind. Then he decided when (after dinner) and how long (45 minutes) he

would ride a bike with one of his children. Also, to save some energy for biking, he decided to order out dinner and take two breaks during the ride. Lastly, he would bring cold water to prevent dehydration. After implementation, the participant reported extreme fatigue because it was too hot and humid that day and he and his daughter biked longer (1.5 hrs) than planned. However, the participant was very satisfied with his effort and thought that this trial of the solution was successful.

Case 12: Recreation and Leisure, and Driving

Case 12 was a 66-year-old white female and lived alone in her house. Also, she reported that she did not have anyone whom she could ask for help. She had CA 97 days before her participation in this study. She was retired before her CA, but was receiving cardiopulmonary rehabilitation 3 times a week at the time of participation.

During the sessions for her first fatigue-related problem, she wanted to work on bike riding. Before her CA, she used to go bike riding every weekend, but not after her CA. She had a regular size and weight bike and a Jeep which had enough room for her bike. The goal for this problem was set to ride a bike once during the coming weekend. To achieve the goal, she generated five solutions, including loading the bike a day before the bike riding, taking frequent rests, choosing an easier track, bike riding during the highest-energy period of the day, and leaving the bike in the car after coming back from bike riding. The participant chose one solution (do bike riding while experiencing the most energy of the day) and created an action plan that included several considerations to save energy. For example, she decided to load the bike in the car a day before the bike riding, take rests every 15 minutes, and leave the bike in the car after coming back from bike riding. After implementation, the participant reported very low

fatigue with very high satisfaction. She reported that planning out in advance allowed her to know what to expect.

The second problem was her fatigue from a trip involving a 2-hour drive. She visited her friend's house at a 1-hour distance a week before her participation in this study. She was already exhausted when she arrived at the friend's house and was very tired when she came back home. Therefore, she would have liked to try a trip involving the 2-hour drive with less fatigue. Five solutions were generated to achieve the goal: 1) check the road information in advance; 2) leave while feeling the most energy of the day; 3) go to the place with someone else; 4) take frequent rests with a bottle of water; and 5) plan an agenda for when she arrived. She chose the third solution because she would not need to drive on the way back home. For this solution, the participant created an action plan, including whom she would go with, when she would leave, planning the trip on site, and checking the traffic in advance. However, she reported very high fatigue after her trip. Because she could not find any person to go with, she decided to go alone. Also, it took longer than she expected (2 hours one way). However, she reported that she did not feel any fatigue when she arrived at the place and walked around the place. Also, she understood what the problems of this implementation were and was very satisfied with her effort. Therefore, she decided to finish the sessions.

Case 13: Household Tasks and Acquisition of Necessities

Case 13 was a 53-year-old white female and lived with her boyfriend. She went into CA 96 days before her participation in this study. She was not allowed to drive at the time of her participation. Before her CA, she was a cook in a rehabilitation facility.

The first fatigue-related problem she selected was fatigue from doing dishes at home either by hand or by loading the dishwasher. She made either one or two meals a day and typically left dishwashing till the evening after she and her boyfriend had had dinner. The amount of dishes and pots and pans to wash depended on what she had cooked that day. Her boyfriend and she had two meals together in general. In addition to doing dishes, she wiped down the stove top and counter. Her fatigue level from this activity was 8 before addressing the problem; therefore, the goal for this problem was to feel less fatigue after doing dishes. Five potential solutions were generated: 1) washing the dishes after each meal instead of doing them all together at the end of the day; 2) asking her boyfriend to put his dishes in the dishwasher after each meal; 3) using paper plates; 4) lining pans with foil, wrapping dishes with plastic wrap and discarding them when finishing meals; and 5) asking her boyfriend to clean the stove-top and counter. Among the potential solutions, she chose the last one because that task took too much energy for her to do, and her boyfriend was very supportive. Then she created an action plan about how and when she would communicate with her boyfriend regarding this solution. After her implementation, she was extremely satisfied with her effort, and she reported very low fatigue. She reported that the decrease in the amount of work to do was very helpful in saving energy.

Her second fatigue-related problem was severe fatigue from grocery shopping. She went grocery shopping once a week and needed a ride due to the driving restriction after CA. She usually asked her daughter, niece, or boyfriend for a ride. She never made a list of items for grocery shopping. To solve the problem, she and the PI generated four potential solutions, including delegating grocery shopping to others, riding an electric cart, making a list of groceries and planning a route map for the store, and dividing the list between each person. She decided to

make a list of groceries and plan the route map because it did not require much energy to do and would save her steps. She then generated details for the solution, including when and with whom she would go grocery shopping, when she would make a list, plan the shopping, and ask the cashier to put the perishables together. She was extremely satisfied with her effort to implement the solution and successfully decreased her fatigue level. She reported that it was easy for her to make the list and route map, which allowed her to walk much less than usual.

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