Fatigue and physical activity in older women after myocardial infarction.

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Abstract:

Background

Within 6 years of a myocardial infarction (MI) more women (35%) than men (18%) will have another MI. Participation in physical activity is one of the most effective methods to reduce cardiac risks; however, few older women participate. One of the most frequently reported barriers to physical activity is fatigue.

Objectives

The specific aims of this study were to (1) describe factors related to fatigue in older women after MI and (2) examine the relationship of fatigue to physical activity in older women after MI.

Methods

This descriptive correlational study examined the effects of age, body mass index, comorbidities, sleep, beta-blocker medication, depression, and social support on fatigue and physical activity in women (N = 84), ages 65 to 88 years old, 6 to 12 months post-MI. All women had their height and weight measured and completed (1) a health form on comorbidities, physical activity, and medication history; (2) the Geriatric Depression Scale; (3) the Epworth Sleepiness Scale; (4) the Revised Piper Fatigue Scale; and (5) the Social Provisions Scale.

Results

The majority (67%) of the women reported fatigue that they perceived as different from fatigue before their MI. Moderately strong correlations were noted among depression, sleep, and fatigue, and multivariate analysis indicated that depression and sleep significantly accounted for 32.7% of the variance in fatigue. Although only 61% of the women reported participating in physical activity for exercise, most were meeting minimal kilocalories per week for secondary prevention. Fatigue was not significantly associated with participation in physical activity.

Conclusion

Describing correlates to fatigue and older women's participation in physical activity after MI are important to develop interventions targeted at increasing women's participation in physical activity, thus decreasing their risk for recurrent MIs.

Keywords: fatigue | heart health | lung health | physical activity | women's health | myocardial infection | post myocardial infection treatment | nursing

Article:

The risk of developing heart disease increases with age, especially among women after menopause. Annually, approximately 314,000 women 65 years and older have a myocardial infarction (MI), and more women (35%) than men (18%) have a recurrent MI within 6 years.1 Risk factor reduction strategies after MI reduce recurrent MIs and extend survival,2 thereby impacting morbidity, mortality, and health care costs. Risk factor reduction is especially important for older adults because the prevalence of most cardiovascular risk factors, especially hypertension and decreased physical activity, increases with age.3 and 4 One of the most effective methods to reduce cardiac risk factors after MI is regular physical activity. In fact, increasing physical activity can have a cascading effect on other risk factors by altering the metabolism of fat and carbohydrates, thus reducing obesity and improving lipid profiles. Further, physical activity helps to modify stress, prevents functional decline, and improves quality of life.5 and 6 However, one of the most frequently reported barriers to participation in physical activity is fatigue.7 In fact, in a recent study that examined personal and environmental factors associated with physical activity in middle-aged and older women of equal racial groups, fatigue was listed as the third most frequently reported perceived barrier following lack of time and caregiving duties.8 Because fatigue influences participation in physical activity,9 and 10 and physical activity reduces cardiac risk, research on fatigue and correlates to fatigue in older women after MI is important.

Fatigue has been associated with aging,10 depression,11, 12 and 13 heart failure,14 and 15 sleep disturbance,15 medications,16 and various comorbidities,17 and 18 and it is a prodromal symptom of MI.19 However, few studies have examined fatigue after MI,14, 20, 21, 22, 23 and 24 with 3 studies including samples less than 25,21, 22 and 23 and 4 studies examining fatigue 5 days to 12 weeks post-MI.14, 20, 21 and 22 Studies that examined fatigue 5 days to 12 weeks post-MI may have measured fatigue associated with physiologic recovery, not fatigue that persists over time.25 Although Brink et al.24 noted that the most common symptom reported 5 months after MI was fatigue (41%; N = 114), no studies were found that measured fatigue and correlates to fatigue 6 to 12 months after MI. Therefore, measuring fatigue 6 to 12 months after MI is important to allow time for physiologic recovery, completion of cardiac rehabilitation, stabilization of a medication regimen, and stabilization of emotional distress and functional ability,26 and thus captures fatigue that persists after MI and may impact participation in physical activity.

Determining the influence of certain variables on fatigue and the effects of fatigue on older women's participation in physical activity after MI may be important to develop interventions targeted at increasing women's participation in physical activity. Therefore, this study examined factors associated with the symptom of fatigue and the influence of fatigue on physical activity in older women 6 to 12 months after MI. The specific aims of this study were to (1) describe factors related to fatigue in older women after MI and (2) examine the relationship of fatigue to physical activity in older women after MI.

Conceptual framework

The middle-range theory of unpleasant symptoms27 provided a framework for exploring fatigue. Three major components comprise this theory: (1) the symptom the individual is experiencing, (2) the influencing factors that result in the symptom experience, and (3) the consequences of the symptom. A symptom has 4 common dimensions that are separable but interrelated: intensity, timing, distress, and quality. The distress dimension affects the quality of life the most and is related to the degree the symptom bothers the individual. This theory postulates that 3 categories of influencing factors contribute to the occurrence of the symptom: physiologic factors, psychologic factors, and situational factors. Each of these factors relates to one another and may interact to influence the symptom experience. Physiologic factors include normally functioning bodily systems such as pathology and nutritional balance. Psychologic factors include the mental state, affective reaction to illness, and knowledge related to the symptom. Situational factors include the social and physical environment that can directly affect the experience of the symptom such as employment status and social support. The last component of this theory, consequences of the symptom experience or performance, addresses the outcomes of the symptom experience and is conceptualized to include functional and cognitive outcomes such as activities of daily living or the ability to concentrate.

This framework provided direction in selecting factors related to the unpleasant symptom of fatigue.10, 11, 15, 16 and 17 The physiologic influencing factors examined were body mass index (BMI), comorbidities, sleep, and beta-blocker use. The psychologic factor of depression and the situational factor of social support also were examined as influencing factors contributing to the unpleasant symptom of fatigue. The consequence of the unpleasant symptom of fatigue was participation in physical activity (Fig 1).

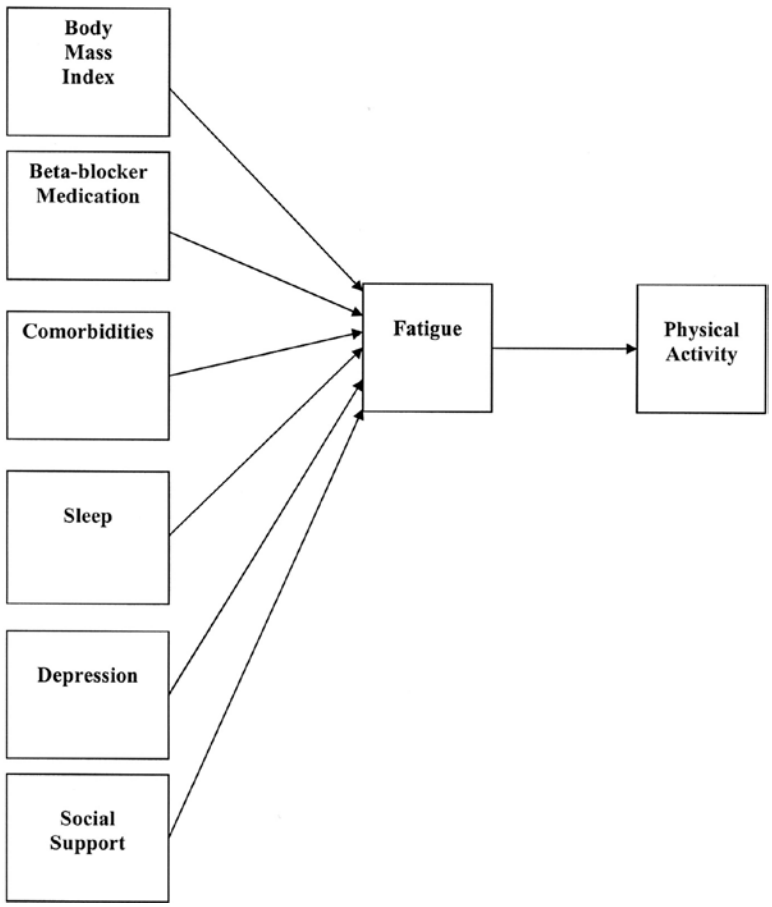

Fig 1. Model of conceptual framework adapted from the Theory of Unpleasant Symptoms.

Methodology

This descriptive correlational study of the effects of age and influencing factors on the unpleasant symptom of fatigue and the relationship of fatigue to participation in physical activity 6 to 12 months after MI included a convenience sample (N = 84) of women from 2 area hospital systems and 1 cardiovascular clinic in central North Carolina. A priori calculation of sample size indicated a sample of 84 would have an 80% power to detect an R2 of 0.15 using the multiple linear regression test of R2 = 0 (alpha = 0.05) for 7 normally distributed covariates: age, BMI, sleep, beta-blocker medication, comorbidities, depression, and social support.28

Procedure

Health care providers from each site obtained a list of women, age 65 years and older, discharged with a diagnosis of MI according to their International Classification of Disease 9 code, and contacted them by telephone to briefly explain the study, confirm their ability to speak English, and ascertain their interest in participation. If the women indicated interest, the health care provider obtained verbal consent to release their name and telephone number to the principal investigator (PI). After receiving a list of women interested, the PI or research assistant contacted each woman by telephone to further explain the study, answer questions, screen for eligibility, and schedule a convenient time to collect the data. Eligibility criteria included (1) 65 years of age or older, (2) no previous diagnosis of memory deficit, (3) not taking antidepressant medication, and (4) verbal validation of having a MI. The age limit of 65 years and older was chosen because the average age for MI is 70.4 years for women, and the majority of MIs occur in the 65 years and older age group.1 Further, this age group has a 2 to 3 times higher rate of coronary heart disease compared with premenopausal women and has lower participation in physical activity than other age groups.29 Because this study used self-report to answer the data-collection instruments and this required that the women recall information since their MI, all women were asked whether they had ever been told by a health provider that they had a memory problem. In addition, all women were asked to report the month of their MI. If the month they reported did not match the month recorded by the medical record department or they indicated they had been told they had a memory problem, they were excluded from the study.

After the women completed the informed consent, the PI or research assistant measured their height and weight using standardized equipment and assisted the women in completing the data-collection instruments. Data-collection sessions lasted approximately 60 to 90 minutes and occurred in the participant’s home or a public location such as a church or public library.

Measurement instruments

Fatigue was measured using the total fatigue score of the Revised Piper Fatigue Scale,30 which captures 4 subjective dimensions of fatigue and is one of the few tools measuring fatigue used with older adults.10 and 14 Each item’s score (n = 22) ranges from 0 to 10, and the total fatigue score is calculated by adding the item scores (range = 0–220). Reliability and validity estimates are consistently moderate to strong,31 internal consistency reliability estimates are greater than 0.80, and the standardized alpha for the total instrument is 0.97.30

Physical activity was measured using 2 questions modified from the Behavioral Risk Factor Surveillance Survey.32 This standard measure of physical activity was chosen because it has been used in multiple studies,33 and 34 specifically focuses on physical activity for exercise, is a parsimonious measure of physical activity to minimize subject burden, and was recommended from an exercise and aging consultant. A recent study reported significant correlations in physical activity from the self-report Behavioral Risk Factor Surveillance Survey and accelerometer measures for moderate intensity and total activity.35 In the present study, the questions asked about the subject's participation in physical activity for exercise before and after MI, the type of activity participated in most often, and the amount of time and how often they participated in the activity. The question regarding physical activity after MI was used for this study and stated, "Since your heart attack, are you participating in any physical activities such as running, calisthenics, golf, gardening, or walking for exercise?" Because the American Heart Association recommends for secondary prevention a minimum goal of 30 minutes of physical activity 3 to 4 days per week over and beyond daily activities, such as household work or gardening, only physical activity for exercise was measured.36 Each participant's reported physical activity for exercise was converted to an energy expenditure of kilocalories per minute ($kcal \cdot min^{-1} \cdot kg^{-1}$). Kilocalories were then multiplied by the amount of total minutes per week the subject reported participating in physical activity for exercise to yield kilocalories expended per week.37

Physiologic factors included BMI, sleep, beta-blocker medication, and comorbidities. BMI was calculated by dividing the subject's weight in kilograms by height in meters squared. Sleep was measured using the Epworth Sleepiness Scale (ESS), which captures daytime sleepiness.38 This scale is composed of 8 scenarios that the participant ranks from a 0, or never doze, to 3, a high chance of dozing, for a total possible score of 24. Johns38 reported that the ESS scores are significantly correlated ($P < .01$) with sleep latency; how quickly one falls asleep, when given the opportunity, during daytime hours; with the multiple sleep latency test at night; and with polysomnography.38 The American College of Cardiology and the American Heart Association guidelines recommend that all persons, except those with contraindications, receive beta-blocker medications after MI.39 However, a major side effect of beta-blocker medication is fatigue.16 Beta-blocker medication was measured by observing the medication, validating currently taking, and recording the drug class and dose on the medication bottle. Use of beta-blocker medication was scored as yes or no. Comorbidities were determined by totaling the number identified on the Demographic Health Status Tool developed for this study. The Demographic Health Status list of diseases and conditions was based on the literature and in consultation with an expert. 19 and 40

Depression, the psychologic factor, was measured using the 30-item dichotomous Geriatric Depression Scale (GDS), which was designed for elders and has been previously validated.41 A cut-point score of 11 produced an 84% sensitivity rate and a 95% specificity rate to screen depression.42

Social support, the situational factor, was measured using the Social Provisions Scale, a 24-item questionnaire that assesses security, sense of belonging to a group with common interests, reliance on someone in time of need, guiding relationships, sense of competence, and caregiving responsibilities.43 Psychometric evaluation of this instrument using a probability sample of older adults supported convergent and discriminant validity.44

Data analysis

Descriptive statistics were used to describe the sample. Multivariate statistical assumptions were tested. The social support score was positively skewed, and the GDS and physical activity measures were negatively skewed. The social support score was transformed using reflection and square root, thereby changing the interpretation of the score: the higher the score, the lower the social support. Transformation of the GDS and physical activity measure yielded data meeting multivariate assumptions.45 All data were analyzed using the Statistical Package for Social Sciences version 11.0 (SPSS Inc., Chicago, Ill). Each model was tested for significance using multiple regression analysis.46

Results

Descriptive

A total of 157 women's names and telephone numbers were provided to the PI, and 84 women participated in the study. Most of the women not participating did not meet the eligibility criteria with 9% taking an antidepressant, 8% not meeting the age criteria, 6% reporting memory problems, and 3% stating they did not have a MI. The date of the MI in 33% of the women (n = 24) was out of the study range. These women either reported having another MI or were unable to be contacted by telephone during the 6- to 12-month post-MI time frame. Other reasons for nonparticipation included direct refusal with no reason (18%) or sickness (13%).

The majority of participants were white (80%) and widowed, divorced, or single (55%). Forty-five percent reported less than a 12th grade education. Their ages ranged from 65 to 88 years (M = 74.9, SD = 5.7). Most women (60%) reported an annual income of $20,000 or less.

Sixty-seven percent (n = 56) of the women reported experiencing fatigue that was different than fatigue before their MI. The majority (n = 61; 73%) were taking a beta-blocker medication, and 71% of the women who reported fatigue were taking beta-blocker medication. Because beta-blocker medications varied, with 6 different beta-blocker drugs used, no comparison of dosages could be made. Only 3 women (4%) indicated having no comorbidities, whereas the other 81 women reported 2 (43%), 3 (32%), 1 (13%), or 4 (8%) comorbidities. Fifty-one (61%) of the women reported participating in some type of physical exercise since their MI an average of 35 minutes (range = 10–120) 4 times per week (mode = 3). In fact, 4 women reported participating in physical activity for exercise 90 or more minutes. The majority of the women (73%; n = 51) identified walking as their primary physical activity. On average, women had moderate fatigue, high social support scores, and low scores on the GDS and ESS, and were obese. Table I presents descriptive statistics for the study variables.

Table I. Descriptive statistics for selected variables (N = 84)

Variables	Mean	SD	Range	Possible range
Physical activity (kcal/wk)	467.57	587.53	0–2655	0–
Fatigue	77.94	64.13	0–190	0–220
Social support	81.54	9.79	52–96	0–96
GDS	6.20	4.98	0–24	0–30
ESS	6.65	4.1	0–18	0–24
Age (yr)	74.86	5.77	65–88	65–
Body mass index	28.67	6.41	16.26–45.3	

GDS, Geriatric Depression Scale; *ESS*, Epworth Sleepiness Scale.

Specific aim 1: factors related to fatigue

Table II presents the correlation coefficients between age, physiologic, psychologic and situational influencing factors, fatigue, and physical activity of the sample. Moderately strong positive correlations were noted between depression and fatigue (r = 0.522) and between sleep and fatigue (r = 0.402). Weak correlations were noted between comorbidities and age (r = −0.211) and comorbidities and BMI (r = 0.234). Weak correlations were also noted between depression and social support (r = 0.358), depression and sleep (r = 0.354), and depression and beta-blocker medication (r = −0.190).

Table II. Intercorrelations between the variables (N = 84)

Variables	1	2	3	4	5	6	7	8	9
1. Physical activity‡		−.060	−.069	.094	−.257†	.165	−.172	.047	−.108
2. Social support‡			.358†	−.006	.128	−.063	.052	.104	−.180
3. GDS‡				.354†	.138	−.190*	.522†	.030	−.008
4. ESS					.026	−.071	.402†	−.063	.110
5. Comorbidity						.075	.020	−.211*	.234*
6. Beta blocker							−.114	−.085	−.090
7. Fatigue								−.143	−.009
8. Age									−.119
9. BMI									—

GDS, Geriatric Depression Scale; *ESS*, Epworth Sleepiness Scale; *BMI*, body mass index.

* $P < .05$.

† $P < .01$.

‡ Transformed.

The relationships of age, BMI, sleep, beta-blocker medication, comorbidities, depression, and social support to fatigue were examined using multiple regression analysis. Results indicated the model significantly explained 36.4% of the variance in fatigue (F[7, 76] = 6.224; P < .001). Reexamination of the model controlling for age and BMI yielded a nonsignificant R2 change (P = .421). Only 2 variables were significant: (1) depression (β = 0.489; t = 4.523; P < .001) and (2) sleep (β = 0.225; t = 2.255; P = .027). Multiple regression analysis entering only these 2 significant variables, depression and sleep, explained 32.7% of the variance in fatigue (F[2, 81] = 19.660; P < .001). A summary of regression coefficients is presented in Table III.

Table III. Multiple regression analysis of demographic variables and influencing factors on fatigue (N = 84)

	Standardized regression coefficient	Standard error	*t*	*P*
Age	−0.153	1.055	−1.611	.111
BMI	−0.057	0.977	−0.585	.560
Social support*	−0.110	5.094	−1.081	.283
Depression*	0.489	6.334	4.523	.000
Sleep	0.225	1.541	2.255	.027
Comorbidity	−0.057	6.853	−0.573	.568
Beta blocker	−0.026	13.525	−0.270	.788

$R^2 = 0.364$. $P < .001$. F = 6.224.

* Transformed.

Specific aim 2: fatigue and physical activity

Women reported an average of 467.5 kcal expended each week (SD = 587.5). Of the women reporting participating in physical activity after MI (n = 51), 80% reported activity that was greater than the minimal kilocalorie recommendation of 315 kcal per week for secondary prevention36 and 47 (range = 135–2655). A multivariate model examining the influence of fatigue on physical activity was not significant (F[1, 82] = 0.876; P = .352). The only variable in the study that significantly correlated with physical activity (r = −0.257; P < .01) was comorbidities. Multivariate analysis examining the relationship of physiologic, psychologic, and situational influencing factors and fatigue to physical activity was also not significant (F[8,75] = 1.829; P = .085).

Discussion

Unpleasant symptom of fatigue

In this study a majority of women experienced fatigue 6 to 12 months after MI that they perceived as different from fatigue experienced before the MI. These results are similar to those of other studies that measured fatigue in women 5 days to 6 weeks after MI,14 and 22 indicating that fatigue persists in older women after MI. These results differ from the 13% of healthy women aged 50 years and more who reported fatigue48 and from the 11.6% (n = 232) of older community-dwelling adults who indicated fatigue as a barrier to exercise.49 Because research indicates that women stop or change the pace of activity to accommodate their fatigue,14 and 23 further studies examining the prevalence of fatigue after MI are needed.

Influencing factors

Literature supports fatigue as a side effect of beta-blocker medication.16, 50 and 51 However, in this study fatigue was not significantly related to taking beta-blocker medication. This result may have been related to the inability to compare dosages because of the variety of beta-blocker medications taken. Because beta-blocker medication after MI is a standard of practice,39 further studies should examine the relationship of beta-blocker medication to fatigue and participation in physical activity in older women.

Both depression and sleep were strongly correlated with fatigue and explained significant variance in fatigue after MI. Previous studies noted that these variables were correlates of fatigue.15, 17, 52 and 53 Although depression and sleep were moderately correlated with fatigue in a recent study of healthy younger adults,54 no studies were found examining the relationship of these variables to fatigue in older women after MI.

Depression after a cardiac event is well documented.55, 56 and 57 The significant correlation of depression with fatigue is consistent with the findings of another study that explored fatigue in older adults.10 Yet, it is not clear how depression and fatigue are related; although both are side effects of beta-blocker medication,50, 51 and 58 little is known about the direction of the relationship.59 Additional studies are needed to explore the directional relationships of depression and fatigue in older women after MI to design effective interventions. In addition, recent research has noted that depression is directly associated with heart failure.60 Because an MI can cause heart failure and heart failure is associated with fatigue,14 and 15 and the diagnosis of heart failure was not available in this sample, future studies of depression and fatigue after MI should include a measure of heart failure.

Multiple studies have reported the association of sleep with fatigue.17, 61, 62, 63 and 64 However, the relationships differed by disease process. Although the samples in studies examining sleep17, 61, 63, 64 and 65 included older adults, the majority did not include subjects older than 69 years. Studies relating sleep to fatigue in patients with cardiac disease vary. Results indicate that problems related to sleep result in experiencing tiredness or fatigue.14 and 66 Sleep has also been related to functional status. Gooneratne et al.67 found that daytime sleepiness was associated with functional status, such as activity, productivity, and vigilance, and thus may contribute to deconditioning. In the hospital setting, sleep efficiency in patients with cardiac disease was significantly correlated ($r = -.46$; $P < .001$) with the New York Heart Association (NYHA) classification on admission.68 A study66 examining sleep and fatigue 1 year after percutaneous transluminal coronary angioplasty with 46% of the sample having a history of MI noted a significant relationship ($r = 0.31$; $P < .01$) between sleep and the NYHA class. The NYHA classification, a subjective measure of function, assesses the effect of cardiac symptoms on daily activities. Although fatigue in older women with heart failure has been associated with the physical symptoms of sleep, pain, weakness, and shortness of breath,15 little is known about fatigue and sleep after MI. The influence of sleep on fatigue may relate to physical symptoms that impact functional status. Further studies are needed to clarify this relationship in older women after MI to develop interventions directed at mitigating fatigue.

Consequence of fatigue: physical activity

Only 61% of the women in this study reported participating in any physical activity for exercise. These results were better than those of Moore et al.'s study69 on women's participation in exercise after cardiac rehabilitation. They noted that 25% of the women participated in no exercise after rehabilitation, and only 48% were still exercising 12 weeks later. The American Heart Association recommends a minimal of 30 minutes of moderate physical activity 3 to 4 days per week in addition to daily activities for secondary prevention. The Centers for Disease Control in accordance with the American College of Sports Medicine denote that moderate activity should have an energy expenditure of 3.5 to 7 kcal per minute.47 Therefore, minimal physical activity levels for secondary prevention after MI should range from 315 to 840 kcal per week. Fifty-one percent of the women in this study were not meeting the minimal 315 kcal per week recommendation. However, of the women exercising, 80% were meeting the minimal energy expenditure of 315 kcal per week. Overall, the amount of energy expended in this study was significantly lower than the 1533 (±122) kcal to prevent and 2204 (± 237) kcal per week to reverse progression of coronary atherosclerotic lesions.70

None of the study-influencing factors, age, or the unpleasant symptom of fatigue significantly influenced participation in physical activity for exercise. This result was surprising because previous studies have reported an association of sleep to physical activity67 and depression and increasing age with a decrease in exercise capacity in women after MI.11 Depression is an important variable to measure in patients with MI because those identified as having mild to major depression report a lower adherence to risk reduction behaviors such as regular exercise,71 and they have higher mortality.72 and 73

The relationship of fatigue to participation in physical activity in older women after MI remains poorly understood. In a study of 387 patients attending cardiac rehabilitation (82% men and 18% women), men's vitality score improved more than women's; with women's vitality score remaining below the population mean.20 Even after a structured exercise program, women continued to report decreased energy. Although another study reported that fatigue and physical activity influenced self-reported physical function in older adults,9 no studies were found examining the effect of fatigue on physical activity after MI. In a study of women 6 weeks after MI, 90% (N = 93) experienced fatigue that was chronic and generalized, and 94% of the women reported changing their pattern of activity, such as sleeping and changing the pace or stopping activities, to obtain relief from fatigue.14 Crane and McSweeney23 also found that women altered their activities to accommodate their fatigue 3 to 12 months after their MI. Because an active lifestyle decreases both cardiac risk factors74 and severity of risk factors,75 exploring fatigue's relationship to physical activity and finding ways to increase older women's participation in physical activity is essential to reduce recurrent MIs in older women.

The lack of association of fatigue and physical activity in this study are different from other studies associating fatigue with physical activity.9, 10, 17, 64, 76 and 77 These results may be related to the sensitivity of the physical activity measure, self-report measure of physical activity, or selection bias. Because approximately half of the women who agreed to be contacted by the PI did not participate in the study, these results may not have reflected the population of women at the greatest risk for fatigue, decreased physical activity, or a recurrent MI.

Summary

Limitations of this study are the small sample size, limited racial diversity, and self-reported measures. Generalizability of the findings is limited to the population studied. In addition, other frameworks may be more appropriate in exploring the study variables.

This study found that fatigue was a frequent symptom in older women 6 to 12 months after MI. Research on correlates to fatigue and physical activity is important in designing interventions to provide secondary prevention for older women after MI, and thus impact the disparity in the 6-year recurrent MI rate between men and women. Therefore, future studies exploring fatigue and the relationship to physical activity are needed.

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