

## ORIGINAL ARTICLE

**Fatigue two months after myocardial infarction and its relationships with other concurrent symptoms, sleep quality and coping strategies**

Ulla Fredriksson-Larsson, Pia Alsén, Björn W Karlson and Eva Brink

**Aims and objectives.** To explore fatigue levels two months after myocardial infarction and examine the associations with other concurrent symptoms, sleep quality and coping strategies.

**Background.** Fatigue has been found to be the most frequent and bothersome symptom after myocardial infarction, influencing health-related quality of life negatively.

**Design.** The present study was explorative and cross-sectional. The focus was on fatigue two months postmyocardial infarction, complemented with a comparative analysis of fatigue dimension levels.

**Methods.** The sample included 142 persons (mean age 63 years), treated for myocardial infarction, who responded to a questionnaire package measuring fatigue, depression, health complaints (symptoms), sleep quality and coping strategies.

**Results.** The main results showed that a global fatigue score two months postmyocardial infarction was associated with concurrent symptoms, such as breathlessness and stress, and coping strategies such as change in values, intrusion and isolation. In comparisons of present fatigue dimension levels (general fatigue, physical fatigue, reduced activity and mental fatigue) two months postmyocardial infarction with baseline measurements (first week in hospital), the results showed that levels of fatigue dimensions had decreased. In comparisons with levels of fatigue four months postmyocardial infarction in a reference group, we found lower levels of fatigue two months postmyocardial infarction.

**Conclusion.** The present findings indicated that postmyocardial infarction fatigue is lowest two months postmyocardial infarction. This may thus be the right time to identify persons experiencing postmyocardial infarction fatigue, as timely fatigue relief support may prevent progression into a state of higher levels of fatigue.

**What does this paper contribute to the wider global clinical community?**

- Early fatigue prevention interventions after myocardial infarction (MI) should be worthwhile and should include symptom relief and coping support.
- In the context of nursing practice, measuring fatigue two months post-MI enables the identification of persons experiencing fatigue in the early recovery phase and the introduction of interventions intended to prevent progression towards a state of fatigue or, at extreme levels, vital exhaustion.

**Authors:** *Ulla Fredriksson-Larsson*, RN, PhD, Department of Nursing, Health and Culture, University West, Trollhättan, Institute of Health and Care Sciences, University of Gothenburg, and Centre for Person-Centred Care, University of Gothenburg, Gothenburg; *Pia Alsén*, RN, Lecture, Department of Nursing, Health and Culture, University West, Trollhättan; *Björn W Karlson*, MD, PhD, AstraZeneca, Mölndal and Department of Molecular and Clinical Medicine, Institute of Medicine, Sahlgrenska Academy, University of Gothenburg, Gothenburg; *Eva Brink*, RN, Professor, Department of Nursing, Health and Culture, University West, Trollhättan, Institute of Health and Care Sciences, University of Gothenburg, and Centre for Person-Centred Care, University of Gothenburg, Gothenburg, Sweden

**Correspondence:** Ulla Fredriksson-Larsson, PhD Student, Department of Nursing, Health and Culture, University West, SE-46186 Trollhättan, Sweden. Telephone: +46 520 223849.

**E-mail:** ulla.fredriksson-larsson@hv.se

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

**Relevance to clinic practice.** Measuring fatigue two months postmyocardial infarction would enable healthcare professionals to identify persons experiencing fatigue and to introduce fatigue relief support. Tailored rehabilitation support should include stress management and breathlessness relief support. If maladaptive use of the coping strategies isolation and intrusion is observed, these strategies could be discussed together with the patient.

**Key words:** fatigue, myocardial infarction, regression analysis, symptom assessment

Accepted for publication: 16 April 2015

## Introduction

In research of symptom experiences four months after treatment for myocardial infarction (MI), 50% of persons reported post-MI fatigue (Alsén *et al.* 2010), and this proportion remained after two years (Alsén & Brink 2013). One year post-MI, Andersson *et al.* (2013) found constant and overwhelming physical and mental fatigue that was difficult to manage and led to obvious restrictions in daily life. Persons treated for MI seldom present with a single symptom, but research on symptom assessment has often focused on isolated symptoms. When a person experiences more than one symptom at the same time, this may pose a challenge to symptom management. Studying co-occurrence may create new insights into the interplay between symptoms.

Therefore, it is of vital importance to study multiple symptoms and their relationships simultaneously (Miaskowski *et al.* 2004). The research on early recovery after MI, including exploration of fatigue and its relation with other concurrent symptoms, sleep quality and coping, is limited and therefore in need of being extended.

## Background

A symptom is generally considered to be a subjective experience (Dodd *et al.* 2001), and considering the period after MI, the experience of fatigue is one of the most bothersome symptoms (Alsén *et al.* 2008). Fatigue is defined as a 'subjective, unpleasant symptom that incorporates body feelings ranging from tiredness to exhaustion, creating an unrelenting overall condition that interferes with persons' ability to function to their normal capacity' (Ream & Richardson 1996, p. 527). Research has also shown that persons with heart disease commonly experience illness-related symptoms in the recovery period, such as breathlessness and chest pain, both of which are associated with post-MI fatigue

(Alsén *et al.* 2010). Further, persons may perceive stress due to different kinds of stressors and, in fact, a risk of developing post-traumatic stress disorder after MI has been identified (Bennett *et al.* 2001). A study of the stressor 'threat appraisal' after first MI showed that perceived threat was correlated with depression and that fatigue is a predictor of threat appraisal (Vögele *et al.* 2012).

Symptoms of depression are prevalent in one-third of persons treated for MI (Thombs *et al.* 2006). Fatigue and depression overlap, as fatigue is a core symptom of depression (American Psychiatric Association 2000). Therefore, in research on post-MI fatigue, symptoms of depression also have to be considered.

Symptom experiences after MI may be associated with the person's use of copings strategies. Coping is a concept for research on illness adaptation and is defined as conscious, cognitive and/or behavioural efforts to deal with demanding situations that may exceed one's personal resources (Lazarus & Folkman 1984). Persons experiencing psychological distress after MI (anxiety and/or depression) used fewer positive coping strategies, and more passive coping strategies (Son *et al.* 2012), than did nondistressed persons. The term coping is used regardless of whether the process is adaptive or nonadaptive, and no single coping strategy is considered inherently good or bad. Some strategies are more effective in certain contexts than others are (Lazarus & Folkman 1984).

Few studies of recovery from MI have emphasised fatigue and sleep quality, but a recent study showed that most patients admitted to hospital with heart disease reported poor sleep quality and that subjective sleep quality and daytime dysfunction were predictors of depressive symptoms (Norra *et al.* 2012). Sleep quality has been defined as including sleep duration, latency periods before falling asleep, number of awakenings, daytime dysfunction and subjective experiences of sleep quality (Buysse *et al.* 1989). Research on self-reported sleep quality in persons treated

with percutaneous transluminal coronary angioplasty showed that 42% experienced difficulties in maintaining sleep and that the greatest daytime dysfunction was physical fatigue (Edéll-Gustafsson & Hetta 2001).

A way to understand the development of fatigue post-MI is through longitudinal mapping of fatigue levels, but also by studying significant variables and their relationships to fatigue simultaneously. Research on fatigue two months post-MI would seem to be worthwhile because at this point persons are expected to have recovered, returned to work and to function in activities of daily living.

Therefore, the aim of the present study was to explore fatigue levels and to examine associations between fatigue and other concurrent symptoms, sleep quality and coping strategies two months post-MI. To evaluate the present fatigue levels two months post-MI, a secondary aim was to compare the present fatigue dimension levels with one baseline measurement point in the present sample and with two reference populations. The first reference group was taken from a four-month post-MI follow-up study and the second reference group from a general population study.

## Methods

### Respondents and procedure

The present investigation was carried out as an explorative, cross-sectional study of fatigue two months post-MI. Respondents who met the diagnostic criteria for MI based on electrocardiographic, symptom and enzymatic criteria and were  $\leq 75$  of age were consecutively recruited by three research nurses during the first week of treatment at a coronary care unit in a Swedish regional hospital between March 2011–March 2012. Exclusion criteria were cognitive disorientation, communicative disabilities and other severe diseases (e.g. cancer). At the present measurement point two months after the heart attack, when most persons treated for MI are expected to have recovered and returned to work, the respondents who agreed to participate during the first week in hospital answered five questionnaires about fatigue, sleep quality, somatic health problems, depression, coping and a single item on stress measurement. To evaluate the present fatigue levels two months post-MI, these means were compared with a baseline measurement in the present sample (first week in hospital) and with two reference groups. The first reference population was taken from a four months post-MI follow-up study comprising 204 persons who received post-MI treatment (percutaneous coronary intervention 71%) and medication (beta blocker 88%) similar to that received by persons in the present

study. Moreover, the exclusion and inclusion criteria, with the exception of age ( $< 80$  year), were similar. The mean age of the respondents was  $64 \pm 10$ , and the majority were men (71%) (Alsén *et al.* 2010).

The second reference group was taken from a general population study consisting of a sample ( $n = 139$ ) taken from the telephone directories and representing the characteristics of normal controls in the age range  $46 \pm 16$  years (Smets *et al.* 1998).

### Questionnaires

The respondents completed The Multidimensional Fatigue Inventory (MFI-20) (Smets *et al.* 1995), a 20-item questionnaire assessing fatigue in relation to five dimensions. A Swedish validation study, conducted with Rasch analysis in an MI sample, guided a multidimensional assessment including four dimensions: mental fatigue, general fatigue, physical fatigue and reduced activity. However, the dimension reduced motivation was not valid in the MI sample, and therefore in the present study, this dimension was excluded from the multidimensional analysis of fatigue. Moreover, the Rasch analysis supported the unidimensionality of the total score, measured by a global MFI-20 score.

According to the Rasch model, when the data fit the model, the global score (summarised raw scale scores) should be transformed into interval scale scores, to obtain a more valid measurement of the outcome (Fredriksson-Larsson *et al.* 2015). The response alternatives run from agreement 'yes that is true' to disagreement 'no, that is not true' on a scale from 1–5, where higher scores indicate more fatigue, with a possible range of 4–20 for each dimension. Cronbach's alpha was between 0.88–0.92, and the range 20–100 for the global score.

Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI) (Buysse *et al.* 1989), which investigates seven components (sleep disturbance, sleep latency, subjective sleep quality, sleep duration, daytime dysfunction, habitual sleep disturbance and use of sleep medication) and gives a total summery score. To complete the 19 items, respondents rated the components on a scale from 0–3, with a possible range of 0–21 and where higher scores indicate poorer sleep quality. In the present study, Cronbach's  $\alpha$  was 0.76.

Somatic health problems were measured using the Somatic Health Complaints Questionnaire (SHCQ) (Brink *et al.* 2007), which investigates four dimensions: fatigue, breathlessness, pain and unrest. The 13 items were rated on a six-point scale, ranging from 'never' to 'always during the past week,' with a possible range of 4–24 for the dimensions fatigue and pain, 2–12 for breathlessness and 3–18

for unrest. Higher scores indicate more severe somatic health problems. In the present study, the dimension fatigue was excluded from the analysis due to the use of another fatigue inventory. Cronbach's alpha was 0.87 for breathlessness, 0.60 for unrest and 0.68 for pain.

Depressive symptoms were measured using the Montgomery-Åsberg Depression Rating Scale (MADRS-S) (Montgomery & Åsberg 1979). The nine self-assessment items measure severity for assessment of depression or depressive symptoms during the past three days using a rating scale from 0–6, with a possible total range of 0–54. Higher scores indicate depression symptoms. In the present study, Cronbach's  $\alpha$  was 0.84.

Coping reasoning was measured using The General Coping Questionnaire (GCQ) (Brink *et al.* 2009), which investigates 10 dimensions (minimisation, social trust, change in values, problem reduced actions, self-trust, restrain adaptation, intrusion, isolation, fatalism, protest and resignation). The 41 items were responded to on a six-point scale ranging from 'I always think or act like this' to 'I never think or act like this'. All scales were transformed to the same range, with a possible total score range of 0–100. Higher scores indicate greater use of the coping strategy in question. In the present study, Cronbach's alpha was between 0.70 (fatalism)–0.89 (protest).

Stress was measured using a single-item measurement of stress symptoms (Elo *et al.* 2003). This item converges with items on sleep disturbance, psychological symptoms and well-being and covers the general experience of stress. 'Stress refers to a situation in which a person feels tense, restless, nervous or anxious or is unable to sleep at night because his/her mind is constantly troubled. Do you currently feel this kind of stress?' The response was recoded on a five-point rating scale ranging from 'not at all' to 'very much', with a possible total score range of 1–5. Higher scores indicate greater stress.

## Ethics

The Regional Ethical Review Board in Gothenburg (720-10) approved the study. The participants' were informed about the study aim and procedures both in writing and verbally and were given adequate time to consider participation during the first week in hospital. Data collection was performed by trained research nurses. Informed written consent was obtained from those who wished to participate.

## Data analysis

Descriptive statistics, frequencies, means and standard deviations were calculated to explore the included variables.

Correlations between global fatigue and other variables were analysed using Pitman's permutation test and Pearson's correlation coefficient (95% confidence interval). Further, for development of a final regression model, a forward stepwise approach was used, choosing variables that had a  $p$ -value of  $<0.05$  in the univariate correlation analyses (Nunnally & Bernstein 1994). These significant independent variables were divided into four groups depending on their content and analysed in four subsequent regression analyses: Group 1: demographic and clinical variables like age, gender, treatment with  $\beta$ -blockers and ejection fraction; Group 2: concurrent symptoms like pain, breathlessness, unrest and stress; Group 3: sleep quality; and Group 4: coping strategies. Then, a final regression model was tested including the remaining significant variables. A  $p$ -value  $<0.05$  was considered statistically significant. To evaluate the present fatigue levels two months post-MI, the MFI-20 dimension means were compared with a baseline measurement in the present sample (first week in hospital) using paired sample  $t$ -tests and with two reference groups using independent samples  $t$ -tests in IBM SPSS Statistics (version 21 SPSS Inc., Chicago, IL., USA).

## Results

### Descriptive data

Two months after MI, 142 persons of 165 answered the questionnaire package. The mean age of the respondents

Table 1 Demographics and clinical data

|   | Total<br>$n = 142 \pm SD$ |
|---|---------------------------|
| Age mean, ( $\pm SD$ )                      | 63 (8.2)                  |
| Gender women, $n$ (%)                       | 32 (23)                   |
| Gender men, $n$ (%)                         | 110 (77)                  |
| Days in hospital ( $\pm SD$ )               | 4.9 (2.8)                 |
| Interventions                               |                           |
| Percutaneous Coronary Intervention, $n$ (%) | 113 (80)                  |
| Coronary Artery Bypass Graft, $n$ (%)       | 5 (3.5)                   |
| Beta blocker, $n$ (%)                       | 116 (82)                  |
| History of Co morbidity, $n$ (%)            |                           |
| Hypertension                                | 52 (37)                   |
| Diabetes                                    | 18 (13)                   |
| Stroke                                      | 2 (1.4)                   |
| Smoking                                     | 12 (8.4)                  |
| Cohabiting $n$ (%)                          | 115 (81)                  |
| Education $\leq 9$ years $n$ (%)            | 67 (47)                   |
| Grammar/High school                         | 48 (34)                   |
| University                                  | 23 (16)                   |
| Occupation employed $n$ (%)                 | 62 (44)                   |

**Table 2** Descriptive data and correlations between transformed fatigue score, concurrent symptoms, sleep quality and coping strategies

|           | Variables                        | Mean $\pm$ SD (Range)                  | <i>p</i> -Value* | Pearsons' correlations coefficient <sup>†</sup> |
|-----------|----------------------------------|--|------------------|---|
| Dependent | Fatigue                          | 59.15 $\pm$ 11.72 (20.0–89.4)          |                  |   |
| Group 1   | Gender                           | <i>n</i> = 110 men, 32 female          | >0.30            | Nonsignificant                                  |
| Group 1   | Ejection fraction                | >50% <i>n</i> = 85, <50% <i>n</i> = 38 | 0.12             | Nonsignificant                                  |
| Group 1   | Beta blockers                    | <i>n</i> = 116 yes, 26 no              | >0.30            | Nonsignificant                                  |
| Group 1   | Age                              | 63.04 $\pm$ 8.23 (35–75)               | 0.034            | <i>r</i> = -0.18 (-0.33 to -0.01)               |
| Group 2   | Stress                           | 2.10 $\pm$ 1.04 (1–5)                  | <0.001           | <i>r</i> = 0.51 (0.38 to 0.62)                  |
| Group 2   | Depression symptom               | 5.76 $\pm$ 5.98 (0–29)                 | <0.001           | <i>r</i> = 0.54 (0.41 to 0.65)                  |
| Group 2   | Pain                             | 6.04 $\pm$ 2.59 (4–16)                 | <0.001           | <i>r</i> = 0.39 (0.24 to 0.52)                  |
| Group 2   | Breathlessness                   | 4.66 $\pm$ 2.18 (2–12)                 | <0.001           | <i>r</i> = 0.48 (0.34 to 0.60)                  |
| Group 2   | Unrest                           | 5.91 $\pm$ 2.58 (3–13)                 | <0.001           | <i>r</i> = 0.52 (0.39 to 0.64)                  |
| Group 3   | Sleep quality                    | 6.13 $\pm$ 3.79 (1–17)                 | <0.001           | <i>r</i> = 0.50 (0.36 to 0.61)                  |
| Group 4   | Coping: Fatalism                 | 27.70 $\pm$ 18.40 (0–75)               | <0.001           | <i>r</i> = 0.30 (0.15 to 0.45)                  |
| Group 4   | Coping: Problem reduced activity | 78.43 $\pm$ 19.10 (20–100)             | 0.032            | <i>r</i> = -0.18 (-0.33 to -0.01)               |
| Group 4   | Coping: Resignation              | 19.30 $\pm$ 20.23 (0–90)               | <0.001           | <i>r</i> = 0.33 (0.17 to 0.47)                  |
| Group 4   | Coping: Change in values         | 58.20 $\pm$ 21.10 (5–100)              | 0.005            | <i>r</i> = -0.23 (-0.39 to -0.07)               |
| Group 4   | Coping: Protest                  | 19.33 $\pm$ 22.93 (0–90)               | <0.001           | <i>r</i> = 0.37 (0.22 to 0.50)                  |
| Group 4   | Coping: Social trust             | 80.90 $\pm$ 20.16 (0–100)              | 0.043            | <i>r</i> = -0.17 (-0.33 to 0.00)                |
| Group 4   | Coping: Isolation                | 13.03 $\pm$ 16.50 (0–84)               | <0.001           | <i>r</i> = 0.51 (0.37 to 0.62)                  |
| Group 4   | Coping: Minimisation             | 77.20 $\pm$ 17.09 (28–100)             | <0.001           | <i>r</i> = -0.44 (-0.57 to -0.30)               |
| Group 4   | Coping: Intrusion                | 17.36 $\pm$ 18.31 (0–90)               | <0.001           | <i>r</i> = 0.51 (0.38 to 0.62)                  |
| Group 4   | Coping: Self-trust               | 72.66 $\pm$ 20.40 (15–100)             | <0.001           | <i>r</i> = -0.36 (-0.5 to -0.2)                 |

SD, standard deviation.

\*Pitmans test.

<sup>†</sup>Pearson's correlation coefficient; with 95% confidence interval.

was  $63 \pm 7.7$  and the majority were men (77%). A total of 50% were employed prior to the MI and 81% were cohabiting. A commonly used in-hospital treatment was percutaneous coronary intervention (80%). Demographics and clinical data are presented in Table 1. Descriptive data and correlations for the global score of fatigue, sleep quality, coping scales and symptom experiences are presented in Table 2.

### Associations between variables

The univariate analyses of associations between fatigue (the summed MFI-20 score) and independent variables two

**Table 3** The final multiple regression analysis. Explaining 49.2% of the variance of fatigue two months postmyocardial infarction

|                  | <i>B</i> | 95% CI         | <i>p</i> -value |
|------------------|----------|----------------|-----------------|
| Stress           | 3.59     | 2.09 to 5.11   | <0.001          |
| Breathlessness   | 1.45     | 0.74 to 2.16   | 0.001           |
| Isolation        | 0.14     | 0.02 to 0.25   | 0.017           |
| Intrusion        | 0.11     | 0.00 to 0.21   | 0.041           |
| Change in values | -0.09    | -0.16 to -0.02 | 0.009           |

B, Beta; CI, confidence interval for beta.

months post-MI showed that age, concurrent symptoms (stress, pain, breathlessness and unrest), sleep quality and all coping strategies were correlated with fatigue; see Table 2. Furthermore, in the four preceding multivariate regression analyses, aimed at identifying a final regression model, nine independent variables remained significantly associated with fatigue: age ( $p = 0.035$ ), depression ( $p = 0.002$ ), breathlessness ( $p < 0.001$ ), stress ( $p = 0.007$ ), sleep quality ( $p < 0.001$ ), and the coping strategies change in values ( $p = 0.044$ ), isolation ( $p < 0.001$ ), minimisation ( $p = 0.001$ ) and intrusion ( $p = 0.012$ ). In the end, based on a regression analysis including these nine independent variables, the final multiple regression model was developed, explaining 49% of the variance in fatigue and comprising five predictors: symptoms of stress and breathlessness and the coping strategies isolation, intrusion and change in values; see Table 3. Concerning concurrent symptoms, each unit increase in stress increased fatigue by 3.6 units (CI 95%; 2.09–5.11), and each unit increase in breathlessness increased fatigue by 1.45 units (CI 95%; 0.74–2.16). Regarding coping strategies, the relationships were also significant; each unit increase in change in values decreased fatigue by 0.09 units (CI; 95% -0.16 to -0.02) and each unit increase in isolation and intrusion increased fatigue by

**Table 4** Multidimensional Fatigue Inventory 20 (MFI-20) levels, in patients with MI at baseline (during first week post-MI) compared with two months post-MI, with four months post-MI (another sample) and general population

| MFI-20 scale     | Fatigue at baseline         | Fatigue two months post-MI  |  | Fatigue four months post-MI* | Two-sample <i>t</i> -test (two months–four months) | General Population <sup>†</sup> | Two-sample <i>t</i> -test (two months–general population) |
|------------------|-----------------------------|-----------------------------|--|------------------------------|--|---------------------------------|---|
|                  | <i>n</i> = 165<br>Mean (SD) | <i>n</i> = 142<br>Mean (SD) | Paired-samples <i>t</i> -test<br><i>p</i> -Value | <i>n</i> = 204<br>Mean (SD)  | <i>p</i> -Value                                    | <i>n</i> = 139<br>Mean (SD)     | <i>p</i> -Value   |
| General fatigue  | 11.9 (4.5)                  | 10.9 (4.4)                  | 0.007  | 12.3 (4.3)                   | 0.003  | 9.9 (5.2)                       | 0.083   |
| Physical fatigue | 11.7 (4.8)                  | 10.6 (4.4)                  | 0.010  | 11.9 (4.7)                   | 0.009  | 8.8 (4.9)                       | 0.001   |
| Reduced activity | 12.1 (6.5)                  | 10.7 (4.3)                  | 0.016  | 12.1 (4.5)                   | 0.004  | 8.7 (4.6)                       | 0.000   |
| Mental fatigue   | 9.3 (3.6)                   | 8.7 (4.0)                   | 0.036  | 10.2 (3.8)                   | 0.000  | 8.3 (4.8)                       | 0.448   |

SD, Standard deviation; MI, myocardial infarction.

\*Alsén *et al.* (2010).

<sup>†</sup>Smets *et al.* (1998).

0.14 (95% CI; 0.02–0.25) and 0.11 (95% CI; 0.00–0.21) units, respectively.

### Fatigue two months post-MI

In comparisons of fatigue dimensions between baseline (first week post-MI) and two months post-MI, decreased levels were found for the four MFI-20 dimensions explored in the present study (general fatigue, physical fatigue mental and reduced activity). In comparisons of fatigue levels with reference populations including persons four months post-MI, all four MFI-20 dimension mean scores were lower at the present two-month measurement point. In a comparison of fatigue level with the general population, two MFI-20 dimension mean scores, physical fatigue and reduced activity were higher at the present two-month measurement point; see Table 4.

### Discussion

The findings showing that the MFI-20 global score was associated with other concurrent symptoms and coping strategies (change in values, intrusion and isolation) indicate that early fatigue prevention after MI should be oriented towards relieving stress and breathlessness, as well as emphasising coping strategies. The present result showing that stress was associated with fatigue has also been found in other studies (e.g. Vögele *et al.* 2012). Persons stricken by a heart attack describe recovery as a traumatic experience, including unusual tiredness and presence of fear and anxiety owing to their unreliable body and altered outlook on life (Andersson *et al.* 2013). Moreover, fatigue, general health and disease-specific symptoms were important stressors immediately after the MI (Vögele *et al.* 2012). Stress occurs when environmental demands exceed the person's

resources, and endangering his/her well-being (Lazarus & Folkman 1984). Accordingly, related to the subjective experience of MI, stressors such as greater fear of dying and experiences of helplessness predicted stress status better than objective measures of MI severity did (Guler *et al.* 2009). In a study of post-traumatic stress three months post-MI, a higher frequency of intrusive and distressing memories of the MI was a potential trigger of post-traumatic stress, as was a higher frequency of symptoms that persons believed were associated with the coronary event (Bennett *et al.* 2001).

Stress appraisal is based on personal beliefs, values and goals, and the options for coping are determined by the person's health and biopsychosocial resources (Lazarus & Folkman 1984). The present study showed that coping strategies such as isolation, intrusion and change in values were associated with fatigue two months post-MI. The coping strategy intrusion includes the inability to keep threats at a distance and a feeling of anxiety about how the situation will end (Brink *et al.* 2009). During early recovery post-MI, persons are worried about suffering a new MI, but over time they gradually get better, some requiring the support of a mentor and some being able to handle the fear themselves (Junehag *et al.* 2013). After MI, persons described no longer daring to trust their bodies or their minds, because their heart could stop without warning, and new signs of irritation and anger were present that had not occurred pre-MI (Andersson *et al.* 2013). Moreover, threat appraisal changes over time, and results have shown that threat appraisal was related to strategies such as a search for affiliation (contacting people who have had a similar experience) and threat minimisation (things are bad now, but they will get better) (Vögele *et al.* 2012).

Our results showed that the coping strategy isolation was associated with perceived fatigue two months post-MI. This

coping strategy involves the person choosing not to talk about the disease, a lack of open communication with the family and thinking that no one understands one's problems, resulting in self-isolation (Brink *et al.* 2009). Persons have different expectations about and approaches to their future life. Some have a tendency to be self-centred and to go their own way, while others take a short-term perspective and are cautious about the future, constantly prepared for a setback (Eriksson *et al.* 2010). It seems important to receive social support, e.g. peer support from lay people with similar experiences and from relatives or family support in the early rehabilitation phase, as such support promotes feelings of security (Junehag *et al.* 2014). Conversely, persons lacking in support may experience undesired loneliness and doubt (Junehag *et al.* 2013). Research on rehabilitation support has shown that couples who were given opportunities to discover differences in their thoughts and expectations regarding the future were able to compensate for and balance each other by working on developing a positive attitude towards life and the future (Eriksson *et al.* 2010).

In the present study, breathlessness makes a strong contribution to the explained variance in fatigue two months post-MI. This result is consistent with an interview study three weeks post-MI showing that persons complained of weakness and shortness of breath (Webster *et al.* 2002). In another interview study six weeks post-MI, persons described breathlessness as the most harmful symptom, leading to disturbed sleep and resulting in fatigue during daily activities (Roebuck *et al.* 2001). Also, at six months post-MI, fatigue and breathlessness were associated with less physical activity measured using pedometer registration (Brändström *et al.* 2009). On the basis of all of these results, we can reasonably conclude that it is important to prevent development of fatigue through early identification and support of persons experiencing breathlessness. An important aspect to consider in helping MI patients be physically active is their possible thoughts about the relationship between tiredness, breathlessness and heart dysfunction. Azevedo *et al.* (2007) showed that a clinical syndrome of heart failure (two or more cardiac symptoms) was common in middle-age and older persons, but that less than half of these cases were objectively related to cardiac abnormality. This means that it is difficult to distinguish pathological conditions from the mere physical decline often associated with ageing. Further, research has shown that persons interpret fatigue incorrectly, believing it to be a sign that cardiac function is impaired and that physical activity is harmful (Webster *et al.* 2002). This may mean that, in the recovery phase, persons who experience fear of

movement (Bäck *et al.* 2013) related to the heart attack event should be encouraged and helped to engage in physical activity, which in turn may have positive effects on breathlessness and fatigue.

The findings at two months post-MI showed that the mean scores for fatigue dimensions in the MFI-20 (physical, mental and general fatigue and reduced activity) were slightly decreased compared to an earlier baseline measurement in the present sample. Furthermore, compared with persons who were tested for fatigue four months post-MI (Alsén *et al.* 2010), the present study group scored lower on general fatigue, physical fatigue, reduced activity and mental fatigue. These comparisons are interpreted as possibly indicating an increase in fatigue from two months to four months post-MI. Compared to the second reference group – the general population – physical fatigue and reduced activity scores were higher in the present sample. This may indicate a recovery problem due to the fact that, at two months post-MI, persons are expected to return to work when their sick leave period has ended. This will likely cause problems for some persons experiencing post-MI fatigue and other concurrent symptoms if they need time for rest and recuperation. Therefore, measuring fatigue after two months could help guide nursing care strategies aimed at early identification of fatigued persons and help prevent progression towards a state of increased fatigue or at extreme levels vital exhaustion.

Finally, other studies have shown that disturbed sleep has an impact on fatigue experience after MI (Brink *et al.* 2012). In the present study, sleep quality was associated with fatigue, but the association was not statistically significant in the final regression analysis. This result does not in any way imply that sleep quality is not important or that it should be excluded from future research on fatigue. Newer research showed that 52% of the participants ( $n = 259$ ) in cardiac rehabilitation reported poor sleep quality, and poor sleep quality occurred more often in persons with depressive symptoms. Poor sleep quality was also associated with decreased health-related quality of life (Banack *et al.* 2014).

## Conclusion

The present findings indicated that post-MI fatigue is lowest two months after MI. Thus, this may be the appropriate time to identify persons experiencing post-MI fatigue, as timely fatigue relief support may prevent progression into a state of increased fatigue. Fatigue relief support may rely on identification not only of fatigue, but also other concurrent symptoms.

## Relevance to clinic practice

Screening for fatigue two months post-MI would enable healthcare professionals to identify persons experiencing fatigue and introduce fatigue relief support. Tailored rehabilitation support should include stress management and breathlessness relief support. If maladaptive use of the coping strategies isolation and intrusion is observed, these strategies could be discussed together with the patient. Identifying and supporting persons experiencing fatigue, but also emphasising the symptoms of breathlessness and stress is of importance in preventing fatigue levels two months post-MI from getting worse.

## Limitation

The present study explored fatigue two months post-MI. The comparison between the fatigue dimension levels of the MFI-20 at two months and four months post-MI was carried out on two different samples, yet these two samples

were based on the same diagnosis as well as similar inclusion and exclusion criteria. The conclusion that there is a risk that fatigue may increase from 2–4 months post-MI has to be handled with some caution. Additional longitudinal research is needed.

## Acknowledgements

This work was supported by the Centre for Person-Centred Care at the University of Gothenburg (GPCC), Sweden. GPCC is funded by the Swedish Government's grant for Strategic Research Areas, Care Sciences (Application to Swedish Research Council no. 333-02) and co-funded by the University of Gothenburg, Sweden.

## Contributions

Study design: UFL PA, BWK EB, data collection and analysis: UFL PA EB and manu-script preparation: UFL, PA BWK, EB.

## References

- Alsén P & Brink E (2013) Fatigue after myocardial infarction – a two year follow up study. *Journal of Clinical Nursing* **22**, 1647–1652.
- Alsén P, Brink E, Brandstrom Y, Karlson BW & Persson LO (2010) Fatigue after myocardial infarction: relationships with indices of emotional distress, and sociodemographic and clinical variables. *International Journal of Nursing Practice* **16**, 326–334.
- Alsén P, Brink E & Persson LO (2008) Living with incomprehensible fatigue after recent myocardial infarction. *Journal of Advanced Nursing* **64**, 459–468.
- Andersson EK, Borglin G & Willman A (2013) The experience of younger adults following myocardial infarction. *Qualitative Health Research* **23**, 762–772.
- American Psychiatric Association (2000) Task Force on DSM- IV. *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV-TR*, 4th edn. American Psychiatric Association, Washington, DC.
- Azevedo A, Bettencourt P, Pimenta J, Friões F, Abreu-Lima C, Hense HW & Barros H (2007) Clinical syndrome suggestive of heart failure is frequently attributable to non-cardiac disorders—population based study. *European Journal of Heart Failure* **9**, 391–396.
- Banack HR, Holly CD, Lowensteyn I, Masse L, Marchand S, Grover SA & Da Costa D (2014) The association between sleep disturbance, depressive symptoms, and health-related quality of life among cardiac rehabilitation participants. *Journal of Cardiopulmonary Rehabilitation and Prevention* **34**, 188–194.
- Bennett P, Conway M, Clatworthy J, Brooke S & Owen R (2001) Predicting post-traumatic symptoms in cardiac patients. *Heart & Lung: The Journal of Acute and Critical Care* **30**, 458–465.
- Brink E, Alsén P, Herlitz J, Kjellgren K & Cliffordson C (2012) General self-efficacy and health-related quality of life after myocardial infarction. *Psychology, Health & Medicine* **17**, 346–355.
- Brink E, Cliffordson C, Herlitz J & Karlson BW (2007) Dimensions of the Somatic Health Complaints Questionnaire (SHCQ) in a sample of myocardial infarction patients. *European Journal of Cardiovascular Nursing* **6**, 27–31.
- Brink E, Persson LO & Karlson BW (2009) Coping with myocardial infarction: evaluation of a coping questionnaire. *Scandinavian Journal of Caring Sciences* **23**, 792–800.
- Brändström Y, Brink E, Grankvist G, Alsén P, Herlitz J & Karlson BW (2009) Physical activity six months after a myocardial infarction. *International Journal of Nursing Practice* **15**, 191–197.
- Busse DJ, Reynolds CF III, Monk TH, Berman SR & Kupfer DJ (1989) The Pittsburgh sleep quality index: a new instrument for psychiatric practice and research. *Psychiatry Research* **28**, 193–213.
- Bäck M, Cider Å, Herlitz J, Lundberg M & Jansson B (2013) The impact on kinesiophobia (fear of movement) by clinical variables for patients with coronary artery disease. *International Journal of Cardiology* **167**, 391–397.
- Dodd M, Janson S, Facione N, Faucett J, Froelicher ES, Humphreys J & Rankin S (2001) Advancing the science of symptom management. *Journal of Advanced Nursing* **33**, 668–676.
- Edéll-Gustafsson UM & Hetta JE (2001) Fragmented sleep and tiredness in males and females one year after percutaneous transluminal coronary angioplasty (PTCA). *Journal of Advanced Nursing* **34**, 203–211.



- Elo AL, Leppänen A & Jahkola A (2003) Validity of a single-item measure of stress symptoms. *Scandinavian Journal of Work, Environment & Health* 29 (6), 444–451.
- Eriksson M, Asplund K & Svedlund M (2010) Couples' thoughts about and expectations of their future life after the patient's hospital discharge following acute myocardial infarction. *Journal of Clinical Nursing* 19, 3485–3493.
- Fredriksson-Larsson Ulla, Brink E, Alsén P, Falk K & Lundgren-Nilsson Å (2015) Psychometric analysis of the Multidimensional Fatigue Inventory (MFI-20) in a sample of persons treated for myocardial infarction. *Journal of Nursing Measurement* 23(1), 154–166.
- Guler E, Schmid J, Wiedemar L, Saner H, Schnyder U & Känel R (2009) Clinical diagnosis of posttraumatic stress disorder after myocardial infarction. *Clinical Cardiology* 32, 125–129.
- Junehag L, Asplund K & Svedlund M (2013) Perceptions of illness, lifestyle and support after an acute myocardial infarction. *Scandinavian Journal of Caring Sciences* 28(2), 289–296.
- Junehag L, Asplund K & Svedlund M (2014) A qualitative study: perceptions of the psychosocial consequences and access to support after an acute myocardial infarction. *Intensive & Critical Care Nursing: The Official Journal of the British Association of Critical Care Nurses* 30, 22–30.
- Lazarus RS & Folkman S (1984) The coping process: an alternative to traditional formulations. In *Stress, Appraisal, and Coping* (Lazarus RS & Folkman S eds.). Springer Publishing Company, New York, NY, pp. 141.
- Miaskowski C, Dodd M & Lee K (2004) Symptom clusters: the new frontier in symptom management research. *Journal of the National Cancer Institute* 32, 17–21.
- Montgomery SA & Åsberg M (1979) A new depression scale designed to be sensitive to change. *The British Journal of Psychiatry* 134, 382–389.
- Norra C, Kummer J, Boecker M, Skobel E, Schauer P, Wirtz M & Forkmann T (2012) Poor sleep quality is associated with depressive symptoms in patients with heart disease. *International Journal Behavioral Medicine* 19, 526–534.
- Nunnally J & Bernstein I (1994) *Psychometric Theory* (3). McGraw-Hill, New York, NY.
- Ream E & Richardson A (1996) Fatigue: a concept analysis. *International Journal of Nursing Studies* 33, 519–529.
- Roebuck A, Furze G & Thompson DR (2001) Health-related quality of life after myocardial infarction: an interview study. *Journal of Advanced Nursing* 34, 787–794.
- Smets E, Garssen B, Bonke B & De Haes J (1995) The Multidimensional Fatigue Inventory (MFI) psychometric qualities of an instrument to assess fatigue. *Journal of Psychosomatic Research* 39, 315–325.
- Smets E, Visser M, Willems-Groot A, Garssen B, Schuster-Uitterhoeve A & De Haes J (1998) Fatigue and radiotherapy: (B) experience in patients 9 months following treatment. *British Journal of Cancer* 78, 907.
- Son H, Thomas SA & Friedmann E (2012) The association between psychological distress and coping patterns in post-MI patients and their partners. *Journal of Clinical Nursing* 21, 2392–2394.
- Thombs BD, Bass EB, Ford DE, Stewart KJ, Tsilidis KK, Patel U & Ziegelstein RC (2006) Prevalence of depression in survivors of acute myocardial infarction. *Journal of General Internal Medicine* 21, 30–38.
- Webster RA, Thompson DR & Mayou RA (2002) The experiences and needs of Gujarati Hindu patients and partners in the first month after a myocardial infarction. *European Journal of Cardiovascular Nursing* 1, 69–76.
- Vögele C, Christ O & Spaderna H (2012) Cardiac threat appraisal and depression after first myocardial infarction. *Frontiers in Psychology* 3, 365.