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Original Article

Self-reported sleep quality and depression in post myocardial infarction patients attending cardiology outpatient clinics in Oman

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ABSTRACT

Objective: This study aimed to examine the sleep quality and prevalence of depression in post myocardial infarction patients attending cardiology outpatient clinics of selected hospitals in Oman.
Methods: A descriptive cross-sectional design was used to collect data from patients ($n = 180$) who were at least 4 weeks post myocardial infarction diagnosis and receiving follow-up care in the outpatient clinic. The Arabic version of the Pittsburgh Sleep Quality Index and Patient Health Questionnaire-9 were used to assess sleep quality and depressive symptoms, respectively.
Results: The sample mean age was 62.0 ± 11.3 years. Poor sleep quality affected 61.1% of the participants. The significant predictors of poor sleep quality were gender ($P \leq 0.05$), body mass index ($P \leq 0.05$), and self-reported regular exercise ($P \leq 0.01$). The most impacted domains of sleep quality were sleep latency, sleep duration, and sleep disturbances. The prevalence of major depression was low (5%) and the rate of re-infarction was 27.2%. The prevalence of minimal to mild major depression with a potential of transitioning into major depression overtime was very high. Self-reported regular exercise ($P \leq 0.01$) was the only significant predictor of depressive symptoms.
Conclusion: The sleep quality of post myocardial infarction patients was poor and the prevalence of depression was low. There was no significant relationship between sleep quality or depression with re-infarction.

What is known?

- Myocardial infarction is a major cause of morbidity and mortality worldwide and its impact is escalating in developing and low or middle income countries.
- Some of the modifiable risk factors for myocardial infarction or re-infarction include psychosocial factors such as depression and poor sleep quality.
- There are few studies which have evaluated sleep quality and depression in post myocardial infarction patients in any of the countries in the Middle East region.

What is new?

- Poor sleep quality was very prevalent among Omani post myocardial infarction patients and the domains of sleep quality most affected were sleep latency, sleep duration, and sleep disturbances.
- At a period of at least 4 weeks, all Omani post myocardial infarction patients reported some level of depressive symptoms with the majority having minimal to mild major depression which requires support, education and watchful waiting because of the potential of transitioning into major depression.
- The rate of re-infarction among Omani post myocardial infarction patients was high, but was not statistically significantly associated with the level depressive symptoms or sleep quality.

1. Introduction

According to the World Health Organization (WHO), cardiovascular diseases are one of the leading causes of mortality and morbidity worldwide [1]. Globally, approximately 15.9 million cases of myocardial infarction occurred in 2015 [2]. Myocardial infarction is a very common acute cardiovascular problem and it

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leads to 35% of all hospital admissions [3]. The consequences of myocardial infarction and other cardiovascular diseases (CVDs) are severe because they lead to approximately 50% of all deaths worldwide, and the majority of these take place in low-to-middle-income countries [4].

In the Middle East, countries such as Oman, Yemen, Jordan and others, are experiencing high morbidity and mortality rates due to CVDs [5]. Recent studies show that in the Middle East patients with conditions such as acute coronary syndrome are 7–10 years' younger than their counterparts in western countries [6]. And the rate of acute coronary syndrome (based on the number of percutaneous coronary interventions) among young (<45 years) and older patients (>45 years) in the Middle East is the same (76%) [6]. Analysis of discharge diagnoses using data from the Gulf registry of coronary events in countries such as Oman, Bahrain, Kuwait, Qatar, Yemen and United Arab Emirate shows that 39% of these are ST-elevation myocardial infarction, 32% are non-ST-elevation and 29% are unstable angina [7].

The prognosis of CVDs in the Middle East is also still suboptimal. A study of 7,930 patients with acute coronary syndrome showed that 0.75 suffered a stroke during their index hospitalization [8]. The in-hospital mortality among patients with acute myocardial infarction in a country like Lebanon is reported to be 7.8% and mortality is a common occurrence among patients with complications [9]. The death rate due to CVDs in countries such as Saudi Arabia, United Arab Emirates, Bahrain, and Qatar is estimated at 42%, 38%, 32% and 23%, respectively [10]. In Oman CVDs are estimated to account for 33% of all total deaths [11]. The overall incidence rate of acute coronary syndrome (ACS) in Oman is 338.9 per 100,000 person years and all the different types such as unstable angina (55%), ST-elevation (26%) and Non-ST-elevation (19%) are common [12].

Over the past 20 years in-hospital deaths due to cardiac causes have been increasing in Oman, especially among patients presenting with ACS [13]. However recent improvements in healthcare for patients with heart diseases have led to increased survival and reduced length of stay in acute care settings by patients with myocardial infarction [14]. The majority of hospitalized myocardial infarction patients are now cared for using evidence-based guidelines, and on average, they stay admitted in the hospital for a period of less than four days [15]. The use of evidence-based practice guidelines to treat myocardial infarction has led to increased survival and life expectancy [16]. However patients who survive myocardial infarction may suffer sequels on returning home, and these impacts their well-being and quality of life [17,18].

The post myocardial infarction sequels may be physical or psychosocial in nature [19]. The physical sequels of myocardial infarction may include fatigue, limited physical activity and others [20]. The common psychosocial sequels of myocardial infarction include anxiety, fear of impending death, social isolation, sleep disturbance, and depression [20,21]. The psychosocial sequels stem from feelings of insecurity about future health and fear of inability to return to work or to resume previous activities [22]. Depression is a common post myocardial infarction sequel and studies have shown that it increases the risk of new coronary events and coronary-related mortality [23]. Reports from countries such as Saudi Arabia show that 20.6% of post myocardial infarction patients suffer from depression [24]. The female patients tend to suffer higher levels of depression than males, and depression is an independent predictor of 40% and 33% of post myocardial infarction complications in female and male patients, respectively [25]. Depression is associated with a 2.5 times increase in the risk of new cardiovascular events and mortality [26]. Hence, the increase in the number of clinical studies examining the effect of depression treatment on coronary outcomes [27].

Poor sleep quality has also been reported to be associated with deterioration in the clinical outcomes of acute myocardial infarction during hospitalization [21]. The lack of good sleep quality increases the risk of both depression and myocardial infarction [28,29]. Therefore the increasing prevalence of myocardial infarction in Oman and the Middle East region also implies that a large number of post myocardial infarction patients may be suffering from the associated psychosocial sequels and re-infarction. Despite this understanding, there are no studies which have evaluated the psychosocial sequels such as sleep quality and depression suffered by post myocardial infarction patients in Oman or other parts of the Middle East region. The purpose of this study was to examine the sleep quality and prevalence of depression in post myocardial infarction patients attending cardiology outpatient clinics of selected hospitals in Oman.

2. Methods

2.1. Research design and setting

This was a descriptive cross-sectional study which assessed the outcomes of sleep quality and depressive symptoms among post myocardial infarction patients. The participants were at least 4 weeks post myocardial infarction and were attending the cardiology outpatient clinic. The study was conducted in the cardiology outpatient clinics of two hospitals in Muscat, Oman. The two hospitals were selected because they are the main tertiary referral hospitals that specialize in management of heart diseases in the country. The two hospitals receive referrals from healthcare facilities across the country for further evaluation and management (especially those requiring coronary angiography and coronary artery bypass and graft surgeries). The study targeted adult post myocardial infarction Omani patients attending cardiology outpatient clinics at the two hospitals for regular follow-up care.

2.2. Study population

A convenience sample of post myocardial infarction patients receiving follow up care was recruited. The inclusion criteria were: (1) older than 18 years; (2) diagnosed with myocardial infarction at least one month ago; (3) able to understand and speak Arabic or English; (4) no previous diagnosis of mental health problem; (5) not experiencing complications such as chest pain and arrhythmias at the time of data collection; and, (6) not having any cognitive impairment. The exclusion criteria were: (1) patients with complications like chest pain and arrhythmia at the time of attending the clinic for follow-up; and; (2) inability to complete the questionnaire due to acute symptoms or cognitive impairment. Data was collected from 180 participants and all of these were assessed for eligibility and cognitive capacity. Written informed consent was obtained using a consent form approved by the research and ethics committee.

2.3. Study instruments

Two instruments were used to collect data i.e. the Pittsburgh Sleep Quality Index (PSQI) and the Patient Health Questionnaire (PHQ-9). Data about participants' demographic characteristics was obtained directly from the participants and data about clinical related factors were obtained from the patients' electronic medical records. The PSQI measures subjective sleep quality during the previous month and categorizes the scores as “poor” and “good” sleep quality [30]. The PSQI has seven components (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime

dysfunction) and each has possible scores ranging from 0 to 3. The total of all components yields a global subjective sleep quality score ranging from 0 to 21. A global score greater than 5 indicates poor sleep quality and a score of less than 5 indicates good sleep quality [31]. The psychometric properties of the PSQI have been confirmed in previous studies with a test-re-test reliability of 0.87 [32]. The Cronbach's α of the PSQI in the current study was 0.642.

Depression was assessed using the PHQ-9 [33]. The PHQ-9 consists of nine depressive symptoms and participants indicate how frequently a symptom has bothered them during the previous two weeks ("not at all = 0"; "for several days = 1"; "for more than half of the days = 2"; "nearly every day = 3"). The total scores of the PHQ-9 are interpreted as: 0–4 = minimal depression; 5–9 = mild depression; 10–14 = moderate depression; 15–19 = moderately severe depression; and 20–27 = severe depression [34]. The PHQ-9 has a high sensitivity (88%) and specificity (88%) for major depression [35] and its Cronbach's α in the current study was 0.752.

The study questionnaire was pilot tested among 18 participants who met the inclusion criteria in the cardiology outpatient clinic, to determine how much time is needed to complete the tool, and participants' ability to understand the items. The two tools were being used in Oman for the first time. The participants reported no difficulty with the tool and the questionnaire required approximately 30 min to complete.

2.4. Ethical consideration

Ethical review and approval was obtained from the Research and Ethics Committee of the University where the investigators are faculty and staff, and the Ministry of Health (Government of Oman). The participants were required to provide written informed consent. The participants' identifying information was not collected as part of the study.

2.5. Data collection

Data collection was initiated after obtaining ethical approval from the respective hospitals. On data collection days, the cardiology outpatient clinic list of scheduled post myocardial infarction patients was retrieved. The patients were approached on arrival in the clinic and screened according to the inclusion criteria. The study purpose and procedures were explained to the patients who met the criteria and were willing to participate in the study while waiting to see the physician. The participants who consented to the study were put in a private room to complete the data collection process. The data collection instrument was written in Arabic. Data were collected during the period of September 2017- December 2017 (4 Months) from 180 (62.3%) out of the 289 who were eligible and approached to participate.

2.6. Statistical analysis

Frequencies and percentages were reported for categorical variables. The continuous data was summarized using mean and standard deviation. Normality was examined using the Shapiro-Wilk statistic for the variable of sleep quality ($P = 0.126$) and level of depression ($P = 0.362$). Multiple linear regression analyses were performed to explore the factors associated with level of sleep quality and depression. For all analyses a P-value of <0.05 (two tailed) was considered to be statistically significant.

3. Results

3.1. Demographic characteristics of participants

A total of 180 post myocardial infarction patients participated in the study and their characteristics are summarized in Table 1. Their mean age was 62.0 ± 11.3 years. The majority were male (68.3%), married (77. 2%), had no formal education (61.7%), and were retired (40.6%) or unemployed (39.4%).

3.2. Participants' clinical characteristics

The participants' clinical characteristics are presented in Table 2, and show that the rate of re-infarction was 27.2%. The majority were: not engaged in regular physical exercise (68.3%); overweight according to body mass index (61.1%); and were 13–24 months (42.8%) post myocardial infarction. The participants had other medical diagnoses (co-morbidities) such as dyslipidemia (78.9%), coronary artery disease (77.2%), hypertension (69.4%), diabetes mellitus (58.3%), and were currently taking medications such as aspirin (100%), atorvastatin (93.9%), atenolol (60%), lisinopril (58.3%), and clopidogrel (56.1%).

3.3. Sleep quality of post myocardial infarction patients

The results presented in Table 3 show sleep quality of post myocardial infarction patients. The patients' PSQI score was 6.95 ± 2.82 and the majority (61.1%) had poor sleep quality. A descriptive exploration of the seven components of PSQI shows that the participants had more problems with sleep latency, sleep duration, and sleep disturbances.

3.4. Incidence of depression in post myocardial infarction patients

The results summarized in Table 4 show incidence of depression in post myocardial infarction patients. The mean depression score was 5.44 ± 0.44 and the majority of participants had minimal depressive symptoms (82.2%). Only a few participants (5%) had moderate to major depression (might need referral for antidepressant and psychotherapy). A large number (95%) had scores interpreted as minor depression (only need support, education and watchful waiting).

3.5. Factors associated with sleep quality and depressive symptoms in post myocardial infarction patients

Multiple regression analysis was used to test the factors associated with sleep quality and level of depression as summarized in Table 5. The results indicate that three factors explained 15% of the variance in sleep quality ($R^2 = 0.15$, $F = 4.48$, $P < 0.01$). It was found that self reported performance of regular exercise ($\beta = -0.20$, $P \leq 0.01$), gender ($\beta = 0.18$, $P \leq 0.05$), and body mass index ($\beta = -0.14$, $P \leq 0.05$) were significant predictors of sleep quality. Only one factor was significantly associated with the level of depressive symptoms and it explained 9% of the variance ($R^2 = 0.09$, $F = 3.12$, $P < 0.05$). Self reported performance of regular exercise ($\beta = -0.25$, $P \leq 0.01$) was a significant predictor of depressive symptoms. There was no significant relationship between sleep quality and re-infarction or between depressive symptoms and re-infarction.

4. Discussion

The aim of this study was to assess the level of sleep quality and depression in patients who were at least 4 weeks post myocardial

Table 1
Participants' demographic characteristics ($n = 180$).

Characteristic		*n* (%)
Gender	Male	123 (68.3)
	Female	57 (31.7)
Age in years	18–40	6 (3.3)
	41–60	73 (40.6)
	≥ 61	101 (56.1)
Level of education	No formal education	111 (61.7)
	Completed primary school	34 (18.9)
	Completed secondary school	22 (12.2)
	Bachelors' degree and above	13 (7.2)
Marital status	Single	4 (2.2)
	Married	139 (77.2)
	Divorced	4 (2.2)
	Widow	33 (18.3)
Employment status	Employed in formal sector	21 (11.7)
	Self-employed	15 (8.3)
	Retired	73 (40.6)
	Unemployed	71 (39.4)
Monthly income in US dollars	0–1024	129 (71.7)
	1025–2560	33 (18.3)
	≥ 2561	18 (10.0)

Table 2
Participants' clinical characteristics ($n = 180$).

Characteristic		*n* (%)
History of re-admission due to re-infarction	Yes	49 (27.2)
	No	131 (72.8)
Currently smoking	Yes	16 (8.9)
	No	164 (91.1)
If you smoke, how many years have you been smoking?	20–30	12 (6.7)
	≥ 31	4 (2.2)
	None	164 (91.1)
Time in months since diagnosis of myocardial infarction	0–6	74 (41.1)
	7–12	29 (16.1)
	13–24	77 (42.8)
Body Mass Index	Underweight (<18.5)	9 (5.0)
	Normal (18.5–24.9)	61 (33.9)
	Overweight (≥25.0)	110 (61.1)
Engaging in regular exercise	Yes	57 (31.7)
	No	123 (68.3)
Other concurrent medical diagnoses reported by participants *(multiple responses)*	Diabetes mellitus	105 (58.3)
	Hypertension	125 (69.4)
	Coronary artery disease	139 (72.2)
	Dyslipidemia	142 (78.9)
	Ischemic heart disease	64 (35.6)
	Chronic kidney disease	11 (6.1)
	Benign prostate hyperplasia	5 (2.8)
	Hypothyroidism	4 (2.2)
	Chronic respiratory disease	6 (3.3)
	Gastritis	4 (2.2)
	Other heart diseases	9 (5)
Current medications *(multiple responses)*	Aspirin	180 (100)
	Clopidogrel	101 (56.1)
	Metformin	65 (36.1)
	Gliclazide	21 (11.7)
	Atenolol	108 (60)
	Bisoprolol	23 (12.8)
	Carvedilol	32 (17.8)
	Lisinopril	105 (58.3)
	Amlodipine	18 (10)
	Nitroglycerin	50 (27.8)
	Isosorbide dinitrate	20 (11.1)
	Atorvastatin	169 (93.9)
	Furosemide	20 (11.1)
	Spironolactone	9 (5)
	Omeprazole	20 (11.1)
	Others	36 (20)

infarction and attending the cardiac outpatients' clinic for follow-up care in Oman. The mean global PSQI score was 6.95 and a large proportion of participants (61.1%) had poor sleep quality. There are no other studies from Oman or the Middle East region to

Table 3
Scores of PSQI among post myocardial infarction patients ($n = 180$).

Components of Sleep quality	Score (*Mean* ± *SD*)
Subjective sleep quality	0.87 ± 0.07
Sleep latency	1.33 ± 0.10
Sleep duration	1.47 ± 0.09
Habitual sleep efficiency	0.11 ± 0.08
Sleep disturbances	1.38 ± 0.06
Use of sleep medications	0.13 ± 0.06
Day time dysfunction	0.93 ± 0.08
Global PSQI Score	6.95 ± 2.82

Note: PSQI = Pittsburgh Sleep Quality Index.

Table 4
Depression among post-MI patients ($n = 180$).

	Category	Scores	*n*	%
Symptom category	Minimal symptoms	0–9	148	82.2
	Mild Major Depression	10–14	23	12.8
	Moderate Major Depression	15–19	8	4.4
	Major depression	≥ 20	1	0.6

Table 5
Summary of simple regression analyses for variables associated with Sleep Quality and level of Depression ($n = 180$).

Variable	Sleep Quality				Depression			
	B	*SE*	*β*	*P*	*B*	*SE*	*β*	*P*
Body mass index	0.10	0.05	0.14	0.05	0.10	0.07	0.01	0.89
Regular exercise	−1.39	0.54	−0.20	0.00	−2.36	0.75	−0.25	0.00
Smoking status	1.12	0.85	0.20	0.19	0.27	1.19	0.02	0.82
Age in years	0.03	0.03	0.11	0.22	0.03	0.04	0.08	0.40
Gender	1.29	0.56	0.18	0.02	1.02	0.79	0.12	0.19
Level of education	0.09	0.29	0.03	0.77	0.11	0.41	0.02	0.80
R^2	0.15				0.09			
F	4.48**				3.12*			

Note: $^{**}P < 0.01$; $^{*}P < 0.05$.

compare with, but our results are generally consistent with those from other settings. The incidence of poor sleep quality (using the PSQI) has been reported to be even much higher in patients with acute myocardial infarction (71.1%) [36]. A study conducted in Australia among coronary artery bypass grafting patients also found that poor sleep quality was present in 62% and 12% of the patients at 6 months and at all times, respectively [37]. Studies which have recruited patients with other types of cardiovascular diseases such as chronic arterial disease and atrial fibrillation have also found them to have higher rates of poor sleep quality [36,38]. The findings of our study, like others, suggest that post myocardial infarction patients continue to experience poor sleep quality after hospital discharge.

A study of sleep quality (using PSQI) and myocardial infarction reoccurrence reported that patients with poor sleep efficiency and poor overall sleep quality had myocardial infarction reoccurrence in significantly higher numbers [31]. In the current study, sleep quality was not significantly associated with myocardial infarction reoccurrence, but was associated with gender (non-modifiable factor) and modifiable factors such as body mass index and regular exercise. The rate of re-infarction in this study was also high (27.2%). Other studies have found similar results showing that poor sleep quality tends to be more in women, people with a high body mass index and who do not engage in physical activity [39]. The other aspects which may explain the sleep quality reported in the current study include the changes of aging, comorbidities, and the environmental factors in Oman. The mean age of participants in the current study was 62.0 ± 11.3 years and aging tends to lead to changes in the sleep pattern. Additionally, the desert climate in Oman may be influencing sleep behaviors, since most people become more active at night when temperatures are cooler [40].

Other studies have showed that a combination of comorbidities and their respective treatments can lead to poor sleep quality [32]. Diabetes mellitus and physical inactivity are some of the culprits that contribute to poor sleep quality [36]. In the current study most participants (58.3%) had diabetes mellitus and were not engaged in regular physical exercise (68.3%). All these factors could have contributed to the higher PSQI scores. It seems alterations in sleep quality are very common in post myocardial infarction patients and literature shows that poor sleep quality is associated with an increased risk of new coronary artery disease and acute myocardial infarction. Therefore assessment of sleep quality and related disorders should be part of the routine evaluation of post myocardial infarction patients during follow up care. It is also essential to integrate interventions that enhance sleep quality in cardiac rehabilitation programs for post myocardial infarction patients because of their potential benefits towards prevention of re-infarction.

The current study also assessed depression and found that 95% of the participants had minor depression and 5% had major depression. The findings are contrary to those of previous studies which have reported higher rates of major depression (15%–22%) [41,42]. A study conducted among post myocardial infarction patients in Denmark (used the Hospital Anxiety Depression Scale) found the rate of depression to be 18.6% at three months post myocardial infarction, and depression was associated with a 1.76-times risk of suffering a new cardiovascular event or death within 2.2 years [43]. In the current study only 5% of the participants had major depression. The depressive symptoms were significantly associated with regular exercise, but not with re-infarction. The low rate of major depression could be due to factors such as lack of worry about health care costs (all Omanis have access to free health care), living in predominantly extended family arrangements (source of regular social and family support in Oman), strong religious beliefs and practices, and lack of follow up of patients over a long period of time.

It is very important to continuously monitor depression in post myocardial infarction patients because it is a common predictor of death and morbidity. Studies show that 65% of patients suffer symptoms of depression after acute myocardial infarction, and 15%–22% of these present with major depression post discharge [41]. We recommend utilization of formal support systems to assist patients to adapt and adjust to the new life post myocardial infarction. Support systems, screening and education are all very important towards preventing the sequels of poor sleep quality and depression. The literature shows that 31%–35% of post myocardial infarction patients have limited participation in social activities during the first year post infarction, but those who receive appropriate psychological support have a better quality of life and less risk of re-infarction in the future [19]. Treatments such as short-term psychotherapy and others have also been reported to be beneficial [41,44]. Therefore prevention and treatment of depression can help to curtail the associated poor quality of life, prognosis, risk of re-admission and associated health care costs in post myocardial infarction patients [42].

By the year 2030, depressive disorders and ischemic heart diseases are projected to be among the major causes of disability in developed nations [45]. Poor sleep quality is highly prevalent in post myocardial infarction patients and in other studies it has been found to be associated with depression in cardiovascular patients [46]. This information leads us to anticipate a future increase in the rate of post myocardial infarction major depression above the 5%

reported by this study, as the patients live longer post-MI. This entrenches the need for regular assessment of sleep quality and depression during follow-up care and longitudinal studies of post myocardial infarction patients.

The findings of the study have to be considered in view of its limitations of self-report method of data collection and small sample size. Additionally, the reliability of the PSQI in this study was low (the Cronbach's α of the PSQI in the current study was 0.642), but the PHQ-9 showed acceptable reliability. There is a possibility that participants over reported sleep symptoms and under reported depression related symptoms. The best way to objectively study sleep quality is through sleep studies in a hospitals setting. We therefore recommend longitudinal cohort studies with large sample sizes to explore the prevalence and mediators of sleep quality and depression in post myocardial infarction patients in Oman. Multiple regression analysis was used to test the factors associated with sleep quality and level of depression. It should be noted that studies focusing on explaining human behaviors and psychosocial aspects (sleep and depression) have a greater amount of unexplainable variation and are bound to have lower R^2. This is especially relevant because perceived sleep quality and depressive symptoms can vary from hour to hour in the course of the day due to prevailing environment, other extrinsic and intrinsic factors. This could be the reason behind the above low R^2 in Table 5.

The findings of the study show that poor sleep quality continue to be a major problem among post myocardial infarction patients even after discharge from the hospital. Hence, the need to add regular assessment of sleep quality and depression to be part of cardiac rehabilitation and follow-up care for post myocardial infarction patients. Additionally, healthcare providers working with post myocardial infarction patients should emphasize interventions to enhance sleep quality and prevent depression because they can both help to curtail the risk of re-infarction or other cardiac events.

5. Conclusions

This study demonstrates that a large number of Omani post myocardial infarction patients continue to experience poor sleep quality after discharge from the hospital; although in the short term (4 weeks to one year) only a few suffer from major depression. The findings show the importance of regular assessment and interventions to prevent and manage sleep problems and depressive symptoms in post myocardial infarction patients.

Conflicts of interest

The authors declare that they have no competing interests.

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Appendix A. Supplementary data

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