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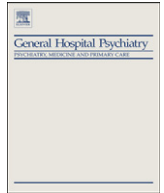
Psychiatric–Medical Comorbidity

The Psychiatric–Medical Comorbidity section will focus on the prevalence and impact of psychiatric disorders in patients with chronic medical illness as well as the prevalence and impact of medical disorders in patients with chronic psychiatric illness.

The presence of a depressive episode predicts lower return to work rate after myocardial infarction ☆,☆☆

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A B S T R A C T

Context: No studies have evaluated whether the presence of a depressive episode is associated with an increased risk of not returning to work following myocardial infarction (MI).
Objectives: To examine the prospective associations between depressive episode and anxiety disorders with return to work (RTW) after MI at 3 and 12 months based on *International Classification of Diseases, 10th Revision.*
Design: Prospective cohort study.
Setting: Four hospitals in the North of The Netherlands.
Participants: From a sample of patients hospitalized for MI ($n=487$), we selected those who had a paid job at the time of the MI ($N=200$).
Main exposure measures: Presence of a depressive episode and presence of any anxiety disorder during the first 3 months post-MI.
Main outcome measures: RTW at 12 months post-MI.
Results: Of the patients with work prior to MI, 75% had returned to work at 12 months. The presence of a depressive episode during the first 3 months (prevalence: 19.4%) was a significant predictor of no RTW at 12 months post-MI, also after controlling for confounders [odds ratio (OR) 3.48; 95% confidence interval (CI): 1.45–8.37]. The presence of an anxiety disorder (prevalence: 11.9%) had a borderline significant association with no RTW as well. This association remained after controlling for confounders (OR 2.90; 95% CI: 1.00–6.38) but diminished when controlling for depression.
Conclusions: The presence of a depressive episode was associated with an increased risk of no RTW in MI patients. The association between anxiety and risk of no RTW could in part be explained by the presence of depression. Further studies may address the possibility of countering the effect of depression by effective treatment.

1. Introduction

Work is important to the individual, his/her family and social network, the employer and society at large. Poor work outcomes have been found in workers with myocardial infarction (MI), in particular, those with co-existing depressive symptoms [1,2]. A recent review, including 12 articles covering the period from 1994 to 2009, showed that depression significantly predicted a reduced likelihood to return to work (RTW) following MI in 7 out of 12 studies [3]. Unfortunately, none of the included studies used a diagnostic interview but relied on self-reported questionnaires to assess the presence of depressive symptoms. As depressive symptoms following MI may sometimes occur as a physiological consequence of the heart disease [4] and generally are associated with a large proportion of false positive screens to identify major depressive disorder cases [5,6], it remains unclear whether the reduced likelihood of RTW is a true result of a depressive episode. Given the importance of RTW in MI patients and the potential to treat depression, it is important to evaluate the impact of a clinical diagnosis of post-MI depressive episode on RTW.

Besides depression, also anxiety appears to be associated with impaired work outcomes. Like depressive episodes, anxiety disorders are associated with longer sick leave duration [7], and anxiety is associated with delayed RTW in several medical conditions including occupational injury [8], traumatic brain injury [9] and head and neck cancer [10]. A recent meta-analysis identified only two studies evaluating the impact of anxiety on RTW in coronary artery disease patients [11], showing inconsistent results. Therefore,

the impact of anxiety after MI on RTW remains unclear and should be addressed.

In the present study, we examined the effects of post-MI depressive disorder and anxiety disorder as obtained with a diagnostic interview on RTW rates at 12 months after the MI.

2. Methods

2.1. Study design and participants

The study was conducted using the data from the Depression After Myocardial Infarction (DepreMI) study, a naturalistic cohort study to evaluate the association of depression with cardiovascular prognosis in MI patients. Patients admitted for MI were recruited consecutively from four hospitals in the North of The Netherlands between September 1997 and September 2000. Details of this study have been described previously [12]. To be included, patients had to fulfill at least two of the following criteria: (1) 20 min of chest pain, (2) increased enzyme levels (creatinine phosphokinase and creatinine phosphokinase-MB) and (3) new pathological Q waves on the electrocardiogram in at least two leads. Exclusion criteria were (1) life expectancy of less than a year due to non-cardiac condition, (2) MI occurring during admission for another reason, (3) poor physical function, (4) cognitive dysfunction, (5) inability to speak or read Dutch and (6) follow-up visits scheduled in a nonparticipating hospital. For the present analysis, an additional inclusion criterion was that patients had to have paid work during the year before MI. Previous reports on the sample have shown that, following MI, (persistent) depressive symptoms, depressive episode and generalized anxiety disorder were associated with mortality and cardiovascular events [13–16].

2.2. Assessment of demographical and clinical characteristics

Age, gender and clinical characteristics were assessed during hospital admission for the index MI and from hospital charts. Left ventricular ejection fraction (LVEF) was assessed with echocardiography, radionuclide ventriculography, gated SPECT, magnetic resonance imaging, angiography or clinical assessment and was classified as <40% or ≥40%. Educational level and marital status were obtained during the interview 3 months post-MI.

2.3. Assessment of depression and anxiety

The presence of a depressive disorder and anxiety disorder (i.e., agoraphobia, panic disorder, specific phobia, social phobia and generalized anxiety disorder) post-MI according to *International Classification of Diseases, 10th Revision* (*ICD-10*) [17,18] was assessed with the Composite International Diagnostic Interview (CIDI) at 3 months after the MI. The CIDI is a fully structured interview with a satisfactory inter-rater reliability [19]. In the present study, we used a slightly adjusted version of the CIDI interview so that the time frame of the depression and anxiety diagnosis reflected the period of approximately 3 months following the MI.

2.4. Assessment of RTW and other work-related aspects

At 3 and 12 months post-MI, patients also underwent a face-to-face interview regarding several aspects related to rehabilitation. During the interview at 3 months post-MI, patients were asked whether they had paid work in the year before the MI. If they answered yes, they were asked whether it was mainly a sedentary or active job, whether it was light or heavy work and the number of work-hours per week. RTW was assessed during the same interviews. Patients who reported that they returned to work were asked how many hours they currently work per week and whether there were adaptations of their tasks (work accommodations).

2.5. Statistical analysis

Differences in baseline characteristics for patients who returned to work and patients who did not RTW were assessed with chi-square or *t* tests for two independent samples. This was done with respect to RTW status at 3 and 12 months post-MI.

The associations between the presence of a depressive episode and an anxiety disorder at 3 months post-MI with RTW status at 12 months post-MI were assessed with logistic regression. Adjustments were made for age and sex (model 1) and for age, sex and LVEF (model 2) only because the sample size was too small to adjust for more covariates without introducing potential bias [20]. Finally, a third model was tested in which depression and anxiety were entered simultaneously, adjusting for age, sex and LVEF. Significance level was set at $P<.05$ (two-tailed).

3. Results

3.1. Sample characteristics

Of 1166 MI patients that were assessed for eligibility, 528 (45.3%) participated in the DepreMI study. Of these, 487 were interviewed at 3 months post-MI and were assessed for paid work in the year before MI. A total of 200 (41.1%) patients had paid work in the year before MI. Of these patients, 186 patients provided complete data on RTW at 3 months post-MI, of whom 86 (46.2%) patients had returned to work and 100 had not. Complete data on RTW at 12 months were available for 173 patients, of whom 133 (76.9%) had returned to work and 40 had not. Fig. 1 shows the flow chart.

Table 1 shows sociodemographic, work-related and clinical characteristics for patients who had/had not returned to work at 3 months and 12 months post-MI. Compared to patients who had not returned to work at 3 months post-MI, patients who had returned to work were significantly higher educated, were more likely to
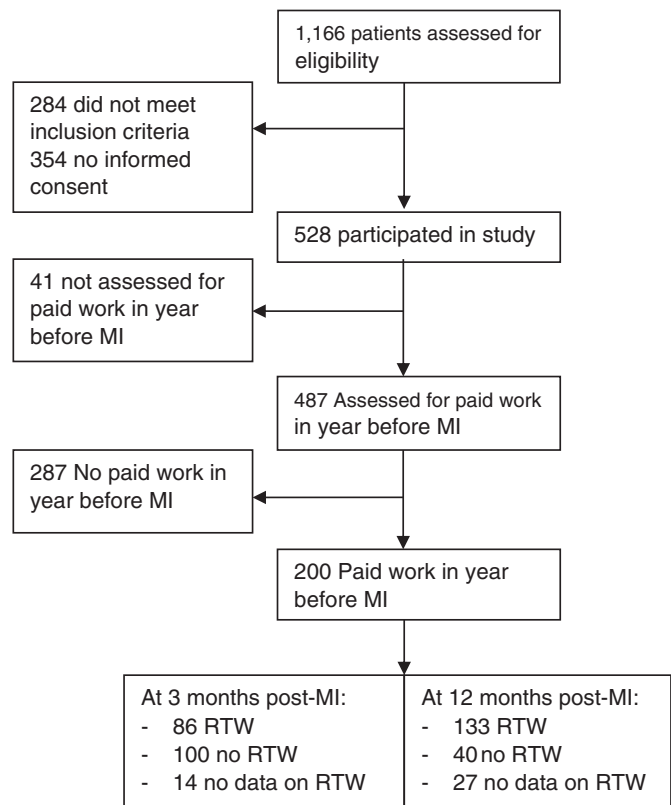

Fig. 1. Flow chart of MI patients enrolled in the present analysis.

Table 1
Characteristics of MI patients who returned to work and who did not RTW at 3 and 12 months post-MI

	3 Months post-MI		12 Months post-MI	
	RTW, $n=86$	No RTW, $n=100$	RTW, $n=133$	No RTW, $n=40$
Age [mean (S.D.)]	50.9 (8.2)	52.3 (8.0)	49.7 (6.7)[a]	53.7 (9.5)[a]
Male, n (%)	78 (90.7%)	89 (89.0%)	122 (91.7%)	35 (87.5%)
Educational level				
Primary school only	7 (8.1%)[b]	11 (11.0%)[b]	9 (6.8%)	5 (12.5%)
Low-level high school	35 (40.7%)[b]	51 (51.0%)[b]	60 (45.1%)	21 (52.5%)
Middle-level high school	20 (23.3%)[b]	27 (27.0%)[b]	36 (27.1%)	8 (20.0%)
High-level high school	15 (17.4%)[b]	9 (9.0%)[b]	20 (15.0%)	4 (10.0%)
University	9 (10.5%)[b]	2 (2.0%)[b]	8 (6.0%)	2 (5.0%)
Marital status				
Married/living together	75 (88.2%)	88 (88.0%)	119 (90.2%)	36 (90.0%)
Widowed	1 (1.2%)	3 (3.0%)	1 (0.8%)	1 (2.5%)
Divorced	7 (8.2%)	3 (3.0%)	8 (6.1%)	1 (2.5%)
Never married	2 (2.4%)	6 (6.0%)	4 (3.0%)	2 (5.0%)
Severity MI				
LVEF<40%	12 (14.0%)	23 (23.0%)	19 (14.3%)[a]	15 (37.5%)[a]
Killip≥2	3 (3.5%)	6 (6.0%)	4 (3.0%)[c]	5 (12.5%)[c]
History MI	5 (5.8%)	10 (10.0%)	10 (7.5%)	4 (10.0%)
Anterior site MI	25 (29.1%)	37 (37.0%)	38 (28.6%)[c]	19 (47.5%)[c]
Medical comorbidities				
Diabetes	3 (3.5%)	9 (9.0%)	7 (5.3%)	1 (2.5%)
Hyperlipidemia	34 (39.5%)	39 (39.0%)	50 (37.6%)	18 (35.0%)
Hypertension	19 (22.1%)	26 (26.0%)	32 (24.1%)	8 (20.0%)
Peripheral vascular disease	2 (2.3%)	2 (2.0%)	4 (3.0%)	1 (2.5%)
Cerebrovascular disease	2 (2.3%)	0 (0.0%)	2 (1.5%)	0 (0.0%)
Work aspect				
Sedentary	39 (45.3%)[d]	32 (32.0%)[d]	55 (41.4%)	10 (25.0%)
Mixed sedentary and active	22 (25.6%)[d]	27 (27.0%)[d]	34 (25.6%)	15 (37.5%)
Mainly active	25 (29.1%)[d]	41 (41.0%)[d]	44 (33.1%)	15 (37.5%)
Physical work load				
Light	54 (62.8%)[e]	38 (38.0%)[e]	70 (52.6%)	17 (42.5%)
Moderate	19 (22.1%)[e]	32 (32.0%)[e]	33 (24.8%)	14 (35.0%)
Heavy	13 (15.1%)[e]	30 (30.0%)[e]	30 (22.6%)	9 (22.5%)
Percentage hours after compared to before MI		NA		NA
100%	11 (14.5%)[f]		44 (37.3%)[g]	
80–99%	13 (17.1%)[f]		30 (25.4%)[g]	
60–79%	14 (18.4%)[f]		20 (16.9%)[g]	
40–59%	21 (27.6%)[f]		10 (8.5%)[g]	
1–39%	17 (22.4%)[f]		14 (11.9%)[g]	
No work accommodations after MI		NA		NA
Directly with RTW	39 (45.3%)			
At 3 months/12 months	53 (63.1%)[h]		101 (78.3%)[i]	
Smoking, n (%)	52 (60.5%)	62 (66.7%)	85 (66.4%)	24 (63.2%)
Family history of CAD, n (%)	44 (51.2%)	43 (43.0%)	65 (48.9%)	18 (45.0%)
BMI mean (S.D.)	26.9 (3.9)	26.9 (3.2)	26.9 (3.7)	27.4 (3.0)
Depressive episode at 3 months	11 (12.8%)	22 (22.0%)	18 (14.9%)[j]	13 (33.3%)[k]
Any anxiety disorder at 3 months	8 (9.3%)	13 (13.0%)	11 (9.1%)[j]	8 (20.3%)[k]

[a] $P<.01$.
[b] $P<.05$; linear by linear association: $P<.01$.
[c] $P<.05$.
[d] $P>.05$; linear by linear association: $P<.05$.
[e] $P<.01$; linear by linear association: $P<.01$.
[f] $n=76$ with complete data.
[g] $n=118$ with complete data.
[h] $n=84$ with complete data.
[i] $n=129$ with complete data.
[j] $n=121$ with complete data.
[k] $n=39$ with complete data.

have a sedentary job and were more likely to have lighter work. At 12 months post-MI, patients who had returned to work were significantly younger, had less often LVEF<40%, higher Killip Class and more often had an MI on the anterior site, compared to those who had not returned to work.

3.2. Depressive disorder, anxiety disorder and RTW

Of 173 patients with complete data on RTW at 12 months post-MI, 13 had missing data on depressive and anxiety disorder during the first 3 months post-MI, leaving 160 patients for analysis. Of these, 31 patients fulfilled *ICD-10* criteria for a major depressive episode

(19.4%), and 19, for an anxiety disorder (11.9%). The presence of a major depressive episode predicted no RTW at 12 months post-MI [odds ratio (OR) 2.86; confidence interval (CI): 1.24–6.58; $P=.013$]. Controlling for age and sex (model 1) and for age, sex and LVEF (model 2) did not affect the association (see Table 2).

An *ICD-10* diagnosis of any anxiety disorder during the first 3 months post-MI was associated with a nearly significant increased risk of no RTW (OR 2.58; CI: 0.96–6.97; $P=.062$). After adjustment for age and sex (model 1) and for age, sex and LVEF (model 2), the association reached borderline significance.

Of the 160 patients in the analysis, 9 patients had both a major depressive episode and an anxiety disorder, which enabled us to

Table 2
Associations of major depressive episode and anxiety disorder with RTW at 12 months post-MI in 160 MI patients

	RTW	No RTW	Unadjusted	OR (95% CI) for no RTW		
				Model 1	Model 2	Model 3
Major depressive episode, *n* (%)	18 (14.9)	13 (33.3)	2.86 (1.24–6.58)	3.48 (1.45–8.37)	4.34 (1.71–11.03)	3.82 (1.46–10.00)
Any anxiety disorder, *n* (%)	11 (9.0)	8 (20.5)	2.58 (0.96–6.97)	2.81 (1.01–7.84)	2.90 (1.00–8.36)	2.06 (0.67–6.33)

Model 1: Adjusted for age and sex.
Model 2: Adjusted for age, sex and LVEF.
Model 3: Adjusted for age, sex, LVEF and both depression and anxiety.

explore the relative importance of anxiety and depression. Adding both major depressive episode and anxiety disorder in the model (model 3) resulted in a significant association for major depressive episode (OR 3.82; 95% CI: 1.46–10.00; $P = .006$), while the association between anxiety and no RTW was substantially reduced (OR 2.06; 95% CI: 0.67–6.33; $P = .21$).

4. Discussion

Half of MI patients who were employed at the time of the MI returned to work within 3 months after MI, and 75% had returned to work 12 months after MI. Predictors of RTW at 3 months post-MI were mainly work related (e.g., sedentary work, light work), whereas predictors of RTW at 12 months post-MI were mainly disease related (e.g., less severe cardiac disease). The presence of a major depressive episode appeared to negatively affect RTW. We found that the presence of a major depressive episode during the first 3 months post-MI significantly predicted no RTW at 12 months post-MI. This association was independent of age, gender and LVEF. The presence of an anxiety disorder during the first 3 months post-MI also predicted no RTW at a borderline statistical level, but this association substantially reduced when anxiety and depression were forced into a single prediction model. It should be mentioned that we have information only regarding RTW during the first 12 months post-MI. However, we feel that this period is the most relevant in terms of RTW and extending the follow-up would have resulted in many missing because of death.

Previous studies that addressed the role of depression in RTW have focused on the presence of depressive symptoms in predicting RTW instead of using a clinical diagnosis. O'Neil et al. [3] present in their recent review three high-quality-rated studies that showed clear associations between depression and delayed RTW post-MI at 12–13 months follow-up [1,21,22]. However, a direct comparison of these studies and the present study is hampered because all studies used self-reported depressive symptoms as compared to a clinical diagnosis, which is problematic as self-reported depressive symptoms are only a moderately effective indicator of the presence of a major depressive episode. Self-reported symptoms of depression may be confounded by MI severity or its consequences and tend to produce many false positives [23]. Elsewhere, we have proposed that self-reported symptoms of depression and a diagnosis of major depressive episode may represent different sources of variation in predicting cardiovascular outcomes [24]. The present study therefore adds substantially to the existing literature and suggests that the presence of a major depressive episode in the first months following MI may be a risk factor for not returning to work and potentially a treatable one.

Only a few studies have assessed the possible role of anxiety in RTW after MI, and these have produced inconsistent results. A study by Guiry et al. [25] suggested that anxiety was associated with a reduced chance of RTW within 12 months after an acute coronary syndrome. In contrast, in a more recent study, Samkange-Zeeb et al. [22] found that anxiety was not associated with RTW status at 6 and 12 months in patients attending cardiac rehabilitation. Our findings suggest that the presence of an anxiety disorder in the first months after MI negatively affects working status at 12 months post-MI. Since depression and anxiety are highly correlated, there is always the possibility that these findings could be explained by the presence of comorbid depression. Our current explorative results suggest that anxiety per se may not be the driving force of not returning to work but that depression is a more likely candidate. However, we acknowledge that these results were based on rather small numbers and should be interpreted with caution.

In future research, it is important to also look beyond RTW and into health-related work functioning in workers who have returned to work after MI. Health-related work functioning concerns the ability of a worker to perform his/her job [26,27]. More detailed knowledge on health-related work functioning after RTW will help to prioritize and target efforts of (occupational) health care professionals and the workplace to assist and support workers with MI after their RTW.

Our findings corroborate with other research showing that, in the absence of medical disorders, mental disorders are associated with delayed RTW, increased sickness absence and reduced work productivity [28]. In MI patients, high prevalence rates of depression and anxiety disorders have been observed [29], while RTW is acknowledged as an important outcome parameter. While several studies, using different approaches, e.g., psychological based-therapies, pharmacologic approaches and CBT, have demonstrated modest improvements in depression for patients with coronary heart disease [30,31], relatively little is known about the effects on improvement of RTW and work functioning after RTW in MI patients. Cardiac rehabilitation programs in which depression and anxiety are addressed and which are tailored to the specific work setting of the MI patient may be key in improving RTW rates in MI patients. Furthermore, as depression is related to poor compliance and less completion of cardiac rehabilitation programs [32], special attention needs to be given to depressed MI patients in order to motivate them to comply to and complete cardiac rehabilitation programs.

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