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Psychological and clinical predictors of return to work after acute coronary syndrome

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Aims Resumption of paid employment following acute coronary syndrome (ACS) is an important indicator of recovery, but has not been studied extensively in the modern era of acute patient care.
Methods and results A total of 126 patients who had worked before hospitalization for ACS were studied with measures of previous clinical history, ACS type and severity, clinical management, and sociodemographic characteristics. Depressed mood (Beck Depression Inventory) and type D personality were measured 7–10 days following admission. Among them, 101 (80.2%) had returned to work 12–13 months later. Failure to resume work was associated with cardiac factors on admission (heart failure, arrhythmia), cardiac complications during the intervening months, and depression scores during hospitalization. It was not related to age, gender, socioeconomic status, type of ACS, cardiac history, acute clinical management, or type D personality. In multivariate analysis, the likelihood of retuning to work was negatively associated with depression, independently of clinical and demographic factors [adjusted odds ratio 0.90, CI 0.82–0.99, $P = 0.032$].
Conclusion Depressed mood measured soon after admission is a predictor of returning to work following ACS. The management of early depressed mood might promote the resumption of economic activity and enhance the quality of life of cardiac patients.

Introduction

Cardiovascular diseases including coronary heart disease (CHD) are the largest cause of sickness and morbidity and the major cause of premature death and reduced quality of life for citizens of the European Union. It has been estimated that some 90 million working days are lost annually within the European Union because of CHD morbidity.[1] Returning to work after acute coronary events not only has economic benefits to the individual and community, but also improves morale and the quality of life of patients and their families.[2]

It is well established that returning to work is not a simple function of clinical status, but is influenced by demographic, social, and psychological factors. Patients' perceptions of their illness and disability appear to be important predictors.[3–5] Emotional responses such as depressed mood may also be significant, although results have been inconsistent.[3,4,6] Much of the data relating psychological factors with return to work were collected in the 1970s and 1980s when clinical management of acute coronary syndrome (ACS) was very different to the present day.[6–10] Developments in the management of ACS including thrombolysis, revascularization, and early mobilization have dramatically changed patients' experience and expectations,[11,12] and it is not clear whether early emotional responses to ACS continue to be related to re-employment in the modern era. Past research on return to work has focused on acute myocardial infarction (MI) and not the broader construct of ACS encompassing ST-elevation MI (STEMI), non-ST-elevation MI (NSTEMI), and unstable angina (UA). The purpose of this study is to determine whether symptoms of depression measured in the acute phase predict return to work independently of clinical factors. Type D or 'distressed' personality is another psychological construct that has been found to predict adverse clinical outcomes following MI and percutaneous transluminal angioplasty.[13,14] Its role as a predictor of return to work following an ACS was therefore also assessed.

Methods

Patients

The participants in this study were the 155 patients who were in paid employment at the time of ACS out of a total of 295 patients admitted to four hospitals in the London area between 2001 and 2004 and recruited as part of an investigation of emotional and behavioural triggers of cardiac events.[15] They were selected on the following criteria: a diagnosis of ACS based on the presence of chest pain with verification by diagnostic electrocardiographic (ECG) changes (new ST-elevation >0.2 mV in two contiguous leads V1,V2, and V3 and >0.1 mV in two contiguous other leads, ST in leads depression >0.1 mV in two contiguous leads in the absence of QRS confounders, new left bundle branch block, or dynamic T wave inversion in more than one lead) and/or cardiac enzyme

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changes (troponin T measurement >0.01 ug/L or a creatine kinase measurement more than twice the upper range of normal for the measuring laboratory).[16] Patients were eligible if they were 18–90 years of age, were able to recall the time of onset of symptoms, and did not to have comorbid conditions that might influence symptom presentation, mood, or troponin positivity.[17] Patients were also excluded if they had severe psychiatric illness or cognitive decline impairing ability to complete measures and if they could not speak English. The study was approved by the Medical Research Ethics Committees of University College Hospital, St George's Hospital, Southend Hospital, and Kingston Hospital, and all patients gave written consent.

A total of 1148 patients was considered for this study: 32.7% were eligible, and the remainder were excluded because of being outside the age range (12.9%), relevant comorbidity (17.7%), unable to recall symptom onset (12.2%), insufficient English (10.2%), critical illness (10.2%), recent revascularization (2.7%), and unable to carry out the interview (1.3%). Of the 375 remaining patients, 48 (12.8%) were discharged or transferred to other hospitals before the first interview could be carried out, and 32 (8.5%) declined participation.

Measures

Admission notes and ECGs were assessed by a cardiologist and scrutinized for presentation as STEMI, NSTEMI, or UA. The highest troponin T (86% of cases) and creatine kinase (79% of cases) levels measured during the admission were recorded. Arrhythmia was defined by the presentation of ventricular fibrillation, ventricular tachycardia, or atrial fibrillation (AF) on the ECG on admission. Heart failure was defined by clinical symptoms and categorized as grade 2 or more on the New York Heart Association grading system. We also computed composite risk scores based on the algorithm developed in the Global Registry of Acute Coronary Events (GRACE) study.[18] This uses nine measures [age, history of congestive heart failure, history of MI, systolic blood pressure and heart rate on admission, ST-segment depression, initial serum creatinine, elevated cardiac enzymes, and no in-hospital percutaneous coronary intervention (PCI)] to define risk of 6-month post-discharge death applicable to all types of ACS. Information was obtained from medical notes about cardiovascular disease history and medication pre-admission and about the management of the ACS. Management strategies were classified as medical, PCI, or coronary artery bypass graft (CABG). Smoking, alcohol consumption, and physical activity were assessed using standard measures.[15]

Patients were given a set of questionnaires while in hospital, and this was completed 7–10 days post-admission. Depressive symptoms were assessed using the Beck Depression Inventory,[19] a 21-item measure that has been widely used for the assessment of symptoms in cardiac patients.[20,21] Each item is rated from 0 to 3, and so total scores can range from 0 to 63, with higher values indicating greater depression. The internal consistency (Cronbach α) in this study was 0.88. Type D personality was measured using the DS-16,[22] a 16-item scale that assesses the two dimensions of negative affectivity and social inhibition. Scores could range from 0 to 32 on each scale. For the purposes of analysis, type D personality was defined on the basis of a score greater than the median for the sample on both the negative affect scale (>10) and the social inhibition scale (>12).[22]

SES was defined by two measures: educational attainment and a social deprivation index. The latter assessed access to resources based on four criteria: living in a crowded household (defined as one or more persons per room), renting as opposed to owning a home, not having use of a motor vehicle (car or van), and living on state benefits.[23,24] Patients were classified as a low deprivation (negative on all items), medium deprivation (one positive), and high deprivation (two to four positive). Previous history of depression was measured as the use of antidepressant medication at the time of hospital admission and by asking patients to estimate whether they had been moderately or severely depressed at any time over the past 6 months.

Information concerning return to work was obtained during a telephone interview with each patient carried out 12–13 months post-discharge. Patients were asked when they had started work again and whether they were working full time or part time. Information about attendance at rehabilitation was also obtained during these interviews, and the recurrence of cardiac disease (defined as a further ACS requiring hospital admission and treatment or recurrence of chest pain leading to revascularization) was recorded.

Statistical analysis

Twelve month data were obtained from 126 (81.2%) patients. The patients included in this analysis did not differ from those who were lost to follow-up in age, gender, ethnicity, marriage, educational attainment, smoking, body mass index (BMI), alcohol consumption, physical activity, type of ACS, previous cardiovascular history, or BDI and type D measures. However, patients lost to follow-up tended to be more socially deprived ($P = 0.01$) and had lower GRACE risk scores ($P = 0.042$) than those included in the study.

Patients who did and did not return to work by 12 months were compared on sociodemographic, clinical, and psychological factors using χ^2 statistics for categorical variables and analysis of variance for continuous measures. All tests were two-sided. The factors that were significantly associated with return to work in univariate analysis were entered into a multiple logistic regression. The linearity assumptions of logistic regression were checked using the procedures described by Katz.[25] Odds ratios (OR) adjusted for all other factors are presented together with 95% confidence intervals (CI).

Results

One-hundred and one (80.2%) patients were working at 12 months following ACS, of whom 64 (63.4%) were working full time and 37 (36.6%) part time. The interval between ACS and restarting work averaged 3.4 months, ranging from <1 month to 11 months. Patients who did and did not return to work did not differ in gender distribution, age, ethnicity, educational qualifications, social deprivation scores, or marital status (*Table 1*). There were also no associations with lifestyle factors such as smoking, BMI, and alcohol consumption, but patients who were physically inactive prior to ACS were less likely to return to work.

The clinical features of patients who were working and not working after 12 months are summarized in *Table 2*. Returning to work was unrelated to the type of ACS, number of vessels diseased, and previous MI. Patients with low GRACE risk scores were more likely to return to work. Fewer patients who were working at 12 months had experienced arrhythmia (4 vs. 24%) or heart failure (5 vs. 16%) on admission than those who failed to resume work. There was no association with whether the ACS was managed medically or with PCI or CABG. Patients who experienced recurrence of cardiovascular problems leading to re-admission or revascularization were less likely than others to be working at 12 months. There were no associations with risk factors or medication before admission or with attendance at cardiac rehabilitation.

Self-reports of moderate-to-severe symptoms of depression over the 6 months before admission were not related to the likelihood that patients would be working at 12 months (*Table 2*). Eight patients were taking antidepressant

Table 1 Characteristics of patients working and not working at 12 months

		Working ($n = 101$)	Not working ($n = 25$)	Differences (P)
Gender	Men	89 (88.1%)	22 (88.0%)	0.98
	Women	12 (11.9%)	3 (12.0%)	
Age (years)		54.5 ± 8.2	55.9 ± 9.8	0.47
Ethnicity	White	87 (86.9%)	20 (80.0%)	0.44
	Others	14 (13.1%)	5 (20.0%)	
Educational qualifications	None	37 (36.6%)	12 (48.0%)	0.49
	Primary	24 (23.8%)	6 (24.0%)	
	Secondary	40 (39.6%)	7 (28.0%)	
Social deprivation	Low	57 (56.4%)	10 (40.0%)	0.13
	Medium	26 (25.7%)	8 (32.0%)	
	High	18 (17.5%)	7 (28.0%)	
Marital status	Married	75 (75.3%)	17 (68.0%)	0.53
	Not married	26 (25.7%)	8 (32.0%)	
Smoking status	Current	47 (46.5%)	16 (64.0%)	0.18
	Ex/non-smoker	54 (53.5%)	9 (36.0%)	
BMI (kg/m^2)		27.5 ± 4.3	27.9 ± 4.5	0.65
Physical activity	None	53 (53.0%)	18 (72.0%)	0.055
	Low	29 (29.0%)	2 (8.0%)	
	≥2 times/week	18 (18.0%)	5 (20.0%)	
Alcohol (units/week)		12.0 ± 15.9	11.2 ± 14.3	0.83

Table 2 Clinical features of patients working and not working at 12 months

		Working ($n = 101$)	Not working ($n = 25$)	Differences (P)
ACS type	STEMI	66 (65.3%)	18 (72.0%)	0.53
	NSTEMI/UA	35 (34.7%)	7 (28.0%)	
No. of vessels diseased		1.71 ± 0.79	1.76 ± 0.88	0.78
Previous ACS	Yes	7 (6.9%)	2 (8.0%)	0.85
	No	94 (93.1%)	23 (92.0%)	
GRACE risk score		81.8 ± 20.1	90.0 ± 21.0	0.072
Heart failure	Yes	5 (5.0%)	4 (16.0%)	0.055
	No	96 (95.0%)	21 (84.0%)	
Arrhythmia on admission	Yes	4 (4.0%)	6 (24.0%)	0.004
	No	97 (96.0%)	19 (76.0%)	
Clinical management	Medical	24 (24.7%)	6 (24.0%)	0.50
	PCI	59 (60.8%)	13 (52.0%)	
	CABG	14 (14.4%)	6 (24.0%)	
Recurrence (re-admission, revascularization)	Yes	34 (33.7%)	14 (58.3%)	0.026
	No	67 (66.3%)	10 (41.7%)	
Attendance at cardiac rehabilitation	Yes	72 (71.3%)	20 (87.0%)	0.12
	No	29 (28.7%)	3 (13.0%)	
Diabetes pre-admission	Yes	9 (8.9%)	3 (12.0%)	0.64
	No	92 (91.1%)	22 (88.0%)	
Hypertension pre-admission	Yes	36 (35.6%)	11 (44.0%)	0.44
	No	65 (64.4%)	14 (56.0%)	
Statin use pre-admission	Yes	9 (8.9%)	1 (4.0%)	0.42
	No	92 (91.1%)	24 (96.0%)	
Moderate/severe depression (6 months)	Yes	28 (27.7%)	10 (40.0%)	0.23
	No	73 (72.3%)	15 (60.0%)	
Antidepressant use pre-admission	Yes	4 (4.0%)	4 (16.0%)	0.027
	No	97 (96.0%)	21 (84.0%)	
BDI depression during admission		7.05 ± 5.3	11.0 ± 10.5	0.018
Type D personality	Present	26 (32.2%)	7 (33.3%)	0.78
	Absent	60 (69.8%)	14 (66.6%)	

medication at the time of admission; half of these patients were not working at 12 months, compared with 82.2% of those who were not taking antidepressants. Additionally, BDI scores measured 7–10 days post-admission were 36% lower in patients who returned to work compared with those who were not working ($P = 0.018$). Just under one-third (30.8%) of patients were categorized as type D personality. There was no relationship between return to work and type D or its subscales (data not shown). The timing of return to work and whether patients resumed full or lighter part-time

Table 3 Determinants of return to work 12 months after an ACS

	Adjusted OR	95% CI	*P*
Age	0.91	(0.31–2.66)	0.87
Gender (M/F)	1.77	(0.19–16.0)	0.63
GRACE score	0.98	(0.93–1.03)	0.38
Arrhythmia	0.09	(0.01–0.79)	0.030
Heart failure	1.19	(0.12–11.4)	0.88
Recurrence	0.25	(0.01–0.84)	0.025
Antidepressant use pre-admission	0.62	(0.01–28.7)	0.81
BDI following admission	0.90	(0.82–0.99)	0.032

duties were not predicted by psychological state or clinical factors at the time of admission.

The multiple regression analysis of predictors of return to work at 12 months is summarized in *Table 3*. The factors that emerged as independent predictors were arrhythmia during admission, recurrent cardiac events, and BDI score following admission. Thus, patients who experienced arrhythmia ($P = 0.030$) and recurrent cardiac events ($P = 0.025$) were substantially less likely than others to be working 12 months after ACS. The BDI effect indicates that for every unit increase in BDI depression score following admission, there was a 10% reduction in the likelihood of returning to work by 12 months ($P = 0.032$).

Discussion

A total of 80% of patients in this study had resumed work 12 months after admission for an ACS. This is comparable with the rates of 78–83% recorded in other recent studies.[5,26,27] Return to work was predicted by clinical factors on admission, cardiovascular complications during the intervening 12 months, and depressive symptoms measured in the days following admission. Demographic factors, pre-admission risk profile, attendance at rehabilitation, and type D personality were not predictive.

Return to work was regarded as a major indicator of success of recovery from acute MI in the 1970's and 1980's,[2,28] but has been relatively neglected over the past decade in favour of more subtle measures of quality of life. However, resumption of work remains an important marker of the success of medical and rehabilitation services in equipping people to maintain economic independence.[29] It cannot be assumed that factors identified over 25 years ago as predictors of return to work will be relevant in the modern era. The concept of ACS has evolved and is no longer limited to acute MI. Treatment is substantially different, with the use of PCI and thrombolysis, and rapid restoration of activities encouraged. The average duration of hospitalization following ACS has reduced substantially, and patients with uncomplicated ACS are often discharged within 2–3 days.[30]

This study showed that clinical markers of ACS severity were predictors of subsequent return to work. The significance of clinical indicators has been limited in past studies, with few associations being observed.[3,5,28] Neither ACS type, elevated cardiac enzymes, nor the number of diseased vessels predicted resumption of work in the present study. However, in univariate analyses, patients who resumed work were less likely to have experienced cardiac arrhythmia in hospital, with near-significant effect for heart failure and the GRACE index. The GRACE index has been found to predict mortality in the 6 months following ACS,[18,31] Interestingly, the method of management of ACS was also unrelated to work resumption, with similar rates among patients treated medically or with PCI and CABG. This endorses the view that when used appropriately, surgical and interventional procedures have favourable effects on long-term adaptation and recovery.

An inconsistent relationship between depressed mood and return to work has been reported in previous investigations. Cross-sectionally, individuals who are not working post-ACS are more depressed than those who are employed.[2] Causal conclusions cannot be drawn from cross-sectional results. It is possible that depression impairs ability to resume and maintain paid employment, but the reverse may also be the case since lack of work and unemployment is a strong predictor of depression.[32] An association between depressed mood measured 4–6 months post-discharge and return to work has been described,[7,26,28] but depressed mood soon after hospital admission is particularly important for two reasons. First, clinical depression and dysphoria in the immediate post-ACS period are predictors of cardiovascular morbidity and mortality.[33] Secondly, depressed mood can be conveniently measured before patients are discharged and so provides potentially important early information about risks to long-term recovery.[34] No associations between depression and anxiety measured during hospitalization and return to work were found by Petrie *et al.*,[3] Mayou,[6] or Mittag *et al.*,[4] though studies have shown positive associations in Sweden and Japan.[5,8]

We observed a robust association between depressed mood during hospitalization for ACS and return to work 12 months later. The effect was independent of demographic and clinical markers and of depression prior to ACS (Table 3). These results add to the evidence for adverse effects of depressive responses to ACS. Other early-phase psychological factors are also important predictors, including patients' understanding of their illness (cognitive representation)[3] and physicians' and patients' expectations of disability.[4,5] In contrast, we found no association with type D personality. Type D personality predicts adverse cardiac events following acute MI and PCI,[13,14] and is related to impaired health status in patients with heart failure and peripheral arterial disease,[35,36] These results suggest that Type D is not a strong predictor of return to work following ACS. However, the finding requires replication with a larger sample before firm conclusions can be drawn.

Work resumption was not predicted by age, gender, or SES. This contrasts with studies carried out in the 1970's and 1980's.[2] The limited sample size may be responsible in part for the lack of effects. Additionally, differences may relate to changes in social expectations and in working practices. During periods of relatively high unemployment (as were present 20 years ago), competition for jobs is great, so lower SES patients with limited skills may be disadvantaged. The physical exertion required in lower SES occupations has also diminished markedly over recent decades because of mechanization, so returning to work is not prevented by physical incapacity. In the past, it may also have been more acceptable for women, especially if married, not return to paid employment.[2]

This study has a number of limitations. The sample was relatively small, and the study may have lacked statistical power for detecting some associations. Data were not collected from a consecutive series of ACS admissions, since patients were excluded if they were not able to recall the time of onset of symptoms and if they had comorbid conditions that might influence symptom presentation or mood. The reason is that the analysis was carried out in the context of a larger study of emotional and behavioural triggers of ACS.[15] Consequently, the study included a higher proportion of STEMI than NSTEMI/UA and a greater number of men than women compared with recent cohorts.[37,38] We did not assess clinical depression, since our concern was with depressed mood, and this was assessed by questionnaire. However, there is evidence that even moderate depressed mood in cardiac patients is associated with adverse outcomes.[39] The response rate was good (81.2%), but the loss of 18.8% might have influenced the pattern of results. The information we collected on type of occupation was not sufficiently detailed for analysis, but is known to relate to return to work.[40] The associations we observed with clinical and psychological factors all concerned return to work rather than timing of return or whether patients resumed full or part-time work; larger samples may be required to investigate these aspects fully. Additionally, unmeasured factors may have acted as confounds of the association between depressed mood and failure to return to work.

In conclusion, the results indicate that depressed mood in the acute aftermath of ACS admission is a powerful predictor of resumption of work 1 year later. Its influence is independent of clinical and demographic factors. Depressed mood is an easily measured and potentially modifiable factor and is consistently associated with other adverse outcomes in CHD. These data indicate that it is relevant to resumption of economic activity as well as other aspects of recovery and rehabilitation.

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Clinical vignette

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Stenting of the left main coronary artery stenosis due to extrinsic compression

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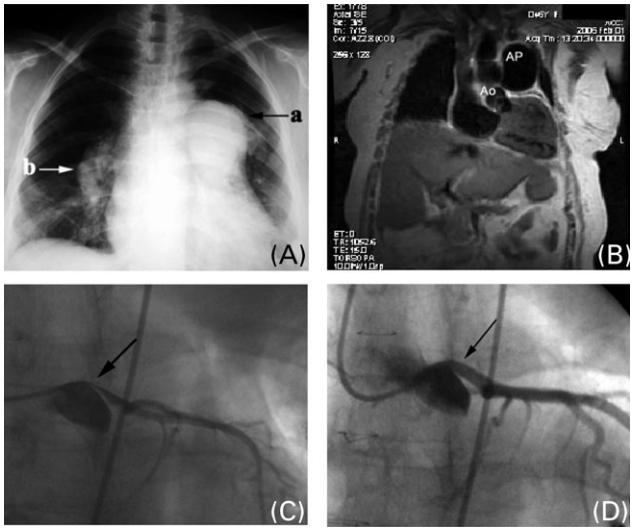
A 46-year-old woman was referred to the Cardiology Department with a history of dyspnoea, fatigue (NYHA class III), and angina on mild exertion. At the age of 14, she was operated for isolated pulmonary stenosis; 26 years after surgery, she was diagnosed with pulmonary regurgitation and pulmonary trunk dilatation.

On admission, the physical examination revealed a diastolic thrill and diastolic and systolic pulmonary murmurs. Electrocardiogram showed sinus rhytm, QRS axis at 70°, right atrial abnormality, right ventricular hypertrophy, and right bundle branch block. The chest X-ray (Panel A) revealed an enlarged cardiac silhouette involving the right chambers, the dilatation of the main pulmonary trunk, and the right main pulmonary artery.

A transthoracic echocardiogram confirmed the dilatation of the right heart, of the main pulmonary artery (69 mm), and of the main pulmonary branches (right 43 mm, left 45 mm), showed a non-dilated left ventricle with preserved systolic function, and permitted the evaluation of the pulmonary hypertension (a systolic value of 70 mmHg). An MRI exam revealed a close proximity between the dilated pulmonary artery and the aortic root (Panel B)

The cardiac catheterization confirmed the severe pulmonary hypertension (82/20/40 mmHg) without finding any shunt, the total pulmonary resistance was 1210 dyn s/cm^5. Coronary angiography was performed, revealing a 90% ostial stenosis of the left main coronary artery (Panel C); there were no other atherosclerotic lesions found in the coronaries. On the basis of the MRI findings, it was thought that the left main stenosis might have been caused by extrinsic compression due to an aneurismally dilated pulmonary trunk.



The patient underwent percutaneous revascularization with direct stenting (a drug eluting stent 4 mm × 12 mm) with excellent results (Panel D) and a favourable outcome (without angina and with an increased exercise tolerance).

Panel A. Chest X-ray (posteroanterior view): cardiomegaly involving the right chambers, enlarged pulmonary trunk (arrow a), and right main pulmonary artery (arrow b).

Panel B. MRI (axial section): the close proximity between the dilated pulmonary main artery and the aortic root.

Panel C. Coronary angiography (RAO cranial): ostial left main coronary artery stenosis of 90% (arrow)—extrinsic compression due to an aneurismally dilated pulmonary trunk.

Panel D. Coronary angioplasty: after stenting of the left main stenosis (arrow).