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ORIGINAL RESEARCH

Complications after acute coronary syndrome are reduced by perceived control of cardiac illness

Sharon McKinley, Mary Fien, Barbara Riegel, Hendrika Meischke, Mohannad E. AbuRuz, Terry A. Lennie & Debra K. Moser

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Correspondence to S. McKinley:
e-mail: sharon.mckinley@uts.edu.au

Sharon McKinley PhD RN
Professor of Critical Care Nursing
Critical Care Nursing Professorial Unit
University of Technology Sydney and
Northern Sydney Local Health District,
Australia

Mary Fien BSc RN
Project Officer
Critical Care Nursing Professorial Unit
University of Technology Sydney,
Australia

Barbara Riegel DNSc RN
Associate Professor
School of Nursing,
University of Pennsylvania, Philadelphia,
Pennsylvania, USA

Hendrika Meischke PhD RN
Professor
Department of Health Services,
University of Washington, Seattle,
Washington, USA

Mohannad E. AbuRuz PhD RN
Education Coordinator
King Fahad Specialist Hospital, Dammam,
Saudia Arabia

Terry A. Lennie PhD RN
Associate Professor
College of Nursing, University of Kentucky,
Lexington, Kentucky, USA

Debra K. Moser DNSc RN
Professor and Gill Chair of Cardiovascular
Nursing
College of Nursing, University of Kentucky,
Lexington, Kentucky, USA

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Abstract

Aims. To investigate the relationship between anxiety, perceived control and rate of in-hospital complications after acute coronary syndrome.

Background. Anxiety may be associated with higher risk of complications following acute myocardial infarction; perceived control may moderate this relationship.

Design. Prospective observational study.

Methods. Patients enrolled in a trial investigating delay in seeking treatment for acute coronary syndrome had anxiety measured at enrolment and 3 months using the Brief Symptom Inventory anxiety subscale. The acute coronary syndrome hospital presentations investigated occurred between 2001–2006. Patients with anxiety scores greater than the population norm at both time points were categorized as persistently anxious. Perceived control was measured at enrolment using the Control Attitudes Scale-Revised. Data were collected from the medical record on in-hospital complications in patients presenting with acute coronary syndrome within 2 years of enrolment. Chi-square and *t*-tests were used for univariate analyses and multiple logistic regression to identify independent predictors of complications.

Results. Patients (n = 171) were 64% men with mean age 69 years. Ischaemic or arrhythmic complications occurred in 26 patients (15%) with no difference in complication rates between those persistently anxious and others. Important univariate predictors of in-hospital complications were lower perceived control, diagnosis of acute myocardial infarction, heart failure and higher pulse rate on admission. Low perceived control and diagnosis of acute myocardial infarction were independent predictors of in-hospital complications in the multiple logistic regression.

Conclusion. Perceived control, but not persistent anxiety, prior to acute coronary syndrome was an important predictor of in-hospital complications after acute coronary syndrome. Interventions to increase cardiac patients' perceived control of their cardiac illness may reduce in-hospital complications after acute coronary syndrome.

Keywords: acute coronary syndrome, anxiety, complications, myocardial infarction, nursing, perceived control, unstable angina

Introduction

Coronary heart disease (CHD) is the leading single cause of death in Australia and the USA, accounting for 18% and 17% of all deaths in those countries in 2005 and 2006 respectively (Australian Institute of Health and Welfare 2008, Lloyd-Jones *et al.* 2010). CHD is estimated to lead to approximately 50,000 hospitalizations per year in Australia and 1·76 million per year in the USA. The mortality rate after a major coronary event, mostly attributable to out-of-hospital cardiac arrests, decreased from 53% to 40% in the decade to 2005 in Australia. However, in-hospital death remains an important risk after acute myocardial infarction (AMI), at around 10% of presentations (Australian Institute of Health and Welfare 2008, Lloyd-Jones *et al.* 2010). As such, understanding the factors influencing survival and recovery after acute coronary events is important to further reduce risk.

Recovery after acute coronary syndrome (ACS) is influenced by physiological and psychological attributes. Among psychological attributes, anxiety has been found to be both a response to ACS and a factor in recovery. Anxiety is an early, common psychological response to ACS including AMI (Moser *et al.* 2003, Grace *et al.* 2004). In patients who experience ACS, the prevalence of anxiety may be as high as 70–80% (Crowe *et al.* 1996, Moser & Dracup 1996).

Anxiety has been shown to have a significant impact on recovery during hospitalization for AMI (Crowe *et al.* 1996). Patients with high anxiety during the first 48 hours after AMI have higher risk of developing in-hospital complications such as reinfarction, recurrent ischaemia and ventricular fibrillation or tachycardia (Moser & Dracup 1996, Moser *et al.* 2007). Perceived control has been shown to moderate the effect of anxiety on in-hospital complications after AMI (Moser *et al.* 2007).

Background

Anxiety may affect recovery after acute cardiac events (Gallagher & McKinley 2007), and increase the risk of cardiac events, but an association between anxiety and outcomes has not been found consistently. Anxiety measured immediately after first AMI was associated with in-hospital complications in one study (Huffman *et al.* 2008), and predictive of death, further AMI and invasive coronary procedures over 7 years in men in the study of Pfiffner and Hoffmann (2004).

Anxiety has also been associated with long-term complications including a higher rate of recurrent AMI, unstable angina (Frasure-Smith *et al.* 1995, Grace *et al.* 2004) and a threefold increase in 5-year mortality (Frasure-Smith 1991). In a review of the relationship between psychosocial factors and CHD morbidity and mortality, the evidence linking anxiety with increased CHD morbidity and mortality was considered enticing but inconclusive (Bunker *et al.* 2003). A more recent longitudinal study of adults with no history of CHD found that anxiety was associated with a modest increase in risk of AMI over 12 years (Shen *et al.* 2008). In the Framingham Heart Study, higher levels of anxiety measured using physiological indicators were associated with an increase in all-cause mortality over 10 years; tension, a measure restricted to psychological indicators, was associated with increased risk of CHD, atrial fibrillation and mortality in men only (Eaker *et al.* 2005).

Various investigators have sought to determine the stability of anxiety or pattern of change over time. In patients undergoing cardiac surgery, state anxiety was found to decrease after preoperative baseline measurement, whereas trait anxiety was relatively stable, as expected (Székely *et al.* 2007). Rising anxiety levels over time were associated with the highest rate of myocardial infarction and death in outpatients with coronary artery disease, compared to stable or decreasing anxiety. Lower cumulative mean anxiety scores were associated with improved survival and reduced occurrence of unstable angina (Shibeshi *et al.* 2007).

In the study of Oxlad *et al.* (2006), anxiety measured after coronary artery bypass graft surgery trebled the risk of hospital readmission, whereas there was no association with preoperative anxiety. However, in another study of cardiac surgery patients, preoperative baseline trait anxiety was predictive of mortality over 2 years (Székely *et al.* 2007). These varying outcomes suggest that psychological measures may be highly changeable around clinical events, and that the timing of data collection and the instrument used may also influence results. Assessments of anxiety and other psychological measures perioperatively may also be reflective of a different stressor than assessments of responses immediately after an acute event.

In most prior research on anxiety and cardiac complications, anxiety was measured only once after the patient was hospitalized for AMI (Lane *et al.* 2000a,b, Mayou *et al.* 2000, Welin *et al.* 2000, Pfiffner & Hoffmann 2004, Moser *et al.* 2007). In only one study of patients with an ACS event (Grace *et al.* 2004) was anxiety measured at more than one time point. Anxiety may not persist in some individuals (Grace *et al.* 2004), so measuring it at only one time point may obscure the relationship between anxiety and subsequent cardiac events or mortality. That is, when persons with transient anxiety are included in studies, it may reduce the power of the study to detect true relationships.

Perceived control over cardiac illness was demonstrated in a previous study to moderate the effect of anxiety on in-hospital complications after AMI (Moser *et al.* 2007). Perceived control is a personal belief in an ability to achieve desired outcomes (Mahler & Kulik 1990). Perceived control was a marginal predictor of lower preoperative anxiety and negative psychological reactions postoperatively among cardiac surgery patients, and also predicted shorter hospital length-of-stay (Mahler & Kulik 1990). Higher health-related perceived control and a combined measure of health-related and general perceived control have been shown to improve self-reported physical functioning after coronary artery bypass graft surgery (Barry *et al.* 2006).

The relationship between anxiety and outcomes related to acute cardiac events therefore remains ambiguous in several populations. Whether or not the recurrence of state anxiety over time is associated with increased risk of poorer outcomes is also unclear. Perceived control over cardiac illness is a relatively new concept in the investigation of outcomes in cardiac illness. This study sought to contribute new evidence to address these questions.

The study

Aims

The purposes of this study were twofold. Firstly, we investigated the effects of anxiety measured prior to ACS on in-hospital complications in patients who experienced an ACS event. Secondly, we investigated the relationship between persistent anxiety, perceived control and rate of in-hospital complications in patients with ACS.

Design

This was a prospective observational study of a subgroup of patients with CHD enrolled in a randomized controlled trial testing an intervention to reduce prehospital delay time in the event of ACS symptoms.

Participants

Patients were previously enrolled in a study in which the impact of an intervention on patient delay in seeking treatment for ACS was measured (PROMOTION) (Dracup *et al.* 2006, 2009). Patients were eligible for PROMOTION if they had a diagnosis of CHD and lived independently, that is, not in an institutional setting. Patients were excluded if they had a complicating serious comorbidity, untreated malignancy, impaired cognition, were unable to understand written or spoken English or had a major and uncorrected hearing loss. In the PROMOTION study, sociodemographic and clinical data including age, gender, CHD history and risk factors were collected at baseline, whereas anxiety and perceived control over cardiac illness were measured at baseline and after 3 and 12 months.

Patients enrolled in the PROMOTION trial who met the following inclusion criteria were included in this study: (i) hospitalization with ACS, defined as a diagnosis of AMI or unstable angina (DeVon 2008), (ii) free of terminal illness. Patients were excluded if unable to understand spoken English or unable to respond to English language questions on the data collection instruments.

Sites for this study were University of Washington Medical Center, Seattle, USA; University of Kentucky Medical Center, Lexington, USA; Sharp HealthCare in San Diego, USA; the Royal North Shore and St. George Hospitals, Sydney, Australia and Auckland City Hospital, Auckland, New Zealand.

Data collection

Patients enrolled in the PROMOTION trial were followed up for 2 years to capture ACS events and prehospital delay times. Patients were given a free-call telephone number on which to contact the investigators at their respective study sites if they attended the hospital for suspected ACS symptoms. Study participants were also asked in scheduled telephone calls from the investigators at 3, 12 and 24 months if they had been to hospital for suspected heart attack symptoms in the intervening period. The ACS hospital presentations investigated in this study occurred between 2001 and 2006, up to 2 years after initial enrolment in the PROMOTION study. The medical records of patients who reported attending hospital for suspected ACS were reviewed by the investigators. Data on clinical characteristics and complications were abstracted from the records of patients who met the inclusion criteria for the study. The data collected were:

- History of CHD, risk factors and comorbidities.
- Details of evaluation and diagnosis on hospital admission.
- Serial laboratory results.
- Medications and procedures during hospitalization.
- Complications during hospitalization.

All medical record reviews were done by experienced cardiovascular nurses trained in data abstraction for the purposes of the study. Psychological and sociodemographic data were obtained from the PROMOTION study database. The anxiety and perceived control measures were obtained in face-to-face interviews at enrolment in PROMOTION, and

by mailed questionnaires with follow-up telephone interviews at 3 and 12 months.

Anxiety measurement

State anxiety was assessed using the anxiety subscale of the Brief Symptom Inventory (BSI). The BSI anxiety subscale consists of six items on which participants rate their level of distress related to a given item on a scale of 0–4 (0 = 'not at all' and 4 = 'extremely'). The scores for the six items are then summed and an average obtained. The range of scores is 0–4, with higher scores indicating higher levels of anxiety (Derogatis & Melisaratos 1983, Derogatis 1993). Patients were categorized as persistently anxious if the BSI scores at enrolment and after 3 months were greater than the published mean population norm at both time points (Derogatis & Melisaratos 1983, Derogatis 1993).

Perceived control measurement

Perceived control over cardiac illness was measured using the Control Attitudes Scale-Revised (CAS-R). The CAS-R is specific to cardiac illness and consists of eight items designed to measure an individual's level of perceived control; sample items are 'I can do a lot of things myself to cope with my heart condition' and 'Regarding my heart problems, I feel lots of control'. The CAS-R can be completed in < 2 minutes by most patients. Each item is rated on a scale of 1–5 (totally disagree to totally agree) to give a total score from 8–40, with higher scores reflecting higher perceived control (Moser *et al.* 2009). There are not yet population norms for this measure, so patients were classed as having high or low perceived control using the median score of 30 on the CAS-R at enrolment as the cut point.

Complications

Complications were defined as the occurrence of any of the following during hospitalization: (i) acute recurrent ischaemia evidenced by new onset of chest pain, with ECG changes or haemodynamic instability, (ii) development of new AMI for angina patients or reinfarction for AMI patients evidenced by elevated cardiac enzymes and standard ECG changes, (iii) sustained ventricular tachycardia (> 15 seconds), or any ventricular tachycardia requiring pharmacological and/or electrical intervention, (iv) ventricular fibrillation, (v) supraventricular tachyarrhythmia with haemodynamic instability, (vi) acute pulmonary oedema, (vii) cardiogenic shock or (viii) in-hospital death.

Validity and reliability

The BSI, used in this study to measure state anxiety, has well established validity and reliability (Derogatis & Melisaratos 1983, Derogatis 1993). Construct, convergent, discriminant and predictive validity of the instrument have been established in a series of studies. The reported internal consistency coefficient for the anxiety subscale is 0·81 using Cronbach's alpha (Derogatis & Melisaratos 1983, Derogatis 1993). In the current sample, the internal consistency coefficient for the BSI anxiety subscale was 0·85 using Cronbach's alpha. There are three published mean norms for this instrument. The anxiety mean norm based on non-patient normal subjects is 0·35, on psychiatric inpatients is 1·7, and on psychiatric outpatients is 1·7 (Derogatis & Melisaratos 1983, Derogatis 1993).

To measure perceived control, we used the CAS-R, for which construct and convergent validity has been demonstrated in a large, mixed sample of cardiac patients. The reported internal consistency coefficient for the CAS-R is 0·70 using Cronbach's alpha (Moser *et al.* 2009). In this smaller sample the internal consistency coefficient of the CAS-R was 0·68 using Cronbach's alpha.

Ethical considerations

Ethics approval was obtained at each site from local human research ethics committees. All patients in the PROMOTION trial gave informed consent to participate in the study that included the review of their medical records if they were admitted to hospital. Where required, at the admission hospital, patients at some sites in this study were sent a letter requesting further written consent for access to their medical records, which was returned by mail.

Data analysis

Data analysis was carried in SPSS v17 (Chicago, IL, USA) and started with a descriptive analysis of the variables, including mean, standard deviation, median and range, or number and percentage by category, as appropriate to the level of measurement. A chi-square test of association was used to test for a difference in the unadjusted prevalence of complications, and any difference in treatment, between the two groups for each psychological measure. Multiple logistic regression was used to test the interaction of persistent anxiety and perceived control against the outcome of any in-hospital complication. Following this, persistent anxiety was removed from the model and a multiple logistic regression was performed to test low perceived control for its effect on the outcome of any in-hospital complication, while controlling for Killip class (i.e. heart failure on admission to hospital after ACS), admission diagnosis and pulse rate on admission.

Results

Data were collected from the medical records for 188 patients who presented to an emergency department with ACS within 2 years of enrolment. Anxiety scores on the BSI at baseline and after 3 months were available for 171 of these patients. Of this sample, 110 patients (64%) were male, mean (SD) age was 69 (11) years and 58% had achieved postsecondary education. Common co-morbidities included hypertension, previous AMI, diabetes mellitus and high body mass index (BMI) (Table 1).

The attributes of the current study sample were compared to the entire PROMOTION database to determine the representativeness of the sample. There were differences at baseline in most clinical, demographic and psychological characteristics between patients in this study and the remainder of the patients in PROMOTION (Table 2). Participants in this study were more likely to have a history of previous AMI or diabetes mellitus and more likely to be persistently anxious and have low perceived control.

Sixty-three participants scored above the cut point of 0·35 on the BSI anxiety score at both baseline and 3 months and were classed as 'persistently anxious'. There were 108 participants who were below the cut point at one or both time points and were classed as 'not persistently anxious'. Forty participants had a presentation with confirmed ACS

Table 1 Patient characteristics at enrolment (n = 171).

	Total (N = 171)	Persistently anxious (n = 63)	Not persistently anxious (n = 108)	P	High perceived control (n = 72)	Low perceived control (n = 99)	P
Gender – n (%)*							
Male	110 (64)	36 (57)	74 (68)	0·134	44 (61)	66 (67)	0·454
Female	61 (36)	27 (43)	34 (32)		28 (39)	33 (33)	
Age in years – mean (SD)†	69 (11)	66 (11)	70 (11)	0·039	72 (8)	66 (12)	< 0·001
Body mass index – mean (SD)†‡	28 (5)	28 (6)	27 (4)	0·177	26 (4)	28 (6)	0·006
Marital status – n (%)*							
Not currently married	62 (36)	26 (41)	36 (33)	0·298	23 (32)	39 (39)	0·317
Married or cohabitate	109 (64)	37 (59)	72 (67)		49 (68)	60 (61)	
Education – n (%)*							
Secondary or less	72 (42)	27 (43)	45 (42)	0·879	27 (37)	45 (45)	0·298
Postsecondary	99 (58)	36 (57)	63 (58)		45 (63)	55 (55)	
History of hypertension – n (%)*	117 (68)	44 (70)	73 (68)	0·760	46 (64)	71 (72)	0·277
History of diabetes mellitus – n (%)*	57 (33)	27 (43)	30 (28)	0·044	20 (28)	37 (37)	0·189
Previous AMI – n (%)*	94 (55)	34 (54)	60 (56)	0·841	39 (54)	55 (56)	0·857
Admission Killip class – n (%)§							
Class I or II	163 (95)	61 (97)	102 (94)	0·712	69 (96)	94 (95)	> 0·999
Class III or IV	8 (5)	2 (3)	6 (6)		3 (4)	5 (5)	
Admission diagnosis – n (%)*							
Unstable angina	140 (82)	51 (81)	89 (82)	0·812	62 (86)	78 (79)	0·220
AMI	31 (18)	12 (19)	19 (18)		10 (14)	21 (21)	
Admission SBP, mmHg – mean (SD)†¶	145 (26)	145 (25)	145 (26)	0·854	142 (26)	147 (26)	0·302
Admission DBP, mmHg – mean (SD)†**	76 (15)	75 (15)	76 (15)	0·768	74 (17)	77 (13)	0·278
Admission pulse rate – mean (SD)†¶	77 (22)	76 (19)	77 (23)	0·756	72 (21)	80 (22)	0·020
Severity of pain, 1–10 – mean (SD)††	6 (3)	6 (3)	6 (3)	0·558	6 (3)	6 (3)	0·651

Statistical tests used to compare groups were:
*Chi-square.
†Independent samples t-test.
‡n = 163.
§Fisher's Exact Test.
¶n = 170.
**n = 169.
††n = 122.
Values are n (%) or mean (SD). P value for comparison between anxiety groups and perceived control groups. AMI, acute myocardial infarction; SBP, systolic blood pressure; DBP, diastolic blood pressure.

Table 2 Characteristics at enrolment.

	Current sample (n = 171)	Remainder of PROMOTION (n = 3352)	P
Country – n (%)*			
Australia/New Zealand	105 (61)	1432 (45)	< 0·001
USA	66 (39)	1779 (55)	
Female gender – n (%)*	61 (36)	1027 (32)	0·314
Age – mean (SD)†	69 (11)	67 (11)	0·072
Body mass index – mean (SD)†	28 (5)	28 (5)	0·954
Married or cohabitate – n (%)*	109 (67)	2265 (72)	0·150
Postsecondary education – n (%)*	99 (58)	2098 (65)	0·044
Hypertension – n (%)*	104 (61)	1760 (56)	0·150
History of diabetes mellitus – n (%)*	52 (30)	668 (21)	0·003
Previous AMI – n (%)*	109 (65)	1714 (55)	0·011
Baseline anxiety on BSI – n (%)*	85 (50)	1511 (47)	0·525
Anxiety at 3 months on BSI – n (%)*	95 (56)	1300 (47)	0·032
Persistent anxiety – n (%)*	63 (37)	873 (29)	0·037
Low perceived control – n (%)*	99 (58)	1567 (49)	0·021

Statistical tests used to compare groups were:
*Chi-square.
†Independent samples t-test.
Values are n (%) or mean (SD). P value for comparison between current sample and remainder of PROMOTION. AMI, acute myocardial infarction; BSI, Brief Symptom Inventory.

between the first and second measurement of anxiety. Participants in the persistently anxious group were significantly younger and more likely to have a diagnosis of diabetes mellitus. There were also trends to female gender and a higher BMI among the anxious group, which did not reach statistical significance (Table 1). Fifty per cent of participants were classed as anxious at baseline, 56% at 3 months, but only 37% at both time points. For participants who also recorded a BSI score at 12 months (n = 154), 58% were anxious at this time.

Seventy-two participants had high perceived control and 99 participants low perceived control at baseline. Participants with lower perceived control had a higher pulse rate on admission, were younger and had a higher BMI (Table 1). Of participants with persistent anxiety (n = 63), 73% had low perceived control and 27% high perceived control. There was a statistically significant relationship between perceived control and anxiety (χ^2 = 9·4, P = 0·002). Participants with high perceived control were significantly less probable to be persistently anxious.

There were no important differences in treatment in the emergency department or during hospitalization according to persistent anxiety group. A higher proportion of participants in the low perceived control group received beta-adrenergic blocking agents during hospitalization (P = 0·049; Table 3).

Twenty-six participants (15%) experienced one or more in-hospital complications, the most common being recurrent ischaemia, which occurred in 14 participants (8%). Other complications – recurrent infarction, sustained ventricular tachycardia, ventricular fibrillation, supraventricular tachycardia, pulmonary oedema, cardiogenic shock and death – occurred in six or fewer participants (Table 4).

There were no important differences in complication rates between the persistently anxious group and the not persistently anxious group. Participants with lower perceived control were significantly more likely to experience any in-hospital complication (χ^2 = 6·58, P = 0·010) or recurrent ischaemia (χ^2 = 7·65, P = 0·006) than those with higher perceived control. Participants with high perceived control who were not persistently anxious had the lowest complication rates (P = 0·005); complication rates of the other three combinations were similar (Table 5).

Killip class on admission (P = 0·002), admission diagnosis (P < 0·001) and higher pulse rate on admission (P = 0·008) were associated with the occurrence of any in-hospital complication when tested with chi-square for Killip class and diagnosis, and independent samples t-test for pulse rate. The effect of the interaction of persistent anxiety and perceived control on complications was tested in a multiple logistic regression, controlling for the important predictors found on univariate analysis. It was found that there was no effect of the interaction on complications. Therefore, the potential moderating effect of perceived control on persistent anxiety and complications was not tested.

Table 3 Treatments received.

	Total (N = 171) n (%)	Persistently anxious (n = 63) n (%)	Not persistently anxious (n = 108) n (%)	P	High perceived control (n = 72) n (%)	Low perceived control (n = 99) n (%)	P
β-Blocker in ED*	28 (16)	8 (13)	20 (19)	0·321	13 (18)	15 (15)	0·612
Nitrates in ED*	109 (64)	40 (64)	69 (64)	0·958	44 (61)	65 (66)	0·542
Anxiolytic in ED†	5 (3)	2 (3)	3 (3)	> 0·999	3 (4)	2 (2)	0·651
Morphine in ED*	40 (23)	13 (21)	27 (25)	0·515	17 (24)	23 (23)	0·954
β-Blocker in hospital*	125 (73)	49 (78)	76 (70)	0·292	47 (65)	78 (79)	0·049
ACEI/ARA in hospital*	98 (57)	32 (51)	66 (61)	0·188	40 (56)	58 (59)	0·692
Anxiolytic in hospital*	23 (14)	10 (16)	13 (12)	0·478	10 (14)	13 (13)	0·886
CABG†	7 (4)	2 (3)	5 (5)	> 0·999	4 (6)	3 (3)	0·456
Angioplasty*	32 (19)	12 (19)	20 (19)	0·932	11 (15)	21 (21)	0·326

Statistical tests used to compare groups were:
*Chi-square.
†Fisher's Exact Test.
Values are n (%). P value for comparison between anxiety and perceived control groups. ED, emergency department; β-blocker, beta-adrenergic blocking agent; ACEI, angiotensin converting enzyme inhibitor; ARA, angiotensin II receptor antagonist; CABG, coronary artery bypass grafting.

Table 4 In-hospital complications experienced (n = 171).

Complication	Number (%)
Any	26 (15)
Recurrent ischaemia	14 (8)
Reinfarction/new AMI	6 (4)
Ventricular tachycardia	2 (1)
Ventricular fibrillation	2 (1)
Supraventricular tachycardia	5 (3)
Acute pulmonary oedema	5 (3)
Cardiogenic shock	3 (2)
In-hospital death	3 (2)

Total number of complications > 26 as 11 patients had > 1 complication.

Table 5 Relationships between anxiety, perceived control and complications.

	Persistently anxious		Not persistently anxious		
	Low perceived control	High perceived control	Low perceived control	High perceived control	
	n (%)	n (%)	n (%)	n (%)	P
Any complication*					
No	40 (76)	52 (95)	38 (83)	15 (88)	0·005
Yes	13 (24)	3 (5)	8 (17)	2 (12)	

*Chi-square test.

After removing persistent anxiety, the full model of the logistic regression to test perceived control for its association with any in-hospital complication was statistically significant (χ^2 = 30·89, d.f. = 4, N = 170, P < 0·001). One case was excluded from the analysis due to missing data on pulse rate on admission. The model correctly classified 85·9% of cases. The only variables to make a statistically significant contribution to the model were admission diagnosis of AMI and low perceived control (Table 6). Participants with low perceived control and diagnosis of AMI were 3·4 and 4·7 times more likely respectively to have complications, controlling for the other factors in the model.

Table 6 Multiple logistic regression of low perceived control and any in-hospital complication.

	Adjusted OR	(95% CI)	P
Pulse rate on admission	1·0	(1·0–1·0)	0·083
Killip class III–IV	6·0	(0·9–40·2)	0·062
Acute myocardial infarction	4·7	(1·7–12·7)	0·003
Low perceived control	3·4	(1·1–10·7)	0·037

OR, odds ratio; Cox and Snell R^2 = 16·6%, Nagelkerke R^2 = 28·9%.

Discussion

In this study we analysed the relationships between state anxiety, perceived control over cardiac illness and in-hospital complications of ACS in an international sample of patients with CHD. The main findings were that persistent anxiety assessed prior to the ACS event was not related to complications and that higher perceived control was associated with lower anxiety levels. Patients with a diagnosis of AMI or low perceived control over their cardiac illness were found to be at higher risk for in-hospital complications of ACS. This

study revealed a relatively low rate of in-hospital complications among the sample of participants presenting with ACS, at only 15%. This is expected, at least in part, to be related to the relatively low acuity of the sample, with 82% of participants diagnosed with unstable angina and only 18% with AMI, the small numbers with heart failure on admission (5% with Killip class III or IV) and few participants undergoing invasive coronary revascularization.

These findings contrast with the results of our previous study (Moser *et al.* 2007) in which anxiety increased the risk of in-hospital complications by 50%, and perceived control moderated the effect of anxiety to reduce the risk of complications. In that study all patients had a confirmed diagnosis of AMI, 64% with ST segment elevation AMI, and a greater proportion had heart failure (Killip class III or IV) on admission. In all, 27% of patients experienced complications, and 31% of those with ST segment elevation AMI had complications. In addition to the sample in the earlier study being at higher risk, anxiety was measured in hospital at a median time of 28 hours after admission for AMI (Moser *et al.* 2007). The differences observed in the present study may be related to the sample being less acutely ill and having their anxiety levels measured in an outpatient setting or by telephone interviews while at home, rather than after the stress of AMI and emergency hospitalization.

The finding that anxiety showed no association with in-hospital complications in this sample adds further to the inconsistency observed from other studies. The higher rates of anxiety at baseline, 3 and 12 months (50–57%) compared to persistent anxiety at two time points (37%) indicate that BSI anxiety levels were similar within the group, but more variable for individuals. It could be postulated that the sample size in this study was insufficient to detect an important effect of anxiety on complications. The sample size for the analysis was not determined *a priori* to detect a difference in complication rates based on anxiety levels, but determined by the number of participants in the original study who presented to hospital with confirmed ACS (Dracup *et al.* 2009). However, the observed difference in complication rates between participants with anxiety levels above and below the norm in this study was very small and the lack of statistical significance is unlikely to be due to small sample size.

Why are there inconsistencies in the finding that anxiety is a predictor of poorer outcomes or complications in CHD participants, including those in the current study? Other studies (Pfiffner & Hoffmann 2004, Oxlad *et al.* 2006, Shibeshi *et al.* 2007, Székely *et al.* 2007, Denollet *et al.* 2008, Shen *et al.* 2008) looked at the event rate (such as AMI or death) for the whole population studied. Another study of 2325 patients with CHD in PROMOTION found that combined persistent anxiety and depression was associated with higher mortality over 12 months, although neither persistent anxiety nor persistent depression alone was significantly associated with mortality (Doering *et al.* 2010). In this study, we investigated complications in a relatively small subset of participants with CHD who presented with ACS, mostly with unstable angina.

Anxiety has been reported not to be an important predictor of mortality or myocardial infarction in non-repressive patients, whereas repressive coping style was significantly predictive of mortality or AMI (Denollet *et al.* 2008). We did not measure repressive coping, but the potential for such patients to under-report their anxiety levels could give some explanation of the lack of any association between anxiety and complications in the current study.

High perceived control was associated with less persistent anxiety. This relationship is consistent with other studies of perceived control (Dracup *et al.* 2003, Moser *et al.* 2009). The combination of high perceived control and low anxiety was associated with the lowest rate of complications, at 6%. The small group of participants with low perceived control who were not persistently anxious experienced the highest rate of in-hospital complications, at 25%. This may indicate a particular psychological profile conferring greater risk than anxiety alone.

Low perceived control was an independent predictor of in-hospital complications and recurrent ischaemia in this study. Among patients with long-term illnesses, perceived control over any aspect of life has been described as beneficial, such that if the patient cannot control their condition, then it is adaptive to transfer their control perceptions to daily issues or events that may be controlled (Thompson *et al.* 1993). To increase perceived control, there is a need for interventions that assist patients to identify and control specific tasks and behaviours, including their response to symptoms of their illness (Thompson *et al.* 1993).

The opportunity of increasing patients' perceived control of their cardiac illness through the use of a targeted intervention (Tullmann *et al.* 2007) suggests that the patient population in this study, people with known CHD at high risk for ACS, could benefit from an intervention to increase perceived control. The effectiveness of disease-specific interventions in raising patients' perceived control has been demonstrated in diabetes (Garrett *et al.* 2005), asthma (Janson *et al.* 2009), arthritis (Barlow *et al.* 1999) and breast cancer (Cameron *et al.* 2007).

Limitations

The PROMOTION study relied on participants to advise that they presented to hospital with possible symptoms, either by

What is already known about this topic

- The association of anxiety with complications and poorer outcomes in patients with coronary heart disease is inconclusive.
- The relationship between anxiety and complications has been shown to be moderated by perceived control over cardiac illness.

What this paper adds

- In this sample, low perceived control, but not persistent anxiety, was predictive of in-hospital complications after acute coronary syndrome.

Implications for practice and/or policy

- It may be possible for nurses to increase cardiac patients' perception of control over their illness.
- Increasing perceived control may reduce the risk of complications after acute coronary syndrome.

contacting the investigators or in the phone calls they received at 3, 12 and 24 months. Although the retention rates at 2 years in PROMOTION were good, it is likely some participants who experienced ACS symptoms were missed because they did not present to hospital. Some participants reported having presented to hospitals from which their data could not be captured by the investigators. This may affect the generalizability of results from the final sample of participants available for analysis in this study. However, the differences found between the current sample and the PROMOTION study population are generally to be expected, as participants presenting to hospital with ACS within 2 years had a higher prevalence of risk factors at baseline than the overall study population. Similarly, the higher rates of persistent anxiety and low perceived control suggest that participants in the current sample were more likely to have psychological risk factors that would confer greater risk of ACS or complications. These differences do not suggest a biased sample due to missed presentations.

Another potential limitation was reliance on self-report for the psychological measures. However, this is a limitation of most studies in this area of research and the instruments used, the BSI anxiety subscale and CAS-R, have established validity and reliability in measuring the subjective states for which they were designed. Reliance on self-report is an accepted approach to the assessment of psychosocial phenomena amenable to nursing interventions (Polit & Beck 2004), in contrast to diagnoses for which psychiatric treatments may be indicated (American Psychiatric Association Task Force on DSM-IV 1994). The definition of persistent anxiety we used in this study and previously (Doering *et al.* 2010) was based on measurement of state anxiety at two time points and should not be interpreted as trait anxiety. Some participants in this study with high levels of anxiety at both time points presented to hospital with ACS symptoms between the baseline and 3-month measurements of anxiety. They fit the above definition, but the second anxiety measure was recorded after their hospital presentation. However, it is not likely that this influenced the results given the overall lack of effect of anxiety on complications in this analysis.

We relied on review of participants' medical records to obtain data on complications, which may have missed complications that were not recorded in the records. However, the reviews were conducted by experienced cardiac nurses specifically trained in data abstraction for the project, and one in 20 was checked by a second investigator, so recorded complications were likely to be captured. Nevertheless, if participants had complications that were not evident in the medical records these were not captured for the study.

Conclusions

This study showed that persistent anxiety prior to ACS was not a predictor of in-hospital complications in patients with CHD. Higher perceived control was associated with lower anxiety, and lower perceived control was an independent predictor of the occurrence of in-hospital complications. It may be possible to reduce complication rates for patients with ACS by identifying patients at risk and increasing their perceived control through a targeted intervention. However, the ambiguity about the contribution of state anxiety to outcomes in acute cardiac events persists and further observational studies are needed. The emerging consistency in the evidence of the protective benefit of perceived control in cardiac populations suggests that the testing of interventions to increase perception of control and improve outcomes is warranted.

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Conflict of interest

No conflict of interest has been declared by the authors.

Author contributions

SM, BR, HM and DM were responsible for the study conception and design. SM, BR, HM, MA, TL and DM performed the data collection. SM and MF performed the data analysis and were responsible for the drafting of the manuscript. SM, MF, BR, HM, TL and DM made critical revisions to the article for important intellectual content. SM, MF, BR and DM provided statistical expertise and administrative, technical or material support. SM and TL supervised the study.

References

American Psychiatric Association Task Force on DSM-IV (1994) *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV*. American Psychiatric Association, Washington, DC.

Australian Institute of Health and Welfare (2008) *Australia's Health 2008: Cat. no. AUS 99*. AIHW, Canberra.

Barlow J.H., Williams B. & Wright C.C. (1999) 'Instilling the strength to fight the pain and get on with life': learning to become an arthritis self-manager through an adult education programme. *Health Education Research* **14**, 533–544.

Barry L.C., Kasl S.V., Lichtman J., Vaccarino V. & Krumholz H.M. (2006) Perceived control and change in physical functioning after coronary artery bypass grafting: a prospective study. *International Journal of Behavioral Medicine* **13**, 229–236.

Bunker S.J., Colquhoun D.M., Esler M.D., Hickie I.B., Hunt D., Jelinek V.M., Oldenburg B.F., Peach H.G., Ruth D., Tennant C.C. & Tonkin A.M. (2003) "Stress" and coronary heart disease: psychosocial risk factors. *Medical Journal of Australia* **178**, 272–276.

Cameron L.D., Booth R.J., Schlatter M., Ziginskas D. & Harman J.E. (2007) Changes in emotion regulation and psychological adjustment following use of a group psychosocial support program for women recently diagnosed with breast cancer. *Psycho-Oncology* **16**, 171–180.

Crowe J.M., Runions J., Ebbesen L.S., Oldridge N.B. & Streiner D.L. (1996) Anxiety and depression after acute myocardial infarction. *Heart & Lung: The Journal of Critical Care* **25**, 98–107.

Denollet J., Conraads V.M., Martens E.J., Nyklicek I. & de Gelder B. (2008) Clinical events in coronary patients who report low distress: adverse effect of repressive coping. *Health Psychology*, **27**, 302–308.

Derogatis L.P. (1993) *BSI. Brief Symptom Inventory. Administration, Scoring, and Procedure Manual*. National Computer Systems, Inc, Minneapolis.

Derogatis L.R. & Melisaratos N. (1983) The Brief Symptom Inventory: an introductory report. *Psychological Medicine* **13**, 595–605.

DeVon H.A. (2008). *Chest Pain, in Moser D.K. and Riegel B. Cardiac Nursing: A Companion to Braunwald's Heart Disease* (Ch. 53, pp. 757–772). Elsevier Saunders, Philadelphia.

Doering L.V., Moser D.K., Riegel B., McKinley S., Davidson P., Baker H., Meischke H. & Dracup K. (2010) Persistent comorbid symptoms of depression and anxiety predict mortality in heart disease. *International Journal of Cardiology* **145**, 188–192.

Dracup K., Westlake C., Erickson V.S., Moser D.K., Caldwell M.L. & Hamilton M.A. (2003) Perceived control reduces emotional stress in patients with heart failure. *The Journal of Heart and Lung Transplantation* **22**, 90–93.

Dracup K., McKinley S., Riegel B., Meischke H., Doering L.V. & Moser D.K. (2006) A nursing intervention to reduce prehospital delay in acute coronary syndrome: a randomized clinical trial. *Journal of Cardiovascular Nursing* **21**, 186–193.

Dracup K., McKinley S., Riegel B., Moser D.K., Meischke H., Doering L.V., Davidson P., Paul S.M., Baker H. & Pelter M. (2009) A randomized clinical trial to reduce patient prehospital delay to treatment in acute coronary syndrome. *Circulation Cardiovascular Quality and Outcomes* **2**, 522–523.

Eaker E.D., Sullivan L.M., Kelly-Hayes M., D'Agostino R.B. & Benjamin E.J. (2005) Tension and anxiety and the prediction of the 10-year incidence of coronary heart disease, atrial fibrillation, and total mortality: the Framingham Offspring Study. *Psychosomatic Medicine* **67**, 692–696.

Frasure-Smith N. (1991) In-hospital symptoms of psychological stress as predictors of long-term outcome after acute myocardial infarction in men. *American Journal of Cardiology* **67**, 121–127.

Frasure-Smith N., Lesperance F. & Talajic M. (1995) The impact of negative emotions on prognosis following myocardial infarction: is it more than depression? *Health Psychology* **14**, 388–398.

Gallagher R. & McKinley S. (2007) Stressors and anxiety in patients undergoing coronary artery bypass surgery. *American Journal of Critical Care* **16**, 248–257.

Garrett N., Hageman C.M., Sibley S.D., Davern M., Berger M., Brunzell C., Malecha K. & Richards S.W. (2005) The effectiveness of an interactive small group diabetes intervention in improving knowledge, feeling of control, and behavior. *Health Promotion Practice* **6**, 320–328.

Grace S.L., Abbey S.E., Irvine J., Shnek Z.M. & Stewart D.E. (2004) Prospective examination of anxiety persistence and its relationship to cardiac symptoms and recurrent cardiac events. *Psychotherapy and Psychosomatics* **73**, 344–352.

Huffman J.C., Smith F.A., Blais M.A., Januzzi J.L. & Fricchione G.L. (2008) Anxiety, independent of depressive symptoms, is associated with in-hospital cardiac complications after acute myocardial infarction. *Journal of Psychosomatic Research* **65**, 557–563.

Janson S.L., McGrath K.W., Covington J.K., Cheng S.C. & Boushey H.A. (2009) Individualized asthma self-management improves medication adherence and markers of asthma control. *The Journal of Allergy and Clinical Immunology* **123**, 840–846.

Lane D., Carroll D., Ring C., Beevers D.G. & Lip G.Y. (2000a) Do depression and anxiety predict recurrent coronary events 12 months after myocardial infarction? *QJM: Monthly Journal of the Association of Physicians* **93**, 739–744.

Lane D., Carroll D., Ring C., Beevers D.G. & Lip G.Y. (2000b) Effects of depression and anxiety on mortality and quality-of-life 4 months after myocardial infarction. *Journal of Psychosomatic Research* **49**, 229–238.

Lloyd-Jones D., Adams R.J., Brown T.M., Carnethon M., Dai S., De Simone G., Ferguson T. B., Ford E., Furie K., Gillespie C., Go A., Greenlund K., Haase N., Hailpern S., Ho P.M., Howard V., Kissela B., Kittner S., Lackland D., Lisabeth L., Marelli A., McDermott M.M., Meigs J., Mozaffarian D., Mussolino M., Nichol G., Roger V.L., Rosamond W., Sacco R., Sorlie P., Stafford

R., Thom T., Wasserthiel-Smoller S., Wong N.D. & Wylie-Rosett J. (2010) Heart disease and stroke statistics – 2010 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation* **121**, e46–e215.

Mahler H.I. & Kulik J.A. (1990) Preferences for health care involvement, perceived control and surgical recovery: a prospective study. *Social Science & Medicine* **31**, 743–751.

Mayou R.A., Gill D., Thompson D.R., Day A., Hicks N., Volmink J. & Neil A. (2000) Depression and anxiety as predictors of outcome after myocardial infarction. *Psychosomatic Medicine* **62**, 212–219.

Moser D.K. & Dracup K. (1996) Is anxiety early after myocardial infarction associated with subsequent ischemic and arrhythmic events? *Psychosomatic Medicine* **58**, 395–401.

Moser D.K., Dracup K., McKinley S., Yamasaki K., Kim C.J., Riegel B., Ball C., Doering L.V., An K. & Barnett M. (2003) An international perspective on gender differences in anxiety early after acute myocardial infarction. *Psychosomatic Medicine* **65**, 511–516.

Moser D.K., Riegel B., McKinley S., Doering L.V., An K. & Sheahan S. (2007) Impact of anxiety and perceived control on in-hospital complications after acute myocardial infarction. *Psychosomatic Medicine* **69**, 10–16.

Moser D.K., Riegel B., McKinley S., Doering L.V., Meischke H., Heo S., Lennie T.A. & Dracup K. (2009) The Control Attitudes Scale-Revised: psychometric evaluation in three groups of patients with cardiac illness. *Nursing Research* **58**, 42–51.

Oxlad M., Stubberfield J., Stuklis R., Edwards J. & Wade T.D. (2006) Psychological risk factors for cardiac-related hospital readmission within 6 months of coronary artery bypass graft surgery. *Journal of Psychosomatic Research* **61**, 775–781.

Pfiffner D. & Hoffmann A. (2004) Psycho-social predictors of death for low-risk patients after a first myocardial infarction: a 7-year follow-up study. *Journal of Cardiopulmonary Rehabilitation* **24**, 87–93.

Polit D.F. & Beck C.T. (2004) *Nursing Research: Principles and Method*. 7th edn. Lippincott, Philadelphia.

Shen B.J., Avivi Y.E., Todaro J.F., Spiro A., Laurenceau J.P., Ward K.D. & Niaura R. (2008) Anxiety characteristics independently and prospectively predict myocardial infarction in men: the unique contribution of anxiety among psychologic factors. *Journal of the American College of Cardiology* **51**, 113–119.

Shibeshi W.A., Young-Xu Y. & Blatt C.M. (2007) Anxiety worsens prognosis in patients with coronary artery disease. *Journal of the American College of Cardiology* **49**, 2021–2027.

Székely A., Balog P., Benkö E., Breuer T., Székely J., Kertai M.D., Horkay F., Kopp M.S. & Thayer J.F. (2007) Anxiety predicts mortality and morbidity after coronary artery and valve surgery – a 4-year follow-up study. *Psychosomatic Medicine* **69**, 625–631.

Thompson S.C., Sobolew-Shubin A., Galbraith M.E., Schwankovsky L. & Cruzen D. (1993) Maintaining perceptions of control: finding perceived control in low-control circumstances. *Journal of Personality & Social Psychology* **64**, 293–304.

Tullmann D.F., Haugh K.H., Dracup K.A. & Bourguignon C. (2007) A randomized controlled trial to reduce delay in older adults seeking help for symptoms of acute myocardial infarction. *Research in Nursing and Health* **30**, 485–497.

Welin C., Lappas G. & Wilhelmsen L. (2000) Independent importance of psychosocial factors for prognosis after myocardial infarction. *Journal of Internal Medicine* **247**, 629–639.

