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Importance of illness beliefs and self-efficacy for patients with coronary heart disease

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Abstract

Title. Importance of illness beliefs and self-efficacy for patients with coronary heart disease

Aim. This paper is a report of a study to assess the association between coronary heart disease patients' illness beliefs and their self-efficacy 3 years after hospital discharge.

Background. Cardiac rehabilitation guidelines recommend that both the illness representation model and the concept of self-efficacy are relevant frameworks for developing effective psychological support, although little is known about what aspects of patients' illness beliefs influence their self-efficacy.

Method. In a longitudinal prospective survey, consecutive patients with coronary heart disease were asked to complete questionnaires measuring illness perceptions; self-efficacy and demographic, illness characteristics; and attendance at a cardiac rehabilitation programme. The questionnaire was completed three times between 2001 and 2005. The response rates were 84% at time 1, 77% at time 2 and 72% at time 3. Multiple regression analysis was used to assess the association between illness beliefs and self-efficacy. The data were collected between 2001 and 2005.

Findings. The average age of the participants was 65 years, 79% were male, 50% had acute myocardial infarction, 50% had angina and 61% had no previous history of cardiac illness; 55% had been admitted as an emergency and 57% subsequently attended cardiac rehabilitation. At baseline 30% of the variance in the exercise self-efficacy at 3 years after index admission was accounted for by patients' view of their illness being long-term. Data collected 9 months after discharge showed similar findings.

Conclusion. Early interventions designed to address individuals' sense of control, beliefs about the length of illness and the management of perceived symptoms before hospital discharge could increase rehabilitation programmes effectiveness in sustaining patients' long-term lifestyle changes.

Keywords: cardiac rehabilitation, coronary heart disease, illness beliefs, illness representation, long-term care, nursing, patient beliefs, psychosocial nursing, self-efficacy, survey

Introduction

National guidelines for cardiac rehabilitation (CR), including the British Association for CR's guidelines (Coats *et al*. 1995) and the National Service Framework for coronary heart disease (CHD) (Department of Health 2000), identify that CR programmes must have an explicit focus on psychological issues if optimal quality of life and lifestyle management are to be achieved by patients. Addressing psychological needs is a priority, given the range of negative psychological reactions a cardiac incident evokes. As early psychological distress does not spontaneously resolve itself over time, patients' beliefs and expectations need to be deliberately and effectively managed to achieve a positive mental outlook towards their condition and recovery. Both the illness representation (IR) model and the concept of self-efficacy (SE) have been recommended as relevant approaches to develop psychological support that meets the needs of individual patients (Coats *et al*. 1995). Using one or other of these approaches, researchers in the United States of America (USA), Australia and Britain have generated considerable evidence of the importance of patient beliefs and expectations in recovery, and the need to manage these beliefs if rehabilitation programmes are to become more effective.

Background

The concepts of IR and SE are prominent in the research related to the development of individualized care (Lau-Walker 2006a). A small number of recent intervention studies have attempted to address patients' illness beliefs in CR to improve care. This research is mainly limited to short-term behaviour changes such as return to work or attendance on rehabilitation programmes (Cooper *et al*. 1999, Petrie *et al*. 1996, Petrie *et al*. 2002, Wyer *et al*. 2001). Particularly in the USA, SE has also been used to facilitate behaviour changes (Bandura 1997, Holman & Lorig 1992, Jeng & Braun 1997). In Britain current National Health Service (NHS) research has started to promote the use of the 'expert patient' which advocates the importance of patients' SE for effective long-term care management (NHS 2001, Lorig *et al*. 1999).

Illness representation

In Leventhal's model, patients' previous experience with illness is organized in a complex memory structure that is used to cluster and organize illness knowledge. As a self-regulating model, it is described with three recurring stages (formation of cognitive representations; development of action plans and appraisal of coping response) which guide an individual's coping or adaptive behaviour (Leventhal *et al*. 1984).

The consistency of numerous research findings identifying the IR framework (identity, cause, timeline, consequences and control/cure) as predictors of health outcomes has lead to the creation of a psychometrically sound Illness Perception Questionnaire (IPQ) (Weinman *et al*. 1996). This instrument is used in this study to examine CHD patients' perception of their illness.

Self-efficacy

Bandura (1997) distinguished two types of expectations, outcome expectation and SE. Outcome expectancy beliefs refer to the perception of the possible consequences of one's own action: that a given behaviour will lead to a particular outcome. According to Bandura (1977), expectations of SE are the most powerful determinants of behavioural change because SE determines the initial decision to perform the behaviour, the effort to be expended, and the extent of the persistence in the face of adversity.

Sherer and Maddux (1982) stated that although SE has been primarily conceptualized as a situation-specific belief, there is evidence that the experiences of personal mastery that contribute to the efficacy expectancies generalized to actions other than the target behaviour. To cover both general and specific efficacy, this study incorporated three efficacy questionnaires – a general self-efficacy (GSE) questionnaire and a context-specific SE questionnaire for diet and another for exercise.

Researchers and healthcare practitioners accept that patients' illness beliefs are an important determinant of an individual's health behaviour changes. However, a better understanding of which specific aspects of the patients' beliefs following their cardiac diagnosis are probably to influence the individual's confidence in maintaining long-term health behaviour changes would benefit the current use of cognitive therapy and motivational interview techniques to facilitate health behaviour changes in CR. The available data and evidence on how illness beliefs predict the patient's long-term health behaviour changes is sparse. This is the first study to examine CHD patients' illness beliefs 3 years after their cardiac diagnosis, a long enough period of time for them to be independent from hospital and community rehabilitation programmes.

The study

Aim

The aim of the study was to examine the association between CHD patients' illness beliefs and their SE 3 years following hospital discharge.

Design

A longitudinal, prospective, cohort survey design was devised to explore the possible relationship between IR components and SE measures in CHD patients. A more precise understanding of the relationship between specific illness beliefs which influence SE in the long-term could provide nurses with evidence to develop effective individualized care.

The findings and analysis of the baseline data and the 9 months follow-up analysis of the current study have already been published (Lau-Walker 2004, Lau-Walker 2006b). The current paper, therefore, is a report of the 3-year follow-up data, using mixed model and multiple regression (MR) analyses.

Participants

Three hundred questionnaire packs were issued directly to all patients admitted to two hospitals in the south of England. Data were collected over a period of 11 months from the patients with a confirmed diagnosis of a heart attack (myocardial infarction) or angina. Apart from the cardiac diagnosis, the inclusion criteria required patients to be over 18 years. Exclusion criteria were patients who were confused or unable to speak or understand English. Two hundred and fifty-three completed questionnaires were returned while respondents were inpatients, a response rate of 84% for time 1 (T1). The only recorded reasons for non-completion were that patients had eyesight problems and could not complete the questionnaire unaided, or were too confused at the time of their hospital visit.

Of the original 253 participants, 194 (77%) went on to complete the follow-up questionnaire 9 months later, time 2 (T2). Five returnees were removed from the sample because they confirmed changes in diagnosis that no longer fitted the study. Of the 54 non-returnees at T2, five had died, four had moved and there was no information for the remaining 45. Of the 194 (T2) participants, 140 (72%) went on to complete the follow-up questionnaire in the third year of the study, time 3 (T3). Of the 54 non-returnees at T3, six had died, three had moved and there was no information for the remaining 44.

Data collection

The T1 questionnaire packs were administered, while the subjects were inpatients following the diagnosis of their cardiac condition and the T2 and T3 follow-up questionnaires were administered 9 months and 3 years after the patients had completed and returned the initial questionnaire, when they were likely to be managing on their own. In both follow-up phases, the questionnaires were administered by post, with a four-week postal reminder to non-respondents (Figure 1). The questionnaire was piloted with the first 30 patients. No major changes were required and these 30 questionnaires were included in the analysis.

Instruments

Four pre-validated instruments were used, and two created specifically for the study. The four pre-validated questionnaires have had considerable application in the recent research and have a proven reliability and validity. They are briefly described below. A summary of the data collected is set out in Table 1.

Dependent variables

Generalized self-efficacy scale The Generalized Self-Efficacy Scale (GSES) by Sherer and Maddux (1982), devised to assess the strength of an individual's belief in their ability to respond to novel or difficult situations and to deal with obstacles or setbacks. The scale scores are calculated using the mean score of the actual values of the 17 items (reversing scores where appropriate). This validated questionnaire obtained a Cronbach alpha reliability coefficient of 0·86 (Sherer & Maddux 1982) and the internal consistency for GSE in the current study was adequate with alpha = 0·68.

Cardiac diet and exercise self-efficacy instruments The cardiac diet self-efficacy instrument (CDSEI) and the cardiac exercise self-efficacy instrument (CESEI), devised by Hickey *et al.* (1992) measure patients' beliefs in their ability to cope with their behaviour changes in diet or exercise after a cardiac event. The overall CDSE and CESE scale scores were calculated by mean scores of the actual values of the 16 items of each of the scales. These instruments were found to have high internal consistency with alpha coefficients of 0·9 (Hickey *et al.* 1992) and for the current study alpha = 0·93.

Independent variables

Illness perception questionnaire The IPQ by Weinman *et al.* (1996) devised to measure the components of IR, based on Leventhal *et al.* (1984)'s cognitive model of illness perceptions. It contains five scales:

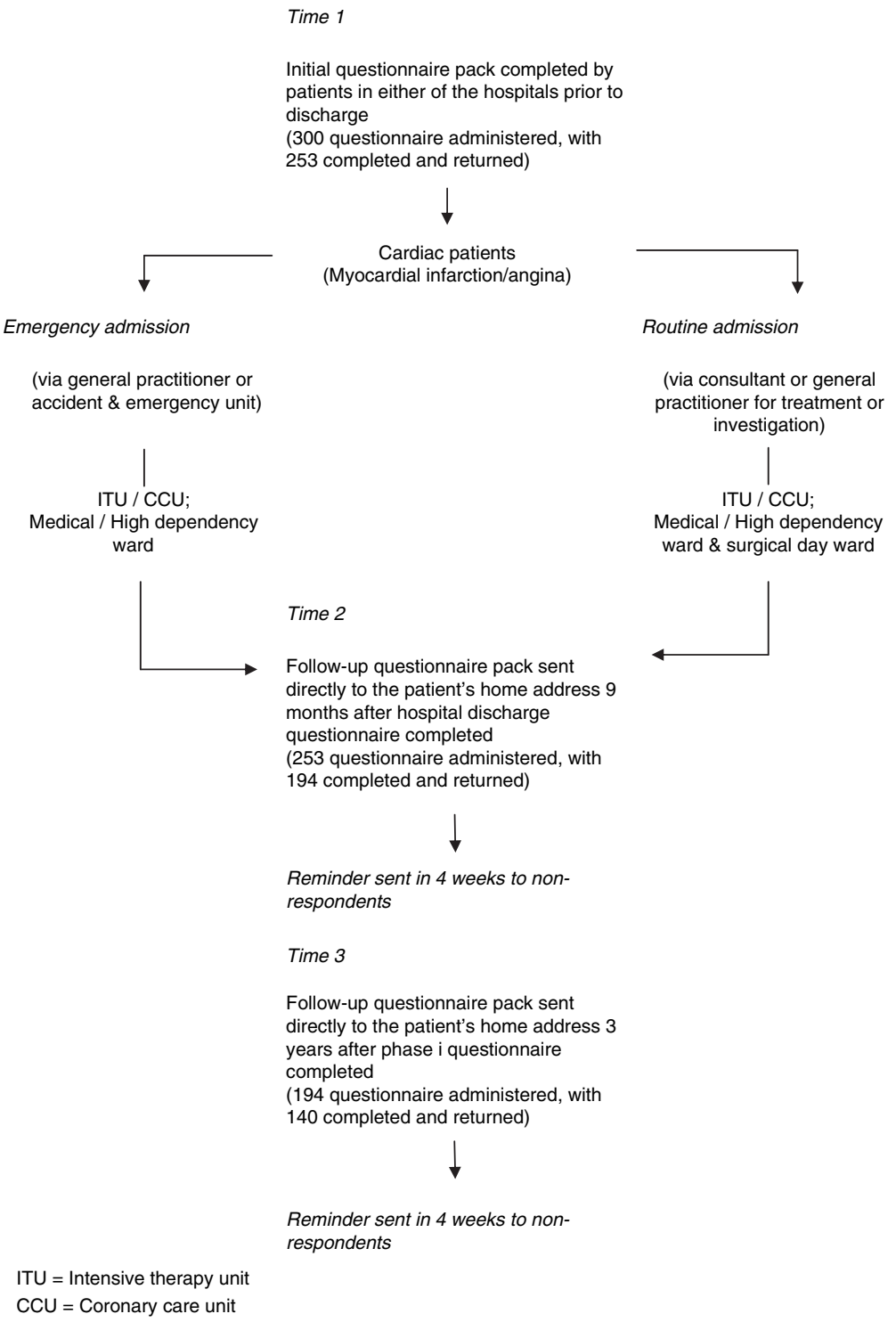

Figure 1 Flow chart to show data collection from time 1 to time 3.

- Identity: 10 items to assess the frequency of various symptoms a patient may experience in his/her illness which reflects individual's perception of what the problem is;
- Timeline: 3 items to assess the individual's belief about the duration of the illness and whether it will be acute, chronic, episodic or cyclical in nature;

Table 1 Summary of data collected

Measures	Time 1: (after cardiac diagnosis)	Time 2: (9 months follow-up)	Time 3: (3 years follow-up)
Outcome measures	GSES, CDSEI and CESEI	GSES, CDSEI and CESEI	GSES, CDSEI and CESEI
Predictive measures	Four IPQ components: (Identity, timeline, consequence and control and cure). Two outcome expectations: (DOES and EOES)	Four IPQ components: (Identity, timeline, consequence and control and cure.) Two outcome expectations: (DOES and EOES)	
Other variables	Demographics: gender, age, ethnicity, occupational status, living arrangement. Illness characteristics: diagnosis, route of admission, history of cardiac illness	Attendance to cardiac rehabilitation programme	

Key: GSES, General Self-Efficacy Scale; CDSEI, cardiac diet self-efficacy instrument; CESEI, cardiac exercise self-efficacy instrument; IPQ, Illness Perception Questionnaire; DOES, Diet Outcome Expectation Scale; EOES, Exercise Outcome Expectation Scale.

- Consequences: 7 items to assess individual perceptions about the effects of physical, social, economic and emotional consequences; and
- Control/cure: 6 items to assess individual perceptions about the degree of control the individual feels they have over the illness and whether they believe it to be curable.

The scales were calculated using the mean score of the actual values of the items for each of the illness perception components, except for the Cause scale where each represents a specific causal belief and cannot be analysed as continuous data and so cannot be summed and therefore were not be included as an independent variable in this study. Each scale in this questionnaire obtained an adequate internal consistency using the Cronbach alpha reliability coefficient test in the current study (Identity, $\alpha = 0{\cdot}78$; Timeline, $\alpha = 0{\cdot}75$; Consequence, $\alpha = 0{\cdot}72$ and Control/cure, is marginally adequate $\alpha = 0{\cdot}59$).

Diet and Exercise Outcome Expectation Scales Two scales have been designed for this study to measure diet outcome expectation (DOES) and exercise outcome expectation (EOES). Three items were designed for each of the DOES and EOES scales to assess patient's beliefs about the contribution that maintaining a healthy diet and maintaining a regular exercise regime would have on recovery or prevention of further heart problems respectively. These items reflected factors identified in the literature review on lifestyle changes in diet and exercise in CR, using Bandura's expectancy theory, and reviewed with a group of healthcare and psychology experts. The overall DOES and EOES scores were calculated by mean scores of the actual values of the three items of each of the scales. The scales were tested for internal consistency and obtained alpha = 0·72 for outcome expectation of diet and alpha = 0·84 for outcome expectation of exercise in a pilot study, and in the study itself both scales reported a similar consistency. Finally, because outcome expectation has been defined as a belief that certain behaviours would lead to a particular outcome, outcome expectation has been placed alongside the illness perception components as a predictor of SE. For example, if Diet was believed to be the cause of the cardiac event then a positive outcome expectation would be a belief that maintaining a healthy diet would lead to early recovery.

Ethical considerations

The study was approved by the Local Research Ethics NHS Committees. A letter from the researcher invited the approved patients to participate in a final phase of the 3-year study. The letter contained information about the follow-up study, along with the questionnaire pack for the final phase. The return of the completed questionnaire was taken as consent to participate.

Data analysis

The relationship between the individual's IR and their SE was examined by a standard MR analysis to assess the relative importance of each IR component in predicting the SE the patient was likely to exhibit 3 years after their cardiac event. In the standard MR all independent variables were entered into the equation simultaneously. Each

independent variable was evaluated in terms of its prediction power, over and above all the other independent variables. Potential confounding factors such as demographic (age, gender, employment and living arrangement) and illness characteristics (diagnosis, previous cardiac illness and routine of admission) and attended to a CR programme were identified from the literature review (Dusseldorp *et al.* 1999, Linden *et al.* 1996, Mullen *et al.* 1992) and they were all included in the models. For the MR analysis, the sample size (n) was estimated using the power calculation equation of $8\ m + 50 = n$ [independent variable (m) = 13] (Tabachnick & Fidell 2001).

Mixed model analyses were used to assess which factors might have had an influence on the (general, diet and exercise) SE measures. In the mixed models the random effects were the patients; each SE measure was recorded at three time points with the repeated measures nested within the patient. The fixed effects estimated from the baseline values: demographic (age, sex, living on their own and in employment) and illness characteristic (diagnosis of myocardial infarction or angina, history of cardiac problem and route of admission) and attendance to a CR programme. Although it changes over time, age is included in the effects because it will increase at the same rate for every patient.

Standard MR analysis was used to assess the influence of the patients' illness beliefs (IPQ scores) measured both initially in hospital (T1) and at 9 months (T2), on their SE (GSES, CESEI and CDSEI scores) measured 3 years from their hospital discharge. Normality probability plots and residual scatter plots were used to test the normality assumptions for the MR models. All analyses were performed using SPSS for Windows version 11.

Table 2 Mixed model analysis for (a) general self-efficacy (GSE), (b) diet self-efficacy (DSE) and (c) exercise self-efficacy (ESE)

	Coefficient	95% CI		*P* value
(a) Mixed model analysis for GSE				
Change per year	−0·02	−0·05	<0·01	0·09
Age (years)	0·01	−0·00	0·02	0·19
Males	−0·06	−0·25	0·14	0·58
Living alone	−0·09	−0·30	0·13	0·44
Employed	0·20	−0·01	0·41	0·05
Angina	−0·03	−0·19	0·14	0·76
First time heart problem	0·10	−0·05	0·26	0·19
Emergency admission	−0·12	−0·28	0·05	0·17
Attendance at CR programme	−0·05	−0·21	0·19	0·57
(b) Mixed model analysis for DSE				
Change per year	0·03	−0·01	0·06	0·17
Age (years)	0·01	−0·01	0·02	0·15
Males	−0·20	−0·47	0·07	0·15
Living alone	−0·26	−0·55	0·04	0·09
Employed	0·17	−0·11	0·45	0·23
Angina	0·01	−0·22	0·23	0·95
First time heart problem	0·05	−0·16	0·27	0·62
Emergency admission	−0·02	−0·25	0·20	0·85
Attendance at CR programme	≤0·01	−0·23	0·23	0·99
(c) Mixed model analysis for ESE				
Change per year	0·06	0·01	0·10	0·03
Age (years)	−0·01	−0·03	0·01	0·23
Males	0·29	−0·01	0·59	0·06
Living alone	−0·38	−0·71	−0·04	0·03
Employed	0·06	−0·25	0·37	0·69
Angina	−0·02	−0·28	0·23	0·85
First time heart problem	0·21	−0·03	0·44	0·09
Emergency admission	0·02	−0·23	0·27	0·88
Attendance at CR programme	0·31	0·05	0·56	0·02

$P < 0·05$.
CR, cardiac rehabiliation; CI, confidence interval.

Results

Results from the mixed model analyses suggest that patients GSE slightly reduces over time, although patients in employment had higher GSE over the 3 years [0·20 95% CI (<−0·01, 0·41) $P = 0·05$] (Table 2a). Diet SE (DSE) increased slightly over time and none of the factors were significantly related to DSE (Table 2b). Exercise SE (ESE) changed significantly over time with an average increase of 0·06/year [95% CI (0·01, 0·10) $P = 0·03$], although patients living on their own reported a significantly lower ESE [−0·38 95% CI (−0·71, −0·04) $P = 0·03$]. Patients attending a CR programme reported a significantly higher ESE over the 3 years [0·31 95% CI (0·05, 0·56) $P = 0·02$] (Table 2c).

Two separate standard MR analyses were employed for each of the three outcome measures – ESE, DSE and GSE – at T3. They were used to assess the independent contribution of each of the IR components (identity, consequence, timeline and control/cure) and outcome expectations (diet and exercise) at T1 and at T2, while controlling the effects of demographic and illness characteristics in predicting patients' SE (exercise, diet and general) 3 years following their initial diagnosis of their cardiac event. The statistical significance was defined as $P < 0·05$, and since a number of models have been run, the results need to be interpreted with this in mind.

Assessing the predictive value for exercise self-efficacy

Two standard MR analyses were employed to assess the independent contribution of each of the IR components and outcome expectations while controlling the effects of

demographic and illness characteristics in predicting ESE 3 years following the patients' initial diagnosis of their cardiac event.

For the first standard MR analysis (Table 3) the IR components at T1 and outcome expectations at T1 and demographic and illness characteristics were entered as explanatory variables. The four significant independent variables identified were Timeline, Identity, Route of admission and Control/cure. The results of this analysis suggest that patients who viewed their cardiac illness as long-term; had been admitted to hospital through the emergency route; reported less symptoms; or believed their cardiac condition was controllable following their cardiac diagnosis before discharge from hospital – were likely to have a higher confidence in their exercise lifestyle changes 3 years from their hospital discharge.

For the second MR analysis (Table 4), the IR components (identity, consequence, timeline and control/cure) at T2, outcome expectations (diet and exercise) at T2 and Attendance to a CR programme and the demographics and illness characteristics variables were entered as explanatory variables. In this analysis the three predictive variables were Identity, Timeline and Route of admission. These results suggest that after controlling the effects of the demographics, illness characteristics, attendance to CR programme, cardiac patients who were admitted through the emergency route, who reported less symptoms of their cardiac condition, or who viewed their cardiac condition as lasting for a long time at 9 months following the diagnosis of their cardiac condition, were likely to have a higher confidence in the exercise behaviour change 3 years from their hospital discharge.

Assessing the predictive value for diet self-efficacy

Two standard MR analyses were also employed using the same procedure as for the DSE to assess the relative contribution of each of the explanatory variables in predicting DSE T3 – 3 years after the patients' initial diagnosis of their cardiac event. For the first MR analysis (Table 5), all the T1 variables (four IR components, two outcome expectations, demographic and illness characteristics variables) were entered as explanatory variables. A non-significant model was produced ($P = 0{\cdot}14$).

For the second MR analysis (Table 6) the IR components at T2, outcome expectations (diet and exercise) at T2 and Attendance to a CR programme and the demographics and illness characteristics variables were entered as explanatory variables. A non-significant model was produced ($P = 0{\cdot}34$).

Assessing the predictive value for general self-efficacy

Two MR analyses were also employed to assess the relative contribution of T1 and T2 explanatory variables in predicting GSE at T3. The same procedure was followed for the MR analysis (Table 7) of data as with the specific self-efficacies. The results suggested that none of the demographic, illness characteristics, attendance to a CR programme, IR components or outcome expectations significantly predict the patients' general confidence 3 years after the diagnosis of

Table 3 Regression analysis for Illness Perception Questionnaire and patient characteristics on exercise self-efficacy at baseline (T1)

	Standardized coefficients beta	*t*	Sig	95% CI	
				Lower	Upper
Age (years)	−0·08	−0·70	0·49	−0·03	0·01
Gender	−0·04	−0·46	0·64	−0·47	0·29
Living alone	0·08	0·98	0·33	−0·21	0·62
Employed	−0·19	−1·68	0·10	−0·79	0·07
Cardiac diagnosis	−0·03	−0·33	0·74	−0·37	0·26
History of cardiac illness	−0·02	−0·25	0·81	−0·35	0·27
Route of admission	−0·23	−2·70	0·01*	−0·76	−0·12
Identity (T1)	−0·23	−2·60	0·01*	−0·80	−0·11
Timeline (T1)	0·25	2·92	0·01*	0·95	0·49
Consequences (T1)	−0·09	−0·94	0·35	−0·37	0·13
Control/cure (T1)	0·22	2·27	0·03*	0·05	0·70
Diet outcome expectation (T1)	0·08	0·76	0·45	−0·16	0·35
Exercise outcome expectation (T1)	0·03	0·29	0·78	−0·20	0·27

*$P < 0{\cdot}05$.
Adjusted $R^2 = 0{\cdot}30$, $F = 4{\cdot}99$ (d.f. = 13,106), $P < 0{\cdot}0005$.
CI, confidence interval.

Table 4 Regression analysis for Illness Perception Questionnaire and patient characteristics on exercise self-efficacy at 9 months (T2)

	Standardized coefficients beta	*t*	Sig	95% CI	
				Lower	Upper
Age (years)	−0·09	−0·79	0·43	−0·03	0·01
Gender	0·04	0·49	0·63	−0·31	0·50
Living on alone	0·11	1·36	0·18	−0·13	0·68
Employed	−0·18	−1·64	0·11	−0·76	0·07
Cardiac diagnosis	−0·03	−0·31	0·76	−0·38	0·27
History of cardiac illness	0·03	0·39	0·70	−0·25	0·38
Route of admission	−0·20	−2·40	0·02*	−0·71	−0·07
Attendance CR programme	−0·01	−0·03	0·98	−0·33	0·32
Identity (T2)	−0·33	−3·45	0·00*	−1·09	−0·29
Timeline (T2)	0·24	2·64	0·01*	0·07	0·48
Consequences (T2)	−0·12	−1·28	0·20	−0·44	0·09
Control/cure (T2)	0·10	0·86	0·39	−0·21	0·53
Diet outcome expectation (T2)	0·03	0·27	0·79	−0·24	0·31
Exercise outcome expectation (T2)	0·16	1·31	0·19	−0·10	0·47

*$P < 0·05$.
Adjusted $R^2 = 0·31$, $F = 4·83$ (d.f. = 14,105), $P < 0·001$.
CI, confidence interval.

Table 5 Regression analysis for Illness Perception Questionnaire and patient characteristics on diet self-efficacy at baseline (T1)

	Standardized coefficients beta	*t*	Sig	95% CI	
				lower	Upper
Age (years)	−0·05	−0·37	0·71	−0·02	0·15
Gender	0·23	2·38	0·02*	0·07	0·78
Living alone	0·04	0·40	0·69	−0·31	0·46
Employed	−0·03	−0·24	0·81	−0·44	0·35
Cardiac diagnosis	−0·05	−0·51	0·61	−0·37	0·22
History of cardiac illness	0·11	1·16	0·25	−0·12	0·46
Route of admission	−0·15	−1·52	0·13	−0·53	0·06
Identity (T1)	−0·16	−1·54	0·13	−0·57	0·07
Timeline (T1)	0·11	1·13	0·26	−0·08	0·29
Consequences (T1)	−0·09	−0·90	0·37	−0·34	0·13
Control/cure (T1)	0·29	2·58	0·01*	0·09	0·70
Diet outcome expectation (T1)	−0·16	−1·26	0·21	−0·39	0·09
Exercise outcome expectation (T1)	0·05	0·42	0·68	−0·17	0·27

*$P < 0·05$.
Adjusted $R^2 = 0·05$, $F = 1·48$ (d.f. = 13,109), $P = 0·14$.
CI, confidence interval.

their cardiac condition, although the exception is that Employment ($P = 0·05$) is borderline significant as a predictor for GSE at T3. Results suggested that patients who are in employment are likely to have a higher general confidence in their ability to cope.

For the second MR model (Table 8) a significant model was produced and Employment was the only significant predictor identified. The finding suggests that patients who were in employment 9 months following their hospital discharge were more likely to have a higher confidence in their ability to cope generally 3 years after the hospital discharge.

Inspection of the regression diagnostic plots gave no reason to doubt the assumptions under-pinning the MR models.

Discussion

Study limitations

While statistically significant association between illness beliefs and ESE were identified, the evidence for causal association would be strengthened by an experimental

Table 6 Regression analysis for IPQ and patient characteristics on diet self-efficacy at 9 months (T2)

	Standardized coefficients beta	*t*	Sig	95% CI Lower	95% CI Upper
Age (years)	−0·03	−0·21	0·83	−0·02	0·02
Gender	0·22	2·10	0·04*	0·02	0·79
Living on alone	0·09	0·97	0·33	−0·20	0·57
Employed	−0·07	−0·51	0·61	−0·50	0·29
Cardiac diagnosis	−0·01	−0·08	0·93	−0·32	0·30
History of cardiac illness	0·11	1·09	0·28	−0·13	0·46
Route of admission	−0·12	−1·16	0·25	−0·48	0·13
Attendance at cardiac rehabilitation programme	0·16	1·60	0·11	−0·06	0·56
Identity (T2)	−0·20	−1·78	0·07	−0·72	0·04
Timeline (T2)	0·11	1·04	0·30	−0·09	0·30
Consequences (T2)	−0·06	−0·57	0·57	−0·33	0·18
Control/cure (T2)	0·11	0·77	0·44	−0·22	0·49
Diet outcome expectation (T2)	0·00	−0·02	0·99	−0·26	0·26
Exercise outcome expectation (T2)	0·03	0·21	0·84	−0·24	0·29

*$P < 0·05$.
Adjusted $R^2 = 0·01$, $F = 1·13$ (d.f. = 14,108), $P = 0·34$.
CI, confidence interval.

Table 7 Regression analysis for Illness Perception Questionnaire and patient characteristics on general self-efficacy at baseline (T1)

	Standardized coefficients beta	*t*	Sig	95% CI Upper	95% CI Lower
Age (years)	0·05	0·36	0·72	−0·01	0·02
Gender	0·05	0·48	0·64	−0·21	0·35
Living alone	−0·05	−0·52	0·61	−0·38	0·23
Employed	−0·25	−1·96	0·05*	−0·62	0·00
Cardiac diagnosis	0·02	0·25	0·80	−0·20	0·26
History of cardiac illness	−0·09	−1·01	0·31	−0·35	0·11
Route of admission	0·07	0·74	0·46	−0·15	0·33
Identity (T1)	−0·11	−1·09	0·28	−0·39	0·11
Timeline (T1)	0·10	1·04	0·30	−0·07	0·22
Consequences (T1)	−0·13	−1·23	0·22	−0·30	0·07
Control/cure (T1)	0·20	1·80	0·07	−0·02	0·46
Diet outcome expectation (T1)	−0·18	−1·45	0·15	−0·33	0·05
Exercise outcome expectation (T1)	0·14	1·12	0·24	−0·07	0·28

*$P < 0·05$.
Adjusted $R^2 = 0·08$, $F = 1·83$ (d.f. = 13,110), $P = 0·05$.
CI, confidence interval.

interventional study. Some caution needs to be exercised in their interpretation because of the potential inflated type I error due to multiple testing. Interpretation of the findings also needs to be cautious as data were collected using self-reported questionnaires rather than the measure of patients' actual behaviour.

The study population was predominantly white (97·9%), reflecting the demographics of the catchment area of the two hospitals. It is therefore not possible to draw any conclusion about ethnic differences in the association between illness beliefs and SE. Non-response bias in the sample is possible, with a drop-out rate of 45% 3 years from the initial data collection. However, comparison of demographic and illness characteristics between respondents and non-respondents at T3 showed no significant difference except for gender. A higher proportion of responders were male compared with the non-responders (83% vs. 72% respectively, $P = 0·05$). Gender as a characteristic was not found to be significant in the MR analysis.

Table 8 Regression analysis for Illness Perception Questionnaire and patient characteristics on general self-efficacy at 9 months (T2)

	Standardized coefficients beta	*t*	Sig	95% CI	
				Lower	Upper
Age (years)	0·05	0·38	0·71	−0·01	0·02
Gender	0·04	0·39	0·70	−0·23	0·35
Living alone	0·02	0·26	0·80	−0·25	0·33
Employed	−0·24	−2·03	0·05*	−0·61	−0·01
Cardiac diagnosis	0·07	0·73	0·46	−0·15	0·32
History of cardiac illness	−0·05	−0·57	0·57	−0·29	0·16
Route of admission	0·11	1·16	0·25	−0·10	0·37
Attendance at cardiac rehabilitation programme	0·09	0·95	0·35	−0·12	0·35
Identity (T2)	−0·12	−1·18	0·24	−0·46	0·12
Timeline (T2)	−0·05	−0·50	0·62	−0·19	0·11
Consequences (T2)	−0·18	−1·69	0·09	−0·36	0·03
Control/cure (T2)	0·11	0·80	0·42	−0·16	0·38
Diet outcome expectation (T2)	0·01	0·09	0·93	−0·19	0·21
Exercise outcome expectation (T2)	0·10	0·70	0·49	−0·13	0·27

*$P < 0·05$.
Adjusted $R^2 = 0·12$, $F = 2·24$ (d.f. = 14,109), $P = 0·01$.
CI, confidence interval.

Discussion of results

The experience patients had between T1 and T3 in this study appeared to have promoted a significant increase in patients' confidence in their ability to exercise regularly (Table 2c), but not a significant increase of either their GSE or their DSE (Table 2a and b). These findings could indicate that the different approaches to exercise and diet within Britain's current CR programmes have contrasting effects. The two CR programmes attended by patients in this study were very similar. Both programmes contained an individualized approach to exercise, allowing patients to work at their own pace, developing skills and confidence to manage their exercise regime leading, it would appear, to increased patients' confidence in their ability to change their exercise lifestyle. The approach to the dietary education was quite different. Generic educational information were given to the patients using leaflets and discussion groups. This approach did not individualize information or build skills, with the potential result of failing to increase patients' confidence to manage their dietary lifestyle changes in the long term.

Patients' view of their illness being long-term, a perceived lower number of symptoms, admission as an emergency rather than routine, and the belief that the illness was controllable were the four factors that have showed to be significantly associated with ESE 3 years after hospital discharge. Those patients who believed their cardiac condition would last for a long time were likely to maintain their ESE 3 years later. This finding supports Meyer *et al.* (1985) study of patients with hypertension, which suggests that if patients were able to accept that their condition was long term (Timeline) they were more likely to participate in, and sustain, the treatment regime. Finding out more about the short- and long-term relationship between Timeline and patients' adherence to treatment would be an interesting area for further research.

Illness identity is defined as the individuals' perception of illness symptoms and, from research in both cardiac and other illness conditions, it has been found to be an important factor for health behaviour (Scharloo *et al.* 1998). Johnson & King (1995) found myocardial infarction (MI) patients who had expectations that matched their symptom experience sought treatment considerably faster than those whose symptoms did not match their expectations. The current study found a consistent pattern in that CHD patients who reported a lower illness identity were associated with a higher ESE at 9 months and similar results were found at 3 years following their cardiac diagnosis. The consistent findings from T1 and T2 suggest that individuals' interpretation of their specific illness symptoms influenced their confidence in their ability to maintain long-term exercise behaviour changes. This finding would suggest that to support and continuously monitor patients' ability to manage their illness symptoms could be one of the most important psychological interventions to improve the likelihood of sustained long-term exercise behaviour changes by patients following a cardiac heart disease diagnosis.

What is already known about this topic

- Many problems experienced by patients in rehabilitation are because of anxiety and misconceptions about their cardiac illness.
- Psychological interventions in cardiac rehabilitation promote cardiac rehabilitation programme attendance and return to work and reduce anxiety.
- Illness representation and self-efficacy are the two prominent psychological theories in the assessment of individual's health behaviour changes.

What this paper adds

- There was a long-term relationship between specific illness representation components (timeline, identity and control/cure) and exercise self-efficacy.
- Early intervention to increase patients' sense of control is important to promote their confidence in the long-term management of exercise lifestyle changes.
- Continuous monitoring and support of patients' ability to manage their perceived illness symptoms and encouragement to acknowledge that their cardiac illness is a long-term condition are important for confidence in maintaining long-term exercise lifestyle change.

The patients' initial belief, following diagnosis, that the cardiac condition was controllable was shown in this study to be an important factor in predicting patients' confidence in their ability to maintain exercise health behaviour in the long term. The finding suggests that it is the patients' illness belief, initially following the diagnosis, that their condition was controllable, that predicted their ESE 3 years later. Therefore, the assessment and management of CHD patients' illness belief in the controllability of their condition at the initial phase of their cardiac illness is of particular importance as the Control/cure T1 measure predicted the patients' ESE in the third year.

The design of interventions needs to aim to improve not only the patients' immediate reactions to their health condition but also develop their longer term responses to managing change by strengthening their SE. To design and inform the development of effective psychological interventions such as cognitive therapy and motivational interviews for CHD patients to promote their long-term risk factor management, it would appear helpful to focus on three enabling approaches – promoting patients' management of their perceived symptoms and their sense of control of their illness, and the acceptance of their cardiac illness as a long-term condition. These approaches are likely to increase the patients' confidence in maintaining lifestyle changes in the long term.

The results suggest that patients admitted via an emergency route were more likely to maintain their ESE 3 years later. Patients admitted via an emergency route were usually suffering from an acute cardiac episode, and the findings suggest that such patients were likely to perceive their cardiac condition to be more severe or have a higher Consequence. As a result, such patients might be more likely to put more effort into maintaining exercise lifestyle changes in the long-term. However, research on illness beliefs suggests that the perception of the illness is more influential than the severity of the illness (Petrie *et al*. 1996, Diedericks *et al*. 1991, Byrne 1982). These studies show that the severity of the patient's condition had less bearing on patients overall capability to attempt to cope with their condition, rather it was their perception of the consequences and the length of their illness that affected their willingness to try to make lifestyle adjustments and access the available therapeutic support. Whether it is the actual severity of the condition or the perception of the consequence of the illness, the findings of the current study suggest that the experience of being admitted through an emergency route had an impact on the patients' confidence in their ability to maintain exercise health behaviour in the long term.

Conclusion

Researchers accept that patients' illness beliefs are an important determinant of their health behaviour, and healthcare practitioners use their findings to inform the development of specific psychological interventions to enable positive health behaviours. Most research has been limited to short-term behaviour changes, with very limited on the effects of illness beliefs on diet and exercise risk factor management in the long term. To promote long-term risk factor management, it is important to have available more evidence of how cardiac patients' illness beliefs predict their confidence in the maintenance of long-term lifestyle changes. The findings from the current study suggest that the three IR components – Timeline, Identity and Control/cure – are associated with patients' confidence in maintaining their lifestyle changes in exercise 3 years after their cardiac diagnosis. To integrate both IR and SE in an approach to patient education might provide more effective individualized care for rehabilitation. Hence, future healthcare interventions need to address individual patients' sense of control early, following the initial diagnosis; provide continuous monitoring and support for the management of patients' perceived symptoms; and encourage

patients to acknowledge that their cardiac illness is a long-term condition. Being aware of these three strategies is likely to increase the effectiveness of individualized care and support patients to sustain long-term lifestyle changes.

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