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Testing relationships between metacognitive beliefs, anxiety and depression in cardiac and cancer patients: Are they transdiagnostic?

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ABSTRACT

Objective: Anxiety and depression symptoms are common in patients with physical health conditions. In the metacognitive model, beliefs about cognition (metacognitions) are a key factor in the development and maintenance of anxiety and depression. The current study evaluated if metacognitions predict anxiety and/or depression symptoms and if differential or common patterns of relationships exist across cardiac and cancer patients.

Method: A secondary data analysis with 102 cardiac patients and 105 patients with breast or prostate cancer were included. Participants were drawn from two studies, Wells et al. [1] and Cook et al. [2]. All patients reported at least mild anxiety or depression symptoms. Patients completed the Metacognitions Questionnaire 30 (MCQ-30) and the Hospital Anxiety and Depression Scale (HADS). Hierarchical linear regressions evaluated metacognitive predictors of anxiety and depression across the groups.

Results: The results of regression analyses controlling for a range of demographics and testing for effect of illness type showed that uncontrollability and danger and positive beliefs were common and independent predictors of anxiety in both groups. There was one positive bi-variate association between metacognitive beliefs (uncontrollability and danger) and depressive symptoms.

Conclusions: Findings support the metacognitive model, suggesting that a common set of metacognitive factors contribute to psychological distress, particularly anxiety. Uncontrollability and danger metacognitions and positive beliefs about worry appear to make independent contributions to anxiety irrespective of type of physical illness. While metacognitive beliefs were not reliably associated with depressive symptoms this may be because the current sample exhibited low depression scores.

1. Introduction

The World Health Organization (WHO) has defined four main non-communicable diseases (NCDs): cardiovascular disease (CVD), type 2 diabetes mellitus (T2DM), cancer, and chronic respiratory disease, which make the largest contribution to morbidity and mortality [3]. Cardiovascular disease and cancer have been associated with the greatest disease burden of the four main non-communicable diseases [3,4], including a large psychological burden. Anxiety and depression symptoms are common in patients with physical health conditions [5,6,7], and can reduce quality of life, increase healthcare use, and delay time to return to employment [8,9].

In cardiovascular patients, 28% starting cardiac rehabilitation (CR) report borderline or clinically significant levels of anxiety and 19% report borderline or clinically significant levels of depression [10]. In cancer patients, 50% experience depression, anxiety or both within a year of diagnosis [11,12,13], which can be broken down into 30% with depression and 20% with anxiety [14–17].

Despite increasing evidence of the high prevalence of anxiety and depression in cancer and cardiac populations, the efficacy of current

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psychological interventions is limited. Whalley et al. [18] evaluated psychological interventions for coronary heart disease and found only small to moderate effects on improving symptoms of anxiety (d = 0.25) and depression (d = 0.21). This is in line with previous studies that highlight the limited efficacy of psychological interventions in cardiac patients [19–21]. Similarly, in cancer patients small to moderate effect sizes are found [22–25]. For example, Jassim et al. [26] evaluated psychological interventions in breast cancer patients and found a standard mean difference of 0.28 between intervention and control groups. There is a clear need for improved interventions for anxiety and depression in these groups. One way forward might be by increasing our understanding of the psychological processes linked to the severity and persistence of anxiety and depression, which might aid in developing more effective interventions.

Models in health psychology have evaluated the role of illness perceptions and coping as maintenance factors in distress. For example, Leventhal's Common Sense Model of Self-regulation (CSM; [27]), proposes that the beliefs individuals hold about their illness gives rise to coping responses which influence health outcomes (i.e. anxiety and depression). According to the CSM there are five illness perceptions that impact on outcomes: identity (the illness and its symptoms), cause (beliefs about the perceived cause of the illness), time-lines (beliefs regarding how long the illness will last), consequences (beliefs about the physical and social impact of the illness on oneself), and controllability (beliefs about if the illness can be cured or managed). While various studies have associated illness beliefs of the CSM to psychological outcomes [28] the model does not explicitly conceptualize the mechanisms linking these beliefs with psychological outcomes leading to inconsistencies in the interpretation of the model. One model prevalent in the cancer literature is the fear of cancer recurrence (FCR) model, whereby patients fear that cancer could return or progress [29]. The FCR model follows a cognitive-behavioural formulation, and was influenced by Leventhal's Self-Regulation Model [27]. According to the FCR model a patient's emotional reaction is due to their interpretations of the threat of cancer which is triggered by their perception of cues (i.e. physical symptoms) and their knowledge about cancer. This influences behavioural or emotional reactions, for example leading to increased checking for signs of illness and reassurance seeking. Similar to the CSM the FCR model is based on the cognitions or beliefs that the individual holds about illness rather than the underlying processes that link beliefs with psychological distress. For instance, it is often realistic and common to believe that cancer might recur but some individuals manage this fear better than others.

In contrast to models based on illness-related beliefs such as the common-sense model, the metacognitive model of psychological distress views anxiety and depression resulting from difficult to control repetitive negative thinking processes [30,31]. Such thinking consists of anticipating threat (worry), ruminating about the past, and focusing attention on danger and is viewed as a transdiagnostic cognitive attentional syndrome (CAS). A core principle of the metacognitive model is that this unhelpful thinking pattern is a result of underlying metacognitive beliefs which perpetuate and strengthen negative thought patterns and associated emotions [32]. Metacognitive beliefs have been divided into two broad types; positive and negative metacognitive beliefs [32]. Positive metacognitive beliefs focus on the advantages of repetitive negative thinking, for example: “Worrying helps me to avoid problems in the future”, or “worrying helps me to get things sorted out in my mind”. Whilst, negative metacognitive beliefs focus on the uncontrollability and danger of repetitive negative thinking, for example, “My worrying is dangerous for me”, or “When I start worrying I cannot stop.” In addition to these metacognitions a range of others have also been identified: including beliefs concerning the need to control thoughts, (i.e. I should be in control of my thoughts all of the time), lack of cognitive confidence (i.e., my memory can mislead me at times), and cognitive self-consciousness (i.e., I am constantly aware of my thinking), which can potentially impact on behaviour and ability to cope with stress-related cognitions.

Recently, research has begun to investigate the metacognitive model in various physical illnesses such as; Parkinson's disease [33], chronic fatigue [34,35], and cancer [2,36]. Allot et al. [33] found that negative metacognitive beliefs of uncontrollability and danger, predicted emotional distress amongst patients with Parkinson's disease independently of other disease related factors (e.g. medication, stage of the illness). Cook et al. [2,36] found that negative metacognitive beliefs were related to anxiety, depression and post-traumatic stress symptoms in cancer patients and that these relationships were mediated by the CAS.

Whilst there is increasing evidence that the metacognitive model may be useful in explaining anxiety and depression in patients with different physical illnesses, no study has evaluated the role of metacognitive beliefs in cardiac patients. Furthermore, previous research has focused on specific physical health conditions, and has not directly evaluated if the same or specific metacognitive beliefs are associated with anxiety and/or depression in different health populations. Cardiovascular disease and cancer are serious life threatening illnesses and two of the most common non-communicable disease which are associated with a large psychological burden, however they involve difference diseases processes and treatment trajectories, as such we chose to evaluate these two physical illnesses as a means of exploring possible common and more specific metacognitive correlates of anxiety and depression across illness types. Furthermore, a comparison of relationships between anxiety and metacognition in cardiac and cancer groups is particularly informative for the testing of hypothesised transdiagnostic relationships between these constructs because lay beliefs see worry as a cause of cardiac ill-health but it is not commonly considered to cause cancer. Therefore demonstration of relationships between metacognitions about worry and increased anxiety in both groups as would be predicted by the metacognitive model would provide a robust test of the model. The identification of common or specific factors has implications for targeting psychological interventions for anxiety and depression in these groups.

Therefore, the present study had two main aims: (1) to evaluate if metacognitions predict anxiety and/or depression controlling for sociodemographic factors and (2) to evaluate if metacognitions predict anxiety and/or depression differentially across two types of physical illness, controlling for sociodemographic factors.

2. Method

2.1. Participants and procedure

2.1.1. Cardiac participants

Baseline data from cardiac patients (n = 105) was drawn from the PATHWAY trial [1] a multi-site randomised controlled trial funded by the NIHR, UK and investigating the effectiveness of Metacognitive Therapy (delivered in a group setting by cardiac rehabilitation practitioners) in reducing anxiety and/or depression. Patients were heart disease patients enrolled on a cardiac rehabilitation programme. They met the following Department of Health [37] and/or British Association for Cardiovascular Prevention and Rehabilitation CR [38] eligibility criteria: acute coronary syndrome, revascularisation, stable heart failure, stable angina, implantation of cardioverter defibrillators/cardiac resynchronisation devices, heart valve repair/replacement, heart transplantation and ventricular assist devices, adult congenital heart disease, other atypical heart presentation). They were at least 18 years old and were eligible for the current study if they scored 8 or more on either the depression or anxiety subscale of the Hospital Anxiety and Depression Scale [39]. The optimal cut-off score for the HADS is 8 for the identification of symptoms of anxiety and/or depression, and is appropriate for detecting anxiety and depression in cardiac populations [40,41]. Participants were recruited from 5 National Health Services (NHS) located in Manchester (UK): Central Manchester Foundation

Trust, University Hospital South Manchester, East Cheshire, Pennine Acute Trust and Stockport Trust. Patients were excluded if they met any of the following criteria: (1) cognitive impairment which precluded informed consent or ability to participate, (2) acute suicidality, (3) active psychotic disorders (i.e. two [or more] of the following: delusions, hallucinations, disorganized speech, grossly disorganized or catatonic behaviour, negative symptoms), (4) drug/alcohol abuse leading to clinically significant impairment or distress, (5) receiving psychological support outside the care as usual, (6) having initiated antidepressant or anxiolytic medications 8 weeks before starting the study, (7) life expectancy of <12 months. All participants provided written and informed consent. The PATHWAY study was approved by the National Health Services (NHS) North West Preston Research Ethics Committee (Reference Number: 15/NW/0163).

2.1.2. Cancer participants

Baseline data from cancer patients (n = 102) was drawn from a cross-sectional study exploring metacognitive beliefs and processes associated with anxiety and depression in a cancer population [2]. The sample used as part of Cook et al. [2] was used in the current study. Participants were patients of at least 18 years of age, attending routine pre-treatment clinics after receiving a diagnosis of primary non-metastatic breast (n = 81) or prostate cancer (n = 24). Only data from patients who scored 8 or more on either the depression or anxiety subscale of the HADS were drawn from the sample. The optimal cut-off for detecting anxiety and depression on the HADS of 8 has also been found to be appropriate for cancer patients [42]. Patients were excluded if they met any of the following criteria: (1) recurrent or metastatic disease or (2) considered by the clinical team or researcher to be too distressed or confused to give informed consent. Cancer participants were recruited from a National Health Service (NHS) teaching hospital located in the North West of England. Participants provided written and informed consent. This study was approved by the National Health Services (NHS) North West 5 Research Ethics (Reference Number: 09/H1010/70).

2.2. Measures

The following two measures, which were part of a questionnaire battery for both studies ([1] and [2]) were extracted for purposes of the present analysis:

2.2.1. Metacognitions questionnaire 30 (MCQ-30: Wells and Cartwright-Hatton [43])

This scale assesses metacognitive beliefs across five subscales: (1) positive metacognitive beliefs about worry (e.g., “worrying helps me to avoid problems in the future”), (2) negative metacognitive beliefs concerning uncontrollability and danger (e.g., “when I start worrying, I cannot stop”) (3) cognitive confidence (e.g., “I do not trust my memory”), (4) beliefs concerning the need for control (e.g., “not being able to control my thoughts is a sign of weakness”), (5) cognitive self-consciousness (e.g., “I am constantly aware of my thinking”). The MCQ-30 has one positive belief subscale, while the remaining subscales evaluate more negative metacognitive belief domains. Items are scored on a 4-point likert scale ranging from 1 (Do not agree) to 4 (Agree very much), with subscale scores ranging from 6 to 24, where higher scores indicate higher levels of problematic metacognitive beliefs. The MCQ-30 has shown excellent internal validity, convergent, and predictive validity in clinical and non-clinical samples [43–45]. The Cronbach Alpha's for the current samples are shown in Table 2.

2.2.2. Hospital anxiety and depression scale (HADS: Zigmond and Snaith [39])

This is a 14-item self-report measure of symptoms of anxiety and depression. Items are scored using a 4-point likert scale. Scores are then summed to create two subscales (anxiety and depression), whereby higher scores indicate greater levels of anxiety and/or depression. The HADS has been shown to have good internal consistency and validated in clinical and non-clinical samples [46,47]. The Cronbach Alpha's for the current sample are presented in Table 2.

2.3. Data analysis plan

Less than 2% of the data were missing at the scale level, missing scores for the MCQ-30 and HADS variables were imputed using the SPSS Expectation–Maximisation algorithm [48]. The dataset was then transferred to Stata v15 for further analysis.

Independent sample t-tests (for continuous variables) and Chi-square tests (for categorical variables) were used to compare the clinical groups with respect to demographic characteristics and psychological measures. Bi-variate (Pearson) correlation analyses were conducted to examine relationships between the psychological measures within each clinical group. Hierarchical linear regressions were conducted to evaluate whether metacognitions (MCQ-30) predicted anxiety and depression (HADS) in physical illness (cancer or cardiac). Sociodemographic factors (age, gender, education, employment status, marital status) were entered as a group at step 1. Next, disease types (cancer or cardiac) were entered at step 2, and at step 3 mean-centred scores on all subscales of the MCQ-30 were entered. On the fourth and final step interaction terms between disease group and each MCQ-30 subscale were entered to assess whether relationships between symptoms of anxiety and depression and metacognitive beliefs varied by disease group. Variance inflation factors for the variables in the models were all below 4.0, indicating low risk of multi-collinearity.

3. Results

Descriptives for sociodemographic and clinical information are presented in Table 1. There was a significant difference between groups in gender (p < .001). The cardiac group was predominately male (64.7%) and the cancer group was predominately female (77.1%). There was no significant difference between groups in age (p = .97), with both groups having a mean age of approximately 60 years. However, groups differed significantly in marital status (p = .05) and

Table 1. Participant demographics.[a, b]

	Cancer participants (n = 105)	Cardiac participants (n = 102)	p
Age, mean (SD)	59.68 (9.15)	59.74 (10.58)	.97[a]
Gender (N, %)			<.001[b]
Male	24 (22.9%)	66 (64.7%)	
Female	81 (77.1%)	36 (35.3%)	
Marital status (N, %)			.05[b]
Single	9 (8.57%)	21 (20.6%)	
Married/living with partner	67 (63.8%)	58 (56.9%)	
Divorced/Separated/ Widowed	29 (27.6%)	23 (22.5%)	
Employment status (N, %)			.09[b]
Employed	46 (43.8%)	30 (29.4%)	
Retired	38 (36.2%)	38 (37.3%)	
Long-term sick leave	10 (9.52%)	18 (17.6%)	
Unemployed/ Homemaker/Other	11 (10.5%)	16 (15.7%)	
Level of education (N, %)			.02[b]
No qualifications	36 (34.3%)	30 (29.4%)	
CSE/O-level/GCSE/ Alevels	32 (30.5%)	16 (15.7%)	
Certificate/diploma/ NVQ	24 (22.9%)	40 (39.2%)	
Higher education	13 (12.4%)	15 (14.7%)	

[a] t-test.
[b] Chi-Square test.

Table 2. Summary of scores on psychological measures.[a]

	Cancer participants (n = 105)		Cardiac participants (n = 102)		p
	Mean (SD)	Cronbach Alpha	Mean (SD)	Cronbach Alpha	
MCQ-30					
Pos	10.58 (4.44)	0.87	10.75(4.28)	0.87	.78[a]
Neg	12.86 (3.82)	0.87	13.35 (4.33)	0.80	.39[a]
CC	10.89 (4.55)	0.79	11.51 (4.85)	0.89	.34[a]
NC	10.35 (4.15)	0.86	11.45 (3.52)	0.68	.04[a]
CSC	14.22 (4.17)	0.78	14.64 (4.30)	0.80	.48[a]
Total	58.88 (14.53)	0.79	61.71 (14.60)	0.89	.16[a]
HADS					
Anxiety	11.14 (2.77)	0.84	10.99 (3.17)	0.70	.73[a]
Depression	4.97 (3.46)	0.75	8.65 (3.44)	0.70	< .001[a]

MCQ-30 = Metacognitions Questionnaire-30, Pos = Positive Metacognitive Beliefs, Neg = Negative Metacognitive Beliefs regarding Uncontrollability and Danger, CC = Cognitive Confidence, NC = Need to Control, CSC = Cognitive Self-Consciousness, HADS = Hospital Anxiety and Depression Scale.
[a] t-test.

education (p = .02), with cardiac patients more likely to be single and less likely to have only school-level qualifications. The groups differed significantly on only one metacognitive belief subscale: need for control (t(205) = −2.11, p = .04), where cardiac patients had a greater belief that they needed to control thoughts. Tumour grade for cancer patients was classified as low, intermediate, and high [2]. There was no significant difference between tumour grade category and symptoms of anxiety, F(2,101) = 0.37, p = .69, or symptoms of depression, F (2,101) = 0.87, p = .42.

Information on metacognitive beliefs and depression and anxiety are presented in Table 2. There were no significant differences between groups on symptoms of anxiety, t(205) = 0.35, p = .73. However, there was a highly significant difference on symptoms of depression (t (205) = −7.65, p < .001), highlighting that cardiac patients had greater symptoms of depression in comparison to cancer patients.

Bi-variate (Pearson) correlations between study variables for the cancer and cardiac samples are reported in Table 3. Correlations between HADS anxiety and depression scores were at a low to moderate level for both disease groups (r = 0.383 for cancer participants, and r = 0.149 for cardiac participants). The MCQ-30 subscales mostly inter-correlated at a low to moderate level, with two inter-correlations >0.5 for cancer participants (positive beliefs about worry and negative beliefs about uncontrollability each with beliefs about need to control thoughts) and two >0.5 for cardiac patients (negative beliefs about uncontrollability and negative beliefs about need to control thoughts with cognitive self-consciousness). Positive and negative metacognitive beliefs were positively correlated with anxiety and depression scores within each group of patients, with negative beliefs showing a stronger relationship with anxiety in the cardiac compared with the cancer group.

3.1. Metacognitive predictors of depression (Table 4)

Sociodemographic factors alone explained 16.3% of the variance in depression scores (p < .001) and the inclusion of disease group explained a further 14.6% (p < .001). Age, gender and level of educational qualifications showed no associations with depression scores (p > .05), but being retired or otherwise not working was associated with mean scores between 2 and 3 points higher (p < .05). After controlling for other demographics, being married or previously in a relationship (divorced, separated or widowed) was associated with reductions in mean depression scores of around 2 points (p < .05), but this relationship became non-significant once disease group was added to the model. Neither the addition of metacognitive beliefs (p = .11) nor the interactions between beliefs and disease group (p = .88) made any significant further improvement and added just 3.5% to the explained variance.

3.2. Metacognitive predictors of anxiety (Table 5)

In contrast to the result for depression, neither demographic factors as a set (p = .09) nor the addition of disease group (p = .29) significantly predicted participant anxiety scores, together explaining only 8.4% of variance; although mean anxiety scores were somewhat lower amongst males (p < .01) at all steps in the analysis.

The inclusion of metacognitive beliefs at step 3 however resulted in a model accounting for 38.2% of the variability in anxiety scores (p < .001). Two of the individual metacognitive belief subscales demonstrated significant associations with increased symptoms of anxiety: positive metacognitive beliefs (B = 0.12, 95%CI 0.03–0.22; p = .008), and negative metacognitive beliefs of uncontrollability and danger (B = 0.38, 95%CI 0.27–0.49; p < .001).

Adding the interaction terms between metacognitive beliefs and disease group into the model resulted in a significant though small improvement in model fit (R^2 difference = 4.6%, p = .008), however none of the individual interactions reached significance (p > .05 in all cases). The evidence for interactions (i.e. disease group modifying the

Table 3. Correlation matrix for cancer (Ca; N = 105) and cardiac patients (Cr; N = 102), HADS scores and metacognitive beliefs.[*, **]

	2		3		4		5		6		7		8	
	Ca	Cr	Ca	Cr	Ca	Cr	Ca	Cr	Ca	Cr	Ca	Cr	Ca	Cr
1. HADS Anxiety	0.38**	.15	0.27**	.35**	0.43**	.66**	−.03	.18	0.16	.46**	.02	.47**	.24**	.61**
2. HADS Depression	–	–	.06	.01	.20*	.11	.07	.12	.19	.11	.01	−.04	.15	0.09
3. Positive beliefs about worry			–	–	.38**	.29**	.22*	.18	.61**	.36**	.38**	.30**	.76**	.62**
4. Negative beliefs- uncontrollability and danger					–	–	.22*	.23*	.53**	.54**	.34**	.66**	.70**	.78**
5. Cognitive Confidence							–	–	.27**	.36**	.003	.09	.52**	.57**
6. Need to control thoughts									–	–	.48**	.49**	.84**	.77**
7. Cognitive self-consciousness											–	–	0.63**	.73**
8. MCQ Total													–	–

* $p \leq .5$.
** $p \leq .001$.

Table 4. Metacognitive predictors of symptoms of depression.

	Step 1			Step 2			Step 3			Step 4		
	B	95% CI	*p*	B	95% CI	*p*	B	95% CI	*p*	B	95% CI	*p*
Age	−0.002	[−0.08, 0.08]	.97	−0.008	[−0.08, 0.06]	.82	−0.007	[−0.08, 0.06]	.84	−0.008	[−0.80, 0.06]	.84
Gender (male)	0.89	[−0.17, 1.95]	.10	−0.68	[−1.76, 0.40]	.21	−0.64	[−1.74, 0.46]	.25	−0.62	[−1.75, 0.51]	.28
No qualifications												
CSE/O-level/GCSE / Alevels	−0.32	[−1.79, 1.15]	.67	−0.09	[−1.43, 1.25]	.90	−0.02	[−1.37, 1.33]	.98	0.13	[−1.30, 1.56]	.86
Certificate/diploma/NVQ	0.70	[−0.63, 2.03]	.30	−0.07	[−1.31, 1.16]	.91	−0.05	[−1.29, 1.18]	.93	0.07	[−1.21, 1.34]	.92
Bachelors/masters degree	0.31	[−1.44, 2.06]	.73	−0.003	[−1.60, 1.59]	> .99	0.61	[−1.06, 2.27]	.47	0.62	[−1.10, 2.34]	.48
Working												
Retired	2.29	[0.69, 3.89]	.005	1.97	[0.51, 3.43]	.009	1.90	[0.44, 3.36]	.01	1.97	[0.48, 3.45]	.01
Long-term sick…	2.55	[0.84, 4.25]	.004	2.13	[0.57, 3.69]	.008	1.86	[0.28, 3.44]	.02	1.97	[0.33, 3.61]	.02
Unemployed/homemaker/other	2.71	[0.97, 4.44]	.002	1.76	[0.16, 3.37]	.03	1.62	[<0.01, 3.25]	.05	1.77	[0.12, 3.42]	.04
Single												
Married….	−2.12	[−3.70, −0.54]	.009	−1.25	[−2.71, 0.21]	.09	−1.23	[−2.71, 0.26]	.10	−1.25	[−2.77, 0.27]	.11
Divorced/Separated/widowed	−1.81	[−3.58, −0.03]	.046	−1.04	[−2.67, 0.59]	.21	−1.26	[−2.93, 0.40]	.14	−1.26	[−2.97, 0.46]	.15
R-squared (R^2 difference; *p*-value)	16.3% (16.3; <0.001)											
Group				3.54	[2.45, 4.62]	<.001	3.34	[2.26, 4.43]	<.001	3.33	[2.23, 4.44]	<.001
R-squared (R^2 difference; *p*-value)				30.9% (14.6; <0.001)								
Positive							−0.03	[−0.16, 0.09]	.59	−0.04	[−0.23, 0.16]	.71
Negative							0.11	[−0.04, 0.25]	.15	0.13	[−0.07, 0.34]	.20
CC							0.01	[−0.10, 0.12]	.83	0.003	[−0.16, 0.17]	.97
NC							0.15	[−0.02, 0.33]	.09	0.16	[−0.08, 0.39]	.19
CSC							−0.12	[−0.26, 0.03]	.11	−0.06	[−0.25, 0.13]	.52
R-squared (R^2 difference; *p*-value)							33.9% (3.0; 0.11)					
Pos × Group										−0.007	[−0.27, 0.25]	.96
Neg × Group										−0.01	[−0.31, 0.28]	.93
CC × Group										0.03	[−0.20, 0.25]	.82
NC × Group										−0.05	[−0.40, 0.29]	.76
CSC × Group										−0.11	[−0.40, 0.18]	.46
R-squared (R^2 difference; *p*-value)										34.4% (0.5; 0.88)		

Table 5. Metacognitive predictors of symptoms of anxiety.

	Step 1			Step 2			Step 3			Step 4		
	B	95% CI	*p*	B	95% CI	*p*	B	95% CI	*p*	B	95% CI	*p*
Age	−0.008	[−0.07, 0.05]	.80	−0.009	[−0.07, 0.05]	.78	−0.004	[−0.06, 0.05]	.87	−0.001	[−0.05, 0.05]	.96
Gender (male)	−1.36	[−2.20, −0.52]	.002	−1.58	[−2.52, −0.63]	.001	−1.02	[−1.83, −0.22]	.01	−1.01	[−1.81, −0.21]	.01
No qualifications												
CSE/O-level/GCSE / Alevels	−0.46	[−1.63, 0.71]	.44	−0.43	[−1.60, 0.74]	.47	−0.70	[−1.69, 0.29]	.16	−1.18	[−2.19, −0.17]	.02
Certificate/diploma/NVQ	−0.38	[−1.44, 0.67]	.47	−0.49	[−1.57, 0.58]	.37	−0.33	[−1.23, 0.57]	.47	−0.66	[−1.56, 0.24]	.15
Bachelors/masters degree	−0.49	[−1.88, 0.90]	.49	−0.53	[−1.92, 0.86]	.45	−0.40	[−1.62, 0.82]	.52	−0.57	[−1.78, 0.65]	.36
Working												
Retired	0.26	[−1.01, 1.53]	.69	0.21	[−1.06, 1.48]	.74	0.33	[−0.74, 1.39]	.55	0.11	[−0.94, 1.16]	.83
Long-term sick…	0.15	[−1.21, 1.50]	.83	0.09	[−1.27, 1.45]	.90	0.23	[−0.93, 1.39]	.70	0.10	[−1.06, 1.26]	.87
Unemployed/homemaker/ other	0.83	[−0.54, 2.21]	.24	0.70	[−0.70, 2.10]	.32	0.98	[−0.20, 2.17]	.10	0.74	[−0.43, 1.91]	.21
Single												
Married….	−0.46	[−1.71, 0.80]	.47	−0.34	[−1.61, 0.94]	.60	0.12	[−0.97, 1.20]	.83	0.18	[−0.90, 1.25]	.75
Divorced/Separated/ widowed	−0.41	[−1.82, 1.00]	.57	−0.30	[−1.73, 1.12]	.68	0.11	[−1.11, 1.33]	.86	−0.02	[−1.23, 1.19]	.98
R-squared (R^2 difference; *p*-value)	7.9% (7.9; 0.09)											
Group				0.49	[−0.45, 1.44]	.31	0.07	[−0.73, 0.87]	.87	0.06	[−0.72, 0.84]	.88
R-squared (R^2 difference; *p*-value)				8.4% (0.5; 0.29)								
Positive							0.12	[0.03, 0.22]	.008	0.19	[0.05, 0.32]	.007
Negative							0.38	[0.27, 0.49]	< .001	0.34	[0.19, 0.48]	< .001
CC							−0.07	[−0.15, 0.01]	.09	−0.14	[−0.25,-0.02]	.02
NC							−0.007	[−0.14, 0.12]	.91	−0.07	[−0.24, 0.09]	.40
CSC							−0.04	[−0.14, 0.07]	.48	−0.13	[−0.27,<0.01]	.05
R-squared (R^2 difference; *p*-value)							38.2% (29.8; <0.001)					
Pos × Group										−0.08	[−0.27, 0.10]	.37
Neg × Group										0.03	[−0.19, 0.24]	.81
CC × Group										0.11	[−0.05, 0.26]	.18
NC × Group										0.19	[−0.05, 0.44]	.12
CSC × Group										0.17	[−0.04, 0.37]	.10
R-squared (R^2 difference; *p*-value)										42.8% (4.6; 0.008)		

relationship observed) is therefore equivocal.

4. Discussion

Identifying the common psychological factors that contribute to anxiety and depression in the context of physical illness may support the development of universal interventions. As such, this study aimed to evaluate if metacognitive beliefs predicted anxiety and depression across two physical illnesses (cardiac and cancer patients) when sociodemographic factors were controlled for. In addition, the study evaluated if metacognitive beliefs predicted anxiety and depression differentially across the two physical illnesses, after controlling for sociodemographic factors. Levels of anxiety were slightly lower in males but unrelated to other demographic factors or type of physical illness. However, anxiety was strongly associated with metacognitive beliefs, in particular elevated positive metacognitive beliefs and negative beliefs concerning the uncontrollability and danger of worry. In contrast, depressive symptoms were not related to gender though they were significantly higher amongst those not working and in cardiac participants, but were unrelated to any of the metacognitive belief subscales. These contrasting patterns may be related to the generally higher levels of anxiety than depression in both disease groups.

The result of adding interaction terms (MCQ subscales × group) to the anxiety regression model showed a small increase in variance explained but none of the individual interactions were significant. These data combined with the significant bi-variate relationships observed in the individual illness groups suggest that two domains of metacognitive beliefs: positive beliefs about worrying and negative beliefs concerning the uncontrollability and danger of worry contribute to anxiety in both cancer and cardiac patients. In these analyses we controlled for a range of demographic factors and for gender balance that differed considerably between illness groups. Since these were controlled for they do not account for the relationships observed. However, a limitation of the analysis is that the sample size implies that the power was low to detect interactions, and stronger evidence of common and specific effects is needed.

The results are however in line with previous research demonstrating positive relationships between anxiety and metacognitive beliefs in various physical illnesses including diabetes [49], cancer (Cook et al., 2014) [2,36,50–52]), chronic fatigue [34,35] epilepsy [53], multiple sclerosis [54], chronic pain [55,56], and Parkinsons disease [33,57]. Such studies have noted that negative metacognitive beliefs concerning the uncontrollability and danger of worry are a significant predictor of anxiety and depression in these different illness types [2,33,36,49,51–53,55,56]. Across mental health disorders also, this particular metacognition domain appears to be transdiagnostic [58].

The findings support the metacognitive model [30,31] and extend its reach by implying that under identical statistical control a common set of metacognitive factors contribute to anxiety irrespective of physical illness type. This finding has potentially important clinical implications as it supports the targeting of this common set of metacognitive factors in the psychological treatment of anxiety across physical illnesses Metacognitive therapy [32] is an effective treatment in mental health settings (e.g. [59,60]) and is designed to target and modify these dysfunctional metacognitions. Preliminary evaluation of metacognitive therapy (MCT) for anxiety in physical illnesses has been undertaken in adults and adolescents with cancer [61–63], with uncontrolled recovery rates in distress in adult cancer survivors of 80% and 70% at post treatment and 6-month follow-up respectively [61]. The efficacy of metacognitive therapy in treating anxiety and depression symptoms in

cardiac patients undergoing rehabilitation is currently being evaluated in a large scale NIHR funded trial [1].

MCT may be a more appropriate psychological intervention for anxiety and depression in physical illnesses than approaches such as cognitive behavioural therapy as it does not require identifying thoughts about disease, death, or disability and applying classic CBT techniques such as reality testing. McPhillips et al [64] conducted a qualitative analysis of emotional distress in cardiac patients and compared how cognitive behavioural therapy and MCT models conceptualize distress and why CBT may have limited benefit for cardiac patients. They note that MCT was more parsimonious as it did not distinguish between realistic and unrealistic thoughts but instead focused on perseverative negative thinking that was sufficient to understand participants distress. Similarly, in cancer survivors the fear of cancer recurrence (FCR) is common and realistic, with 60% of patients experiencing debilitating FCR [65]. The reality testing of realistic concerns about one's health may be an inappropriate approach. However, reducing and regulating the extent of the worry process, a target of MCT might be more logical and effective.

The limitations of the current study are as follow: as the study is cross-sectional, causality and temporality could not be evaluated so we cannot discern if anxiety and depression precede or follow metacognitive beliefs; therefore further studies are required to evaluate these relationships. However, Nordahl et al. [66] provide preliminary evidence for temporal relationships between metacognitive beliefs and psychological vulnerability as they evaluated the association between metacognitive beliefs and trait-anxiety using cross-sectional and longitudinal data-sets. They found that metacognitive beliefs accounted for 64% of the variance in propensity to depression and 83% of the variance in propensity to anxiety. Furthermore, they also found that when evaluating the temporal relationships between metacognitive beliefs and psychological vulnerability, negative and positive metacognitive beliefs prospectively predicted both domains.

A limitation of our study is that power to detect differential relationships between metacognitions and symptoms of distress across disease groups was low. Additionally, there is an imbalance in gender, with females dominating the cancer group and males the cardiac participants. This limits the generalizability of the findings. Groups also significantly differed on levels of psychological distress, whereby cardiac patients had greater symptoms of depression and overall symptoms of distress. The cancer group only included patients with two types of diagnosis; breast cancer or prostate cancer. This composition may have accounted for the difference in distress between groups. For example, Cook et al. [50] noted that women with breast cancer were more anxious than men with prostate cancer; therefore future studies should include greater diversity in cancer diagnoses and ensure an improved gender balance. Additionally, there was a difference in how patients were sampled for the studies, while participants for both studies were recruited from routine NHS clinics for their respective physical illness, the cardiac sample were required to have a score of 8 or more on either of the HADS subscales, while for the cancer sample only those with a score of 8 or more on either of the HADS subscales were selected from the original sample to be included in the current study.

Despite the limitations, the study provides preliminary evidence that metacognitive beliefs are predictors of anxiety and these relationships are common across cancer and cardiac illnesses. Therefore, metacognitive therapy techniques developed for use in mental health settings could potentially alleviate distress in cardiac and cancer patients. The results support the potential value of future research to evaluate the effects of metacognitions on anxiety and depression in patients with physical illnesses with particular attention to negative beliefs about the uncontrollability and danger of worry and positive beliefs about the advantages of worrying.

Conflict of interest statement

Professor Adrian Wells is the developer of metacognitive therapy and a co-director of the Metacognitive Therapy Institute.

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