A novel biopsychosocial, cognitive behavioural, stepped care intervention for patients with non-cardiac chest pain

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ABSTRACT
Background: Non-cardiac chest pain (NCCP) is associated with psychological distress, work absenteeism, impaired functioning and reduced quality of life. This study explores how a novel biopsychosocial, stepped-care treatment for NCCP works, and explores outcomes at each step and process variables. Methods: Patients with persistent NCCP were referred to a new biopsychosocial, multidisciplinary clinic for chest pain (CP). There were three possible ‘steps’ of treatment: (1) biopsychosocial assessment (BA) only, (2) BA plus low-intensity cognitive behaviour therapy (CBT) and (3) BA plus high-intensity CBT. Outcome measures assessed chest pain (frequency and interference), anxiety (GAD7), depression (Patient Health Questionnaire-9 (PHQ-9)), somatic symptoms (PHQ-15) and illness perceptions (Brief Illness Perception Questionnaire) at baseline, 3 and 6 months post-assessment. Participants gave feedback about treatment once completed, which was analysed using content analysis. Results: Significant improvements were found on all outcome measures at 3 months and 6 months compared to baseline. Benefits were found in all treatment steps and occurred regardless of baseline distress, chest pain or demographic characteristics. The strongest predictor of improvement in chest pain at 6 months was a positive change in illness perceptions at 3 months. Patients reported how treatment helped by increasing their understanding of chest pain, reducing concern and improving their sense of control. Conclusions: A biopsychosocial, stepped-care intervention appears to be effective, efficient and acceptable for a variety of patients with NCCP. Changes in beliefs about chest pain were the main predictors of improvement (reduced chest pain interference and frequency) at 6 months follow up.

Introduction

Non-cardiac chest pain (NCCP) is common, with a population prevalence of 16–20% (Hotopf, Mayou, Wadsworth, & Wessely, 1999; Nimnuan, Hotopf, & Wessely, 2001). It accounts for approximately three quarters of patients attending Rapid Access Chest...
Pain Clinics (RACPC) in the UK (Chambers, Marks, Knisley, & Hunter, 2013, 2014). Despite excellent medical prognosis, NCCP patients report persistent pain, distress and impairment (Chambers et al., 2013). Cognitive behaviour therapy (CBT) is an effective treatment of NCCP (Kisley, Campbell, Skerritt, & Yelland, 2010; Kisley, Campbell, Yelland, & Paydar, 2012), as well as other persistent physical symptoms, such as irritable bowel syndrome (IBS) (Blanchard et al., 2007) or chronic fatigue (Quarmby, Rimes, Deale, Wessely, & Chalder, 2007; Whiting et al., 2001)

Acceptance of CBT for persistent physical symptoms is enhanced by integrating psychology into the medical clinic (Speckens et al., 1995). Recently we described and evaluated a ‘biopsychosocial’, multidisciplinary clinic for NCCP that led to reductions in chest pain (CP) frequency, severity, interference, psychological distress, and to improved quality of life and functioning (see Chambers, Marks, Russell, & Hunter, 2015). The approach tailored treatment to the individual using a stepped-care, cognitive-behavioural approach (Mayou, Bass, & Bryant, 1999; Nezu, Nezu, & Lombardo, 2001). Stepped-care offers a generic approach to health-care delivery that is often conceptualised as a pyramid. High patient volume is managed at the base of the pyramid using low-intensity (LI) treatments, with progressively smaller volumes, and greater expertise in assessment and treatment, being concentrated towards the top step. An efficient service ensures maximal throughput by stepping patients according to need, matching interventions to needs, and making best use of available expertise. CBT fits well into a stepped-care approach having a range of levels and intensities, and being provided by health professionals with increasing levels of experience (Espie, 2009).

Stepped-care has been recommended for NCCP patients by Mayou, Bass, Hart, Tyndel, and Bryant (2000) who assessed referrals to, and treatment by, cardiologists. From a survey and case note review, the authors describe how the cardiology assessment should be augmented by additional explanation, reassurance and written information about alternative causes of chest pain, followed up by specialist nursing or psychological treatment if diagnostic doubt or chest pain persists. They considered the need to improve access to psychological care, to improve the awareness psychological issues, and to involve specialist nurses in providing explanation, self-help and follow up. Stepped-care should therefore initially involve change in assessment procedures, followed by individualised care to those needing further therapeutic steps. Nezu et al. (2001) also noted that, consistent across CBT protocols for persistent physical symptoms including NCCP, there is an educational component that aims to foster acceptance of the biopsychosocial model, and this can be conducted within the initial assessment. For patients with NCCP a simple intervention at assessment can be effective, but some patients remain unconvinced, and for them further intervention is required, and CBT has the best evidence base (Kisely et al., 2010, 2012).

Our clinic offered joint assessment by a clinical psychologist and cardiologist, with a biopsychosocial formulation, supported by written information. Patients were then offered the type of treatment most suited to their needs. This avoided costly ‘over intervention’ with most patients requiring minimal support over and above assessment and/or medical therapy; guided-self-help was delivered to those requiring some follow-up whilst those with more complex needs were offered higher intensity psychological therapy (see Chambers, Marks, & Hunter, 2015).
We needed to identify whether each treatment step was effective to demonstrate the validity of our approach. We also needed to identify determinants of efficacy or of failure to respond, to aid further development. Since this was a novel therapeutic approach for NCCP, we wanted to gather feedback from patients to help determine which aspects of care were most acceptable and helpful.

**Aims**

The aims of this study were therefore threefold:

1. To describe patient characteristics and outcomes within each treatment ‘step’.
2. To explore baseline predictors of treatment outcome (chest pain frequency and interference), and to evaluate whether changes in illness perceptions, beliefs, mood or somatic symptoms (from baseline to 3 months) can predict chest pain outcomes at 6 months.
3. To assess patients’ views of the treatment they received using content analysis.

**Method**

**Participants and procedures**

Consecutive NCCP patients were referred from a RACPC in an inner London teaching hospital to the Multidisciplinary Chest Pain Clinic (MDCPC) from December 2011 to December 2012. A total of 77 met inclusion criteria (i.e. were aged 18–80, experiencing chest pain at least once a month, with cardiac causes for pain excluded by invasive and non-invasive tests).

All patients attended a biopsychosocial assessment (BA) for one hour with a consultant cardiologist and clinical psychologist. Equal importance was given to medical and psychological factors affecting chest pain. During assessment, an individualised biopsychosocial formulation was discussed and medication was prescribed if indicated. Appropriate treatment was identified and discussed with the patient. There were three ‘steps’ available:

1. BA only
2. ‘LI CBT’ based on a guided-self-help booklet and supported by up to six sessions with a trained cardiac nurse or a clinical psychologist and
3. ‘High-intensity CBT’ (HI) with up to eight sessions with a clinical psychologist. Medication was prescribed where appropriate, regardless of the treatment step. Characteristics of patients and treatments are described in detail in Table 1.

A clinical psychologist (EM) trained in providing and supervising CBT (supervised by MSH), delivered treatment to 52 patients (18 LI and 34 HI). Two cardiac nurses, trained and supervised by EM, delivered LI to 13 patients. Two patients were treated jointly with LI, for training purposes. The remaining 10 patients received BA (8 with and 2 without medication).
Chest pain frequency: Frequency of chest pain over the past 3 months was assessed using a 10-point scale (from 0 = never to 9 = all the time). Chest pain severity and chest pain-related distress, problem-rating and interference ratings were measured on four, 10-point scales (1 = not at all to 10 = extremely). The chest pain distress, problem-rating and interference scales were tested for reliability and found to have a normal distribution with high internal consistency (\( \alpha = .88 \)). The average of these three scores was computed to give an overall ‘chest pain interference’ score.

Cardiac beliefs: Beliefs that chest pain signifies an imminent heart attack or that chest pain signifies serious heart disease were measured on two, 10-point scales (1 = not at all to 10 = extremely). These two scales had a normal distribution with high internal consistency (\( \alpha = .94 \)). The mean of these two scores was computed to give an overall ‘chest pain negative belief’ score.
The Brief Illness Perception Questionnaire (BIPQ): Assesses a patient’s view of their illness (Broadbent, Petrie, Maina, & Weinman, 2006). The 8-item questionnaire includes the following 10-point scales: Consequences; Timeline; Personal Control; Treatment Control; Symptom Frequency; Illness Concern; Illness Coherence and Emotional Response. The questionnaire was adapted by replacing the word ‘illness’ with ‘chest pain’. A total BIPQ score can be calculated with higher scores indicating less helpful beliefs. In our sample, 20–30% of data were missing on items 2 (timeline) and 4 (treatment control). Consequently, a total BIPQ score was calculated by summing items 1, 3, 5, 6, 7 and 8 (reversing items 3 and 7). Reliability analysis showed moderate internal consistency at baseline ($\alpha = .58$) rising to high consistency at 3 months ($\alpha = .92$) and 6 months ($\alpha = .88$).

Avoidance of exercise: Patients were asked to rate how often they avoided exercise due to concern about their heart (0 = often to 3 = never). A mean score was calculated for analysis, a higher score demonstrating improvement (Jonsbu, Dammen, Morken, Moum, & Martinsen, 2011).

Patient Health Questionnaire-9 (PHQ-9): Measures depressive symptoms. Nine items were rated on a 0–3 scale. A total score of 10 or more indicates clinically significant depressive symptoms (Kroenke, Spitzer, & Williams, 2001).

Generalised Anxiety Disorder Assessment-7 (GAD-7): Measures anxiety. Seven items were rated on a 0–3 scale and a total score of 8 or more demonstrated clinically significant anxiety symptoms (Spitzer, Kroenke, Williams, & Lowe, 2006).

The PHQ-15: Assesses the severity (0–2 scale) of 15 somatic symptom clusters common in outpatient settings. The total score reflected the severity of somatic symptoms, and scoring 10 or more predicted a diagnosis of a somatoform disorder (Kroenke, Spitzer, & Williams, 2002).

The Work and Social Adjustment Scale (WSAS): Measured impairment of functioning and quality of life due to chest pain. Five items were rated on a 0–8 scale. A total score of 10–20 suggested significant functional impairment and scores over 20 suggested severe psychopathology (Mundt, Marks, Shear, & Greist, 2002).

Qualitative information: At 3- and 6-month follow-up, in addition to completing questionnaires, patients were asked to give their views about treatment, with a focus upon which aspects were most helpful.

Statistical analyses

Potential baseline predictors of treatment outcome at 3 months were examined using logistic (chest pain frequency) and linear (chest pain interference scores) regression analyses. Changes in potential process analysis of variance (beliefs, mood, behaviours) from baseline to 3 months were examined using one-way ANOVA with post hoc tests, paired t-tests and Wilcoxon repeated measures tests. ‘Baseline-to-3 month’ difference scores were computed for the hypothesised processes of change and ‘baseline-to-6 month’ difference scores were computed for the outcome in terms of chest pain interference. A positive outcome in terms of chest pain frequency was viewed as pain occurring less than once a month. Regression analyses were then conducted to assess the extent to which difference scores in potential treatment processes could account for outcomes in chest pain frequency and chest pain interference. SPSS version 21 was used.
Qualitative analysis

Patients’ responses were recorded verbatim and transcribed into a spreadsheet. A content analysis was conducted to facilitate the description of this qualitative data by systematically coding and classifying the information. The content analysis technique was based on checking for the occurrence of terms (both implicit and explicit) within the transcripts (Smith, 2000). Data were coded based upon the main aspects of treatment (medication, formulation, information and the four chapters within the guided-self-help booklet). The data were reviewed by two raters (a clinical psychologist and a cardiac nurse), to identify recurring themes and categories. Initial coding was conducted by EM who created a coding sheet and was used by VR to code the data. After initial coding, redundant and overlapping themes were identified and the codes restructured, and each rater used this final coding structure to code all of the data. Any inconsistencies were discussed and clarified, and the data were re-coded. Consistency was calculated using a reliability analysis equation (Huberman & Miles, 1994) and in the final coding lay at 96%. With this high level of consistency, ratings from one coder (EM) were used for the final analysis.

These outcomes were considered by local ethics research committee to be part of routine evaluation of the MDCPC at Guys’ & St Thomas’ NHS Foundation Trust (clinical evaluation number 2306).

Results

Characteristics of patients’ attending the clinic are summarised in Table 2 and the total sample is described in detail in Chambers, Marks, and Hunter (2015). Of the 77 patients who completed assessment, 13% (n = 10) received BA alone, 43% (n = 33), LI CBT and 34 (44%) HI CBT. Medication was prescribed to 8 of the BA group, 10 of the LI group and 18 of the HI group. The main type of medical treatment was prescription of protein pump inhibitors (PPIs) for gastro-oesophageal reflux. Also prescribed were medications for respiratory disorder (for asthma or allergy), for musculoskeletal pain (paracetamol, non-

Table 2. Baseline and sociodemographic characteristics of patients within each treatment group (BA alone, LI CBT, HI CBT).

|                          | BA alone (n = 10) | LI-CBT (n = 33) | HI-CBT (n = 34) |
|--------------------------|------------------|-----------------|-----------------|
| Age (mean [SD])          | 52.6 [12.8]      | 50.1 [11.0]     | 50.3 [10.6]     |
| Gender (% male)          | 60%              | 52%             | 35%             |
| Ethnicity (% white)      | 40%              | 58%             | 38%             |
| SES (% educated more than 16 years) | 70% | 67% | 56% |
| SES (% with manual occupation) | 50% | 61% | 44% |
| Chest pain interference-baseline | 5.1 [2.5] | 5.3 [2.2] | 6.8 [1.9]* |
| Panic disorder criteria met? | 0 | 5 (15%) | 14 (41%)* |
| Health anxiety disorder met? | 1 (10%) | 2 (6%) | 5 (15%) |
| Other mental health disorder diagnosed | 2 (20%) | 12 (36%) | 21 (62%)* |
| Other physical health condition | 6 (60%) | 24 (73%) | 24 (71%)
| Other ‘persistent physical symptoms’ disorder diagnosed | 0 | 4 (12%) | 14 (41%)* |
| WSAS total score (mean [SD]) | 8.9 [11.4] | 6.5 [6.5] | 14.8 [11.8]* |
| Prescribed medication | 8 (80%) | 12 (36%) | 18 (53%)
| No. treatment sessions attended | 0 | 2.7 [1.5]; range 0–6 | 3.7 [2.1]; range 0–7 |

Note: SES, socioeconomic status.
*p < .05.
steroidal anti-inflammatory drugs or amitriptyline), antispasmodics for oesophageal reflux and antidepressant medication.

**Characteristics and outcomes for patients within each treatment group**

There were no significant baseline differences between the three groups for age, gender, ethnicity and socioeconomic status (education and occupation), nor for chest pain frequency or severity. However, compared to the LI group, the HI group reported significantly higher scores on chest pain interference \( t = -2.8, p < .05 \), total WSAS \( t = -3.5, p < .005 \), depression \( t = -2.0, p < .05 \) and somatic symptoms \( t = -3.7, p < .005 \), and more met criteria for panic disorder \( \chi^2 = 4.6, p < .05 \), comorbid mental health disorders \( \chi^2 = 4.3, p < .05 \) and persistent physical symptoms \( \chi^2 = 7.2, p < .05 \). These scores validated our clinical impression when assigning to each group.

From baseline to 3 months, the whole sample reported a reduction in chest pain frequency \( z = -6.2, p < .001 \), chest pain interference s \( t = 8.4, p < .001 \) and WSAS scores \( t = 6.4, p < .001 \). These improvements were all maintained at 6 months and were significant in all three treated groups, except the BA group that did not gain improvement in WSAS at any point.

Interestingly, chest pain frequency was moderately associated with chest pain interference \( r = .41, p < .01 \) and total WSAS \( r = .38, p = .001 \). Chest pain ‘interference’ was more strongly associated with WSAS \( r = .63, p < .001 \), emphasising the functional relevance of interference compared with chest pain frequency (Table 3).

**Predictors of treatment outcomes**

None of the baseline characteristics (age, gender, ethnicity, SES, somatic symptoms, depression, anxiety, negative cardiac beliefs, chest pain interference score or total Brief Illness Perception score) predicted outcomes in terms of chest pain frequency or chest pain interference at 3 months.

For the total sample, there were significant reductions from baseline to 3 months in the strength of negative cardiac beliefs \( t = 9.1, p < .001 \), in total BIPQ score \( t = 10.2, p < .001 \) and in individual BIPQ items \( p < .005 \), and in depression \( t = 3.4, p < .001 \) and anxiety \( t = 2.8, p < .05 \), PHQ-15 scores \( t = 4.8, p < .001 \) and in the level of avoidance of exercise in the whole sample \( t = -6.6, p < .001 \) (see Table 4). All improvements were maintained at 6

| Table 3. Changes in chest pain (CP) frequency, severity and interference over time within each treatment group and in the overall sample. |
|---------------------------------------------------------------|
| **Frequency chest pain (% with CP ⚡ monthly)**               |
| Baseline          | 100%   | 100%   | 100%   | 100%   |
| 3-month follow-up | 60%*   | 52%*   | 72%*   | 61%**  |
| 6-month follow-up | 40%*   | 47%*   | 61%*   | 51%**  |
| **Interference score** chest pain: mean [SD]                |
| Baseline          | 5.1 [2.5] | 5.3 [2.2] | 6.8 [1.9] | 5.9 [2.2] |
| 3-month follow-up | 3.7 [2.6]* | 2.8 [2.3]** | 4.0 [2.8]** | 3.2 [2.6]** |
| 6-month follow-up | 4.0 [2.7]* | 2.4 [1.7]** | 3.4 [2.4]** | 2.6 [2.1]** |

*p < .05.
**p < .01.
months. A significantly larger proportion of the BA group were prescribed medication compared to the CBT groups ($\chi^2 = 6.2$, $p < .05$), but there were no significant differences in terms of prescribed medication between the LI and HI-CBT groups [8 of those in the assessment group were offered medical therapy (5× PPIs for gastro-oesophageal reflux (PPIs), 1× PPI and respiratory, 1× respiratory and referral to a chest clinic and 1× referral to psychiatry); 10 of those in the LI CBT were offered medical therapy (5× PPI, 3× respiratory and 2× amitriptyline for pain); 18 of the individuals in HI CBT were offered medical therapy: 5× PPI, 2× respiratory, 6× pain medication (2× analgesia, 2× amitriptyline and 2 were advised to recommence or adhere to pregabalin via the general practitioner (GP)) and 5× antidepressants (with only 1 reporting adherence to antidepressants)]. However, no significant effects of medication upon outcome were found either for the whole sample or within each treatment group. Thus overall, medication did not predict treatment outcome.

A binary logistic regression analysis was conducted to explore the relative effects of potential process factors (difference scores from baseline to 3 months of BIPQ, PHQ-9, GAD7, exercise avoidance and cardiac beliefs and number of sessions attended) upon outcome (chest pain frequency). Positive outcome was regarded as chest pain occurring less than monthly at 6 months follow-up. In the final model only the change in the total BIPQ score from baseline to 3 months significantly predicted a positive outcome at 6 months (Exp (B) = 1.1, $p < .005$, 95% CI 1.02–1.10), and accounted for 19% of the variance. Further exploratory analyses were conducted to ascertain whether individual items

| Table 4. Changes in process variable, chest pain beliefs, illness perceptions, depression, anxiety and somatic symptoms for the three groups. |
|-------------------------------------------------|------------------|------------------|-------------------|---------------------|
| Scores: mean [SD] | BA alone (n = 10) | LI-CBT (n = 33) | HI-CBT (n = 34) | Overall sample (n = 77) |
|-------------------------------------------------|------------------|------------------|-------------------|---------------------|
| **Chest pain negative beliefs**                  |                  |                  |                   |                     |
| Baseline                                         | 4.7 [2.6]        | 5.3 [3.2]        | 5.9 [3.3]         | 5.5 [3.2]           |
| 3-month follow-up                                | 2.3 [2.7]        | 1.7 [1.3]**      | 2.4 [2.4]**       | 2.1 [2.0]**         |
| 6-month follow-up                                | 3.0 [3.3]        | 1.5 [1.0]**      | 2.0 [2.0]**       | 2.0 [2.0]**         |
| **Somatic symptoms PHQ-15**                      |                  |                  |                   |                     |
| Baseline                                         | 9.4 [5.4]        | 10.4 [4.2]       | 14.4 [4.8]        | 12.0 [5.0]          |
| 3-month follow-up                                | 6.8 [4.6]        | 6.5 [4.6]*       | 10.7 [6.1]*       | 8.2 [5.6]**         |
| 6-month follow-up                                | 5.7 [4.7]        | 6.6 [3.9]*       | 9.9 [7.7]*        | 7.7 [6.0]**         |
| **Exercise avoidance score**                     |                  |                  |                   |                     |
| Baseline                                         | 2.9 [1.2]        | 2.8 [1.2]        | 2.1 [1.2]         | 2.5 [1.3]           |
| 3-month follow-up                                | 3.3 [1.3]        | 3.8 [0.5]**      | 3.3 [1.1]**       | 3.5 [0.9]**         |
| 6-month follow-up                                | 3.4 [1.3]        | 3.0 [0.2]**      | 3.8 [0.6]**       | 3.8 [0.7]**         |
| **Total BIPQ Score**                             |                  |                  |                   |                     |
| Baseline                                         | 34.0 [11.6]      | 36.6 [10.0]      | 41.1 [8.7]        | 38.2 [9.9]          |
| 3-month follow-up                                | 20.9 [16.5]**    | 14.9 [12.8]**    | 23.7 [18.5]**     | 19.3 [16.2]**       |
| 6-month follow-up                                | 22.0 [17.5]**    | 11.7 [12.1]**    | 16.8 [12.9]**     | 15.2 [13.5]**       |
| **PHQ-9**                                        |                  |                  |                   |                     |
| Baseline                                         | 7.6 [7.8]        | 7.3 [6.9]        | 10.8 [7.2]        | 8.8 [7.2]           |
| 3-month follow-up                                | 4.0 [4.7]        | 3.8 [3.9]*       | 7.4 [7.2]         | 5.4 [5.8]**         |
| 6-month follow-up                                | 3.7 [6.8]*       | 3.5 [3.9]**      | 5.8 [5.3]*        | 4.4 [5.0]**         |
| **GAD-7: mean [SD]**                             |                  |                  |                   |                     |
| Baseline                                         | 4.8 [6.4]        | 6.2 [5.7]        | 8.2 [6.2]         | 6.9 [6.0]           |
| 3-month follow-up                                | 1.9 [3.8]        | 3.7 [3.9]*       | 6.3 [5.9]         | 4.6 [5.1]*          |
| 6-month follow-up                                | 2.7 [6.8]        | 2.6 [3.7]**      | 5.0 [5.2]         | 3.6 [4.7]**         |

*Higher score indicates improvement.

*p < .05.

**p < .005.
on the BIPQ, rather than total BIPQ, could predict outcome more effectively. Both the change in BIPQ1 (consequences) \((\text{Exp} \ (B) = 1.3, \ p < .02, \ 95\% \ CI \ 1.06–1.60)\) and the change in BIPQ7 (coherence) \((\text{Exp} \ (B) = 1.2, \ p < .02, \ 95\% \ CI \ 1.03–1.35)\) predicted a positive outcome at 6 month, together accounting for 27% of the variance.

A parallel linear regression analysis was carried out to assess whether the same process variables could potentially predict improvement of chest pain interference. In the final model, the difference score in total BIPQ from baseline to 3 months: \(B = .05, \ p < .02\) (95% CI 0.008–0.084) and the difference score of the GAD7 from baseline to 3 months: \(B = .15, \ p < .005\) (95% CI 0.047–0.259) predicted a positive outcome at 6 months, overall accounting for 25% of the variance. Further analysis exploring individual items of the BIPQ showed a final model where change in IPQ6 (concern) from baseline to 3 months: \(B = −.34, \ p < .001\) (95% CI 0.19–0.49) and the difference score for anxiety from baseline to 3 months: \(B = .12, \ p < .02\) (95% CI 0.02–0.22), accounted for 39% of the variance.

The majority of patients \((n = 66; \ 86\%)\) completed treatment (91% of the LI group and 76% of the HI group). In terms of follow-up data, at 3 months, there was complete data on 70 (91%) participants and partial data on 5 (with 2 cases missing); at 6 months there was complete data on 64 (83%) participants. Compared to treatment completers, non-completers were significantly younger (53 vs. 39: \(t = 4.7, \ p < .001\)), reported significantly more negative cardiac beliefs (8.0 vs. 5.0; \(t = 1.6, \ p < .005\)), higher total BIPQ scores (44.4 vs. 37.1; \(t = −2.3, \ p < .05\)) and higher scores on the WSAS (11.6 vs. 10.0; \(t = −2.1, \ p < .05\)).

**Patients’ experience of the treatments at 3 and 6 months: a content analysis.**

Patients’ responses at 3 and 6 months were very similar, so the data at 3 and 6 months was combined and analysed together. Table 5 provides an overview of the frequency counts of the main themes, with illustrative quotations.

Several broad themes were evident that related to positive outcomes. In particular, *not worrying about chest pain* (and so not seeking help), *having an improved understanding of chest pain*, and *feeling reassured by the cardiac tests and by the doctor*, i.e. understanding chest pain is not dangerous. Other broad themes included *improved control/coping with pain* and *becoming more active (even despite pain)*. They also noted that treatment led to *improvements in the rest of their health*, but also when chest pain resolved they did report *worries about other health issues*.

As might be expected, common themes highlighted the utility of specific treatment components, with the over-arching message that these improved coping and control of chest pain. Cited most often was *abdominal breathing* (even by those unable to perfect the abdominal breathing technique and simply using breath focus). This was followed by *learning how to reduce or manage stress*, *progressive muscle relaxation* and *cognitive techniques* (such as thought challenging and distraction). The benefits of medication were reported, but not as often as the self-help strategies. Some individuals reported improvement without being able to identify reasons for this and a similar number reported no benefit from treatment and continuing confusion regarding chest pain.
Patients receiving different steps of treatment in this multidisciplinary stepped-care intervention derived significant improvements in chest pain frequency and interference at 3 months, and these improvements were maintained at 6 months. This exploratory study suggests that all three steps of care result in good clinical outcomes for NCCP, and that in some cases, BA with information and medication as indicated was sufficient.

At baseline, all groups reported similar levels of chest pain frequency. However, the HI-CBT group reported greater needs in terms of chest pain interference, comorbidities, somatic symptoms and functional impairment. Such differences might be expected since individuals with greater psychosocial complexities would usually require a higher intensity intervention. Our primary outcomes were chest pain frequency and interference. Both were associated with functional impairment, although the association was stronger for chest pain interference than with pain frequency. Frequency of chest pain alone provides insufficient information and clinicians need to take account of the impact of pain upon the individual and his/her quality of life. If we were to simply measure chest pain frequency as outcome, we would miss important improvements in terms of patient reported outcomes. The content analysis findings support this claim; there were examples of patients who reported functional improvement despite continuing chest pain.

### Table 5. Examples of common themes relating to views about treatment.

| Theme                                                      | Frequency | Examples                                                                                       |
|------------------------------------------------------------|-----------|-----------------------------------------------------------------------------------------------|
| Abdominal breathing or breath focus helpful                | 50        | ‘Now if I feel stress, I use breathing which helps hugely’                                     |
| Do not worry about chest pain (and do not seek help)       | 47        | ‘... it helps me just to focus on my breathing’                                                 |
|                                                            |           | ‘I’m not worried about my heart’                                                              |
|                                                            |           | ‘I don’t worry now because I know it isn’t helpful’                                           |
|                                                            |           | ‘I’m less worried about it so not seeking help from A&E or my GP’                             |
| Understanding the biopsychosocial causes of chest pain (non-cardiac) | 46        | ‘Understanding the link to acid reflux calmed me down’                                       |
|                                                            |           | ‘I now understand my chest pain come from my back pain’                                      |
|                                                            |           | ‘I thought stress could have caused chest pain but now it easier to accept that it is the main cause of the pain’ |
| Increasing activity (and continuing even with pain)        | 41        | ‘I am glad that I came here and was pushed to do exercise when I was fearful because now I am able to do it’ |
|                                                            |           | ‘Although it continues I can manage to continue despite it’                                   |
| Other health worries more important                         | 32        | ‘Now I’m more worried about my eye problem’                                                   |
|                                                            |           | ‘I don’t have chest pain but I still have IBS and sensitive nerves’                          |
| Improved stress management or reduction of stress          | 29        | ‘I know pain comes on when I’m stress, so I’m still active but try to pace myself’            |
|                                                            |           | ‘I get (my family) to help at home so I don’t get so stressed’                               |
| Progressive muscle relaxation helpful                      | 22        | ‘Chest pain is better now; I’m still using the relaxation exercises when I get it ... I try to relax and that makes it go’ |
| Cognitive change/using strategies                           | 22        | ‘I found the flashcard most useful’                                                           |
|                                                            |           | ‘I’m using distraction and doing small tasks ... ’                                            |
| Feel reassured by tests and/or doctor                      | 18        | ‘I’m very reassured by the assessment and doctor’s letter’                                   |
|                                                            |           | ‘My husband feels reassured too’                                                             |
| More control or better coping with chest pain              | 18        | ‘I’m well. I don’t have chest pain very much now because I know how to control it’           |
| Other health has improved too                              | 18        | ‘Understanding IBS was liberating too and now I know how to manage it’                       |
| Pain improved without understanding why                    | 10        | ‘I’m not sure why it’s gone, but it has and I’m not worried any more’                         |
| Medication helpful                                         | 9         | ‘The medication has helped’                                                                  |
| Pain unimproved without knowing why                        | 9         | ‘I don’t know what it is’                                                                    |

### Discussion

Patients receiving different steps of treatment in this multidisciplinary stepped-care intervention derived significant improvements in chest pain frequency and interference at 3 months, and these improvements were maintained at 6 months. This exploratory study suggests that all three steps of care result in good clinical outcomes for NCCP, and that in some cases, BA with information and medication as indicated was sufficient.

At baseline, all groups reported similar levels of chest pain frequency. However, the HI-CBT group reported greater needs in terms of chest pain interference, comorbidities, somatic symptoms and functional impairment. Such differences might be expected since individuals with greater psychosocial complexities would usually require a higher intensity intervention. Our primary outcomes were chest pain frequency and interference. Both were associated with functional impairment, although the association was stronger for chest pain interference than with pain frequency. Frequency of chest pain alone provides insufficient information and clinicians need to take account of the impact of pain upon the individual and his/her quality of life. If we were to simply measure chest pain frequency as outcome, we would miss important improvements in terms of patient reported outcomes. The content analysis findings support this claim; there were examples of patients who reported functional improvement despite continuing chest pain.
None of the baseline characteristics predicted treatment outcome in terms of chest pain frequency or interference. This suggests that our approach was effective regardless of a patient’s initial level of distress, chest pain interference or psychosocial complexity and there were no obvious contraindications. Each treatment group improved, showing how a stepped-care approach can successfully offer the appropriate level of treatment to the majority of patients who were drawn from a socially mixed and ethnically diverse sample.

Overall, treatment led to improvements in cardiac beliefs, illness perceptions, depression, anxiety, somatic symptoms and exercise avoidance. The finding of significant changes in both LI and HI groups again supports the stepped-care model, in that the interventions were intensive enough to change these process variables, i.e. what CBT would be expected to change. One difference between the groups was the reduction in anxiety and depression at 3 months, which only occurred in the LI group. This could be a reflection of the psychological complexity of the HI group, who may have been less responsive to our brief, targeted treatment than the LI group for whom chest pain did not present in the context of other mental health problems.

In a recent study illness perceptions were found to mediate the effects of CBT on mood for patients with NCCP (Jonsbu, Martinsen, Morken, Moum, & Dammen, 2013). However we found that changes in illness perceptions, i.e. consequences, coherence and concern, also predicted chest pain measures of frequency and interference. This finding is consistent with reported associations between illness perceptions and disability in other chronic illness (such as chronic fatigue syndrome: Moss-Morris, Petrie, & Weinman, 1996; and arthritis, chronic obstructive pulmonary disease and psoriasis: Scharloo et al., 1998) and reports of illness perceptions predicting outcome in the treatment of pain at other sites (such as orofacial pain: Galli, Ettlin, Palla, Ehlert, & Gaab, 2010), and in mediating improved symptom severity and social adjustment in a treatment for other persistent physical symptoms such as IBS (Chilcot & Moss-Morris, 2013).

It is interesting to note that changes in illness perceptions predicted outcome, rather than specific negative beliefs about having a heart attack or serious heart condition. The specific illness perceptions that were the strongest individual predictors – coherence and consequences – might reflect the emphasis in the clinic upon formulation, understanding and testing out behavioural consequences of pain in the CBT sessions.

Patients’ own descriptions of the treatment parallel the quantitative findings, for example the changes in perceptions of chest pain. In particular, many individuals described the importance of having a better understanding of pain (i.e. illness coherence), recognising the importance of biopsychosocial factors involved in pain (i.e. causes), and having ways to respond to chest pain using breathing, relaxation and cognitive techniques (i.e. personal and treatment control). As a result, patients reported feeling less worried or stressed about pain (i.e. emotional response). Patients also reported additional benefits in terms of improvements in other health problems, such as those of IBS, possibly due to similarities of treatment approaches (Moss-Morris, McAlpine, Didsbury, & Spence, 2010), and mirroring improvements found on the PHQ-15.

The treatment completion rate of 86% overall compares favourably to other studies of CBT for NCCP reporting attrition rates of approximately 20% (Kisely et al., 2012). Non-completers tended to report more complex problems and negative beliefs, as was the case in a previous study (Jonsbu et al., 2011). We felt that our treatment was broadly acceptable, perhaps due to the hospital location, multidisciplinary approach and a biopsychosocial
model, focus on pain management skills and a patient-centred approach (for example, ensuring that a graded increase was always relevant to the patients’ goals).

**Strengths and limitations**

As a clinical evaluation, the lack of control group means that we cannot be certain that treatment effects were due to the interventions. However, considering the well-documented natural history of chest pain; of continuing distress and disability, and with ‘treatment as usual’ typically involving routine GP follow-up, we feel that the current results are likely to reflect the benefits of our treatment. The lack of control group limits the conclusions regarding potential predictors of outcome. The study had a reasonable sample size, allowing for comparisons between the LI and HI groups. However, the small size of BA group \((n = 10)\) limited the extent to which outcomes could be considered within all groups. Potential bias existed within the content analysis, as it was conducted by members of the clinical team. However, the content analysis was designed to focus upon treatment process rather than treatment outcome.

A strength was that we evaluated a clinic for NCCP within a ‘real world’ setting. Any patient meeting criteria for current ‘NCCP’ was invited, with no other exclusion criteria, thus forming a naturalistic, heterogenous sample. Our study was conducted in a culturally and ethnically diverse part of London, and we therefore feel that it may well be possible to implement this approach in culturally different settings. We also note that other studies of CBT for NCCP have been conducted with some success in other countries such as the Netherlands, Norway, America, Australia. There may however be differences in how health services are delivered that might influence the feasibility of this clinical approach.

As we did not find any predictive effects of patient characteristics on outcome, we have no reason to believe that context-specific factors will be important determinants of outcome, but further research is needed. The clinical team was multidisciplinary, and all members adhered to a biopsychosocial model of chest pain. The nurses who delivered LI CBT had no prior specialist psychological experience, and received all their CBT training and supervision within this clinic; this involved reading, role play, sitting in sessions with the psychologist and psychologist sitting in with the nurse and on-going supervision of cases. As such, we feel that we have demonstrated how this approach, offering brief interventions, could be integrated effectively into Rapid Access Chest Pain or Cardiology Clinics (Chambers, Marks, & Hunter, 2015).

In conclusion, a biopsychosocial clinic offering a CBT-based, stepped-care approach can offer an effective, efficient and acceptable treatment for NCCP. The intervention reduced chest pain frequency, but perhaps more importantly reduced interference of chest pain upon people’s lives. It also led to improvement in other somatic symptoms. This approach appeared to work for a wide range of patients, reporting various levels of comorbidity and complexity. Whilst mood, cognitions and behaviours changed with treatment, illness perceptions (coherence and consequences) were the main predictors of improvement. Further research and evaluation of cost effectiveness is warranted in a larger randomised controlled trial.

**Disclosure statement**

No potential conflict of interest was reported by the authors.
References

Blanchard, E. B., Lackner, J. M., Sanders, K., Krasner, S., Keefer, L., Payne, A., … Dulgar-Tulloch, L. (2007). A controlled evaluation of group cognitive therapy in the treatment of irritable bowel syndrome. *Behaviour Research and Therapy, 45*, 633–648.

Broadbent, E., Petrie, K. J., Maina, J., & Weinman, J. (2006). The Brief Illness Perception Questionnaire. *Journal of Psychosomatic Research, 60*, 631–637.

Chambers, J. B., Marks, E. M., & Hunter, M. S. (2015). The head says yes but the heart says no: What is non-cardiac chest pain and how is it managed? *Heart*, doi:10.1136/heartjnl-2014-306277.

Chambers, J. B., Marks, E. M., Knisley, L., & Hunter, M. S. (2013). Non-cardiac chest pain: Time to extend the rapid access chest pain clinic? *International Journal of Clinical Practice, 67*(4), 303–306.

Chambers, J. B., Marks, E. M., Knisley, L., & Hunter, M. S. (2014). The Rapid Access Chest Pain Clinic: Unmet distress and disability. *QJM: An International Journal, 107*(6), 429–434.

Chambers, J. B., Marks, E. M., Russell, V., & Hunter, M. S. (2015). A multidisciplinary, biopsychosocial treatment for non-cardiac chest pain: A pilot evaluation. *International Journal of Clinical Practice, 69*(9), 922–927.

Chilcot, J., & Moss-Morris, R. (2013). Changes in illness-related cognitions rather than distress mediate improvements in irritable bowel syndrome (IBS) symptoms and disability following a brief cognitive behavioural therapy intervention. *Behaviour Research and Therapy, 51*(10), 690–695.

Espie, C. A. (2009). “Stepped Care”: A health technology solution for delivering cognitive behavioral therapy as a first line insomnia treatment. *Sleep, 32*(12), 1549–1558.

Galli, U., Ettlin, D. A., Palla, S., Ehlert, U., & Gaab, J. (2010). Do illness perceptions predict pain-related disability and mood in chronic orofacial pain patients? A 6-month follow up study. *European Journal of Pain, 14*, 550–558.

Hotopf, M., Mayou, R., Wadsworth, M., & Wessely, S. (1999). Psychosocial and developmental antecedents of chest pain in young adults. *Psychosomatic Medicine, 61*, 861–867.

Huberman, A. M., & Miles, M. B. (1994). *Qualitative data analysis: An expanded sourcebook*. Thousand Oaks, CA: Sage.

Jonsbu, E., Dammen, T., Morken, G., Moum, T., & Martinsen, E. W. (2011). Short-term cognitive behavioural therapy for non-cardiac chest pain and benign palpitations: A randomized controlled trial. *Journal of Psychosomatic Research, 70*, 117–123.

Jonsbu, E., Martinsen, E. W., Morken, G., Moum, T., & Dammen, T. (2013). Change and impact of illness perceptions among patients with non-cardiac chest pain and benign palpitations following three sessions of CBT. *Behavioural and Cognitive Psychotherapy, 41*(4), 398–407.

Kisley, S. R., Campbell, L. A., Skerritt, P., & Yelland, M. J. (2010). Psychological interventions for symptomatic management of non-specific chest pain in patients with normal coronary anatomy. *Cochrane Database Systematic review, 20*(1), CD004101. doi:10.1002/14651858.CD004101.pub3.

Kisley, S. R., Campbell, L. A., Yelland, M. J., & Paydar, A. (2012). Psychological interventions for symptomatic management of non-specific chest pain in patients with normal coronary anatomy. *Cochrane Database Systematic review, 13*(6), CD004101. doi:10.1002/14651858.CD004101.pub4.

Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine, 16*(9), 606–613.

Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2002). The PHQ-15: Validity of a new measure for evaluating the severity of somatic symptoms. *Psychosomatic Medicine, 64*(2), 258–266.

Mayou, R. A., Bass, C. M., & Bryant, B. M. (1999). Management of non-cardiac chest pain: From research to clinical practice. *Heart, 81*, 387–392.

Mayou, R. A., Bass, C. M., Hart, G., Tyndel, S., & Bryant, B. (2000). Can clinical assessment of chest pain be made more therapeutic? *QJM, 93*, 805–811.
Moss-Morris, R., McAlpine, L., Didsbury, L. P., & Spence, M. J. (2010). A randomized controlled trial of a cognitive behavioural therapy-based self-management intervention for irritable bowel syndrome in primary care. *Psychological Medicine, 40*(1), 85–94.

Moss-Morris, R., Petri, K. J., & Weinman, J. (1996). Functioning in chronic fatigue syndrome: Do illness perceptions play a regulatory role? *British Journal of Health Psychology, 1*(1), 15–25.

Mundt, J. C., Marks, I. M., Shear, K., & Greist, J. H. (2002). The Work and Social Adjustment Scale: A simple measure of impairment in functioning. *The British Journal of Psychiatry, 180*, 461–464.

Nezu, A. M., Nezu, C. M., & Lombardo, E. R. (2001). Cognitive-behaviour therapy for medically unexplained symptoms: A critical review of the treatment literature. *Behavioral Therapy, 32*, 537–583.

Nimnuan, C., Hotopf, M., & Wessely, S. (2001). Medically unexplained symptoms: An epidemiological study in seven specialities. *Journal of Psychosomatic Research, 51*, 361–367.

Quarmby, L., Rimes, K. A., Deale, A., Wessely, S., & Chalder, T. (2007). Cognitive-behaviour therapy for chronic fatigue syndrome: Comparison of outcomes within and outside the confines of a randomised controlled trial. *Behavioural Research and Therapy, 45*(6), 1085–1094.

Scharlooa, M., Kapetina, A. A., Weinman, J., Hazes, J. M., Willems, L. N. A., Bergman, W., Rooijmans, H. G. M. (1998). Illness perceptions, coping and functioning in patients with rheumatoid arthritis, chronic obstructive pulmonary disease and psoriasis. *Journal of Psychosomatic Research, 44*(5), 573–585.

Smith, C. P. (2000). Content analysis and narrative analysis. In T. Reis, & C. Judd (Eds.), *Handbook of research methods in social and personality psychology* (pp. 313–335). New York: Cambridge University Press.

Speckens, E. M., Hemert, A. M., Spinhoven, P., Hawton, K. E., Bolk, J. H., & Rooijmans, H. G. M. (1995). Cognitive behavioural therapy for medically unexplained physical symptoms: A randomised controlled trial. *BMJ, 311*, 1328–1332.

Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Lowe, B. (2006). A brief measure for assessing Generalized Anxiety Disorder: The GAD-7. *Archives of Internal Medicine, 166*, 1092–1097.

Whiting, P., Bagnall, A. M., Sowden, A. J., Cornell, J. E., Mulrow, C. D., & Ramirez, G. (2001). Interventions for the treatment and management of chronic fatigue syndrome. A systematic review. *JAMA, 286*(11), 1360–1368.