

## Patients' drawings illustrate psychological and functional status in heart failure

Lisa Reynolds, Elizabeth Broadbent, Chris J. Ellis, Greg Gamble, Keith J. Petrie\*

*Department of Psychological Medicine, University of Auckland, Auckland, New Zealand*

*Department of Cardiology, Auckland District Health Board, Auckland, New Zealand*

Received 14 July 2006; received in revised form 22 February 2007; accepted 1 March 2007

### Abstract

**Objective:** The aim of this study was to evaluate whether the heart drawings of patients with heart failure are associated with their psychological, functional, and clinical status. **Methods:** Sixty patients with heart failure completed a written questionnaire that included a heart drawing task, measures of psychological functioning, and illness perceptions. **Results:** Patients drew their heart significantly bigger in height when they depicted their heart with failure as compared with how they depicted their heart before their heart failure. Greater levels of heart-specific anxiety were associated with significantly larger drawings as measured by height

and overall area. Compared with those who drew no damage, patients who drew damage had significantly higher levels of depression and more negative beliefs about their illness. Drawings also had a significant relationship with the clinical markers of illness severity, B-type natriuretic peptide level, and sodium level. **Conclusions:** Heart drawings of patients with heart failure are associated with important psychological and clinical indicators of health status. Drawings offer an innovative way to understand patients' perceptions of illness and personal models of heart failure. © 2007 Elsevier Inc. All rights reserved.

*Keywords:* Illness perceptions; Heart failure; Psychology; Patient drawings

### Introduction

Heart failure is an illness that is simultaneously lethal and unpredictable. It occurs as a result of the heart working unusually hard over a number of years—when the heart has exhausted all of its reserve capacity [1]. Typically, the heart becomes enlarged and can no longer effectively pump enough blood to satisfy the body's demands for oxygen and nutrients [2]. Approximately 50% of patients diagnosed with heart failure will die within 4 years [3], and this mortality risk increases to 30%–50% within 1 year in patients with severe heart failure [3,4]. Despite the decline in the mortality of coronary heart disease and improvements in other areas of cardiac illness, the mortality rates of heart

failure have seen limited improvement internationally in recent years [5].

Given these stark fatality rates and the unpredictable nature of heart failure, it is perhaps not surprising that patients typically report psychological distress and diminished quality of life [6]. Adults with heart failure have been found to have significant levels of anxiety and depression [7–9] and, compared with those who have other chronic illnesses, poorer role functioning and more negative perceptions of their own health [10]. Many studies have shown the damaging impact of these psychological factors on the quality of life and functional status of patients with heart failure [6,9,11–13].

Gaining new insights into the factors that influence the psychological and physical status of patients with heart failure will become more important as this illness increases in its prevalence. The measurement of psychological status in patients with heart failure has traditionally relied on written questionnaires such as the Hospital Anxiety and Depression Scale (HADS) [14], the Minnesota Living with

\* Corresponding author. Department of Psychological Medicine, Faculty of Medical and Health Sciences, University of Auckland, 85 Park Road, Private Bag 92019, Auckland, 1142 New Zealand. Tel.: +64 9 373 7599x86564; fax: +64 9 373 7013.

*E-mail address:* kj.petrie@auckland.ac.nz (K.J. Petrie).

Heart Failure Questionnaire (LHFQ) [15], and the Illness Perception Questionnaire [16]. Although measures such as these have revealed important associations between psychological and functional status, written questionnaires can be limited by operating along predefined dimensions. Innovative ways of understanding a patient's experience are required to elicit new insights in this area. Asking patients to draw their perceptions about their illness has the advantage of uncovering their idiosyncratic beliefs, experiences, and concerns without imposing preconceived ideas by the researcher [17–19].

Recent research with patients who had experienced a myocardial infarction used patients' drawings of their heart as an alternative measure of illness perceptions [20,21]. These studies have shown that damage illustrated on heart drawings predicts poorer functional status and negative illness beliefs 3 months after the heart attack and that increases in the size of images over time are associated with greater cardiac anxiety, slower return to work, less exercise, and a higher use of alternative medicines. These results indicate that drawings may have the potential to uncover perceptions that play an important role in shaping health behaviors. It is not clear whether these findings extend to features of living with a chronic illness such as heart failure, including overall level of physical functioning and quality of life.

This study intended to further evaluate the use of drawings with cardiac patients. Given that the heart becomes enlarged in heart failure [2], we hypothesized that within subjects, patients would draw their heart larger when depicting it with heart failure as compared when depicting it before their heart failure. Based on previous findings, we also hypothesized that between subjects, larger heart drawings and damage drawn on the heart would be associated with poorer psychological, functional, and clinical status. Because a major cause of heart failure is ischemic heart disease, we further hypothesized that patients whose heart failure was caused by ischemic heart disease would be more likely to draw damage on their heart as compared with those with other causes for their heart failure.

## Methods

### Participants

The participants of this study were patients who had been diagnosed by their cardiologist as having chronic heart failure and were attending the outpatient heart failure nursing clinic of the Greenlane Clinical Center in Auckland. Excluded from the study were patients who did not speak English and those who had cognitive impairment. Consecutive sampling of patients was used over a 6-month period between May and November 2005. Sixty-seven patients who met the inclusion criteria were invited to participate in

the study. Seven patients declined to take part (90% participation rate). They cited either a lack of time or feeling unwell as their restraint to participating. Written informed consent was obtained from the 60 patients who were willing to participate in the study.

### Procedure and measures

The Northern X Ethics Committee granted ethical approval for the study. Participants attending the clinic completed a questionnaire that included questions on basic demographic information as well as medical care use, a heart drawing task, measures of psychological functioning, and illness perceptions. The medical records of the participants were then accessed, and their relevant medical details were recorded.

Clinical status of heart failure was assessed using the left ventricular ejection fraction as calculated by echocardiography and cardiac angiography as well as serum levels of B-type natriuretic peptide (BNP) and sodium. Left ventricular ejection fraction measures the percentage of blood that the left ventricle of the heart is able to pump out with each heartbeat [22]. A normal ejection fraction is approximately between 50% and 70% [22]. The second clinical marker used to evaluate clinical severity was BNP—a neurohormone that can be measured in a simple blood test. B-type natriuretic peptide levels increase in proportion to the severity of cardiac dysfunction [23,24] and have been found to be a useful predictor of left ventricular function [25]. The final clinical marker used in this study was evaluation of serum sodium levels. Reduction in plasma sodium concentration has been found to parallel the severity of heart failure [26].

The heart drawing task was based on a research study conducted by Broadbent et al. [21]. The participants were given the following instruction: "Please draw a picture of what you imagine your heart looked like before your heart failure and another picture of what your heart looks like now. This task is not about artistic ability—simple sketches are fine. We are interested in your own ideas about what has happened to your heart." The drawing task was conducted by 54 of the 60 participants (90%). Reasons given for not completing this task were not being able to draw and not knowing what the heart looks like. No significant difference was found between the patients who did and those who did not draw pictures in terms of age [ $t(58)=-.84, P=.41$ ] and sex [Pearson's  $\chi^2(1, N=60)=.34, P=.54, \text{Cramér's } V=-.08$ ]. It took all participants less than 5 min to complete their drawings.

Anxiety and depression were assessed with the use of the HADS, which has been specifically designed for medically ill patients. This 14-item scale has been used to assess levels of general depression and anxiety in many different populations and has been found to be valid in cardiac patients [27].

Specific heart-related anxiety was assessed with the use of the Cardiac Anxiety Questionnaire (CAQ) [28]. This 18-item scale gives an overall measure of heart-related

anxiety and has demonstrated good psychometric properties with cardiac populations.

Physical functioning and emotional quality of life were assessed with the use of the LHFQ, which was developed by Rector et al. [15]. This 21-item questionnaire is a widely used measure of disease-specific physical functioning and emotional quality of life in heart failure [29,30].

Illness perceptions were measured with the use of the Brief Illness Perception Questionnaire [31]. This is a new nine-item measure of the main dimensions of patients' perceptions of their illness. This scale has shown good test-retest reliability and concurrent validity with the Illness Perceptions Questionnaire-Revised as indicated by appropriate correlations with relevant items (.32–.63). The scale has also demonstrated good predictive validity in patients recovering from myocardial infarction, with individual items being related to mental and physical functioning at 3 months follow-up, cardiac rehabilitation class attendance, and speed of return to work.

#### Data analysis

Drawings of the heart were analyzed in terms of size, measured in two ways by area and height, and whether they depicted damage. To evaluate the total area of the heart, patients' drawings were scanned and imported into PhotoShop and then analyzed using the National Institutes of Health Image-J software [32]. This technique allowed the total area of each heart drawing to be measured. Height was calculated by measuring the heart drawing from bottom to top in millimeters. The difference between the image of the heart before heart failure and that of the heart *now* was calculated in terms of height and total area. Depiction of damage was determined by two raters who independently classified each drawing as showing damage or not. Agreement between the raters was high ( $\kappa=.88$ ), and disagreements were resolved by discussion and consensus.

Data were analyzed using SPSS version 11 software (SPSS Inc., Chicago, IL, USA). Means and reliabilities of the scales were analyzed to check whether the requirements of normal distribution were met. The relationships between height as well as area of the drawings and measures of health status, including psychological, functional, and clinical variables, were computed using Pearson's correlation coefficients when data were distributed normally and using Spearman's correlations when the data did not meet the requirements of normal distribution. Within-group analysis of differences between patients' drawings before heart failure and those with heart failure was conducted using paired-samples *t* tests. Between-group analysis of heart drawing height and area differences was conducted using independent-groups *t* tests when data were normally distributed and using Mann-Whitney *U* tests when the requirements of normal distribution were not met. A two-way contingency table analysis was conducted to evaluate whether there was a difference between those whose cause

of heart failure was ischemic heart disease and those with other causes. Significance was tested at the .05 level for two-tailed tests.

#### Results

The 60 participants included in this study were between 28 and 89 years old (mean age=63.5 years, S.D.=15.35). Most participants were New Zealand Europeans ( $n=36$ ); 10 were Maori, 9 were Pacific Islanders, and 5 were of other ethnicities. At the time of the study, 28 participants were retired, 23 were employed full or part time, 5 were sickness beneficiaries, and 4 were unemployed or students. The clinical backgrounds of the participants were varied. Most of the participants were classified as being of New York Heart Association class II ( $n=36$ ), with the rest being of either class III ( $n=23$ ) or class IV ( $n=1$ ). Thirty-four participants had a history of hypertension, 20 had experienced angina, and 29 had been diagnosed with a previous myocardial infarction.

Illustrations of heart drawings from six participants are depicted in Fig. 1. Panel (A) shows examples in which the heart was drawn bigger in the "heart now" drawing than that in the "before heart failure" drawing. Panel (B) shows examples of damage drawn on the heart with failure. The percentage of people who depicted their heart as damaged in these drawings was 46.3% ( $n=25$ ).

To investigate the hypothesis that patients would draw their heart larger when depicting their heart with failure as compared with their heart without failure, we evaluated the means and standard deviations of the drawings' height and overall area (Table 1). These figures indicate that the hearts tended to be larger in the "heart now" drawings as compared with the "before heart failure" drawings.

Paired-samples *t* tests were conducted to test whether these differences were significant, and the results indicated a significant difference between the mean height of the heart before heart failure and that of the heart now, with a small effect size [ $t(52)=-2.60$ ,  $P=.01$ , Cohen's  $d=.20$ ]. Thus, drawings of the heart with failure were found to be significantly greater in size when measured by height.

#### Heart drawings and clinical status

Clinical variables included ejection fraction, BNP level, and sodium level. Lower ejection fraction, higher BNP levels, and lower sodium levels are all indicative of increased severity of heart failure [24–26]. Table 2 presents the correlations between the height as well as area of the heart drawings and the clinical variables. There were several significant relationships between objective clinical measures of heart failure and the drawings. A greater BNP level was significantly associated with height of the drawings with heart failure ( $r=.37$ ,  $P<.05$ ), area of the drawings with heart failure ( $r=.45$ ,  $P<.01$ ), and a greater difference in the areas

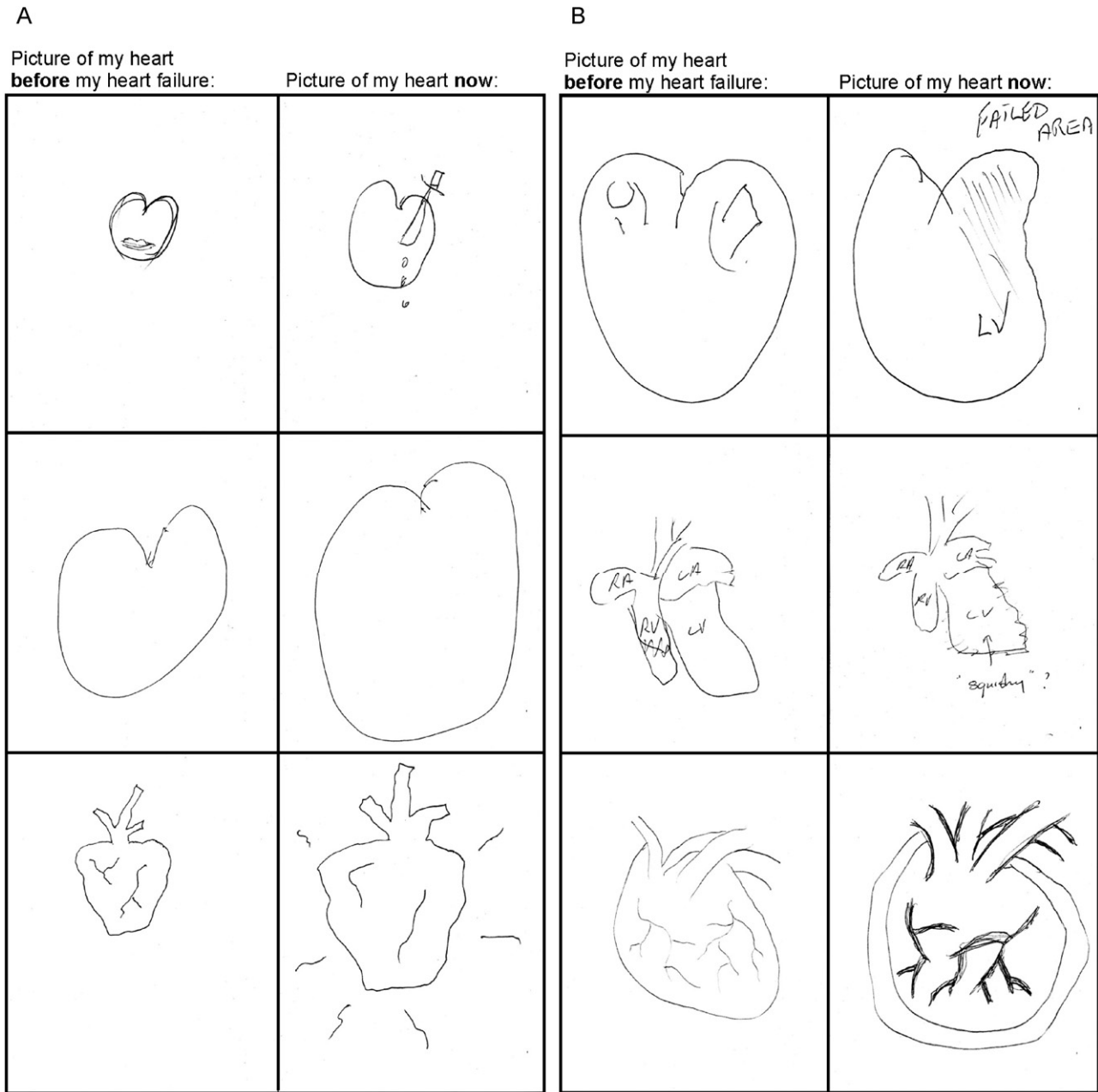


Fig. 1. (A) Three examples of patients' heart drawings being larger when depicted with heart failure. (B) Three examples of patients' heart drawings depicting damage.

of the drawings before and those after heart failure ( $r=.42$ ,  $P<.05$ ). A lower sodium level was significantly associated with a greater difference in the heights of the drawings before and those after heart failure ( $r=-.32$ ,  $P<.05$ ) as well as the areas of the drawings before and those after heart failure ( $r=-.29$ ,  $P<.05$ ). No significant relationship was found between ejection fraction and drawing height or area.

The association between clinical indicators and damage drawn was tested using independent-groups  $t$  tests. No significant difference was found between the patients who did and those who did not draw damage and ejection fraction [ $t(51)=.93$ ,  $P=.36$ ], sodium level [ $t(51)=1.00$ ,

$P=.32$ ], and BNP level [ $t(13)=.61$ ,  $P=.17$ ]. Thus, damage drawn was not found to be associated with more severe clinical indicators.

The cause of heart failure was established from the patients' medical notes and investigated using a two-way contingency table analysis to evaluate whether there was a difference between those whose cause of heart failure was ischemic heart disease and those with other causes. Damage drawn and cause were found to be significantly related [Pearson's  $\chi^2(1, n=54)=8.82$ ,  $P=.003$ , Cramér's  $V=.40$ ]. Thus, people whose heart failure had been caused by ischemic heart disease were significantly more likely to draw damaged

Table 1  
Means and standard deviations for height and area of heart drawings

	<i>n</i>	Mean	S.D.
Height of heart drawing			
Before heart failure	54	5.31 cm	1.97 cm
Now	53	5.72 cm	2.18 cm
Area of heart drawing			
Before heart failure	54	17.95 cm <sup>2</sup>	12.32 cm <sup>2</sup>
Now	53	19.63 cm <sup>2</sup>	14.66 cm <sup>2</sup>

hearts as compared with those who had been diagnosed with heart failure resulting from other causes, which supports the hypothesis that damage drawn would be associated with the cause of heart failure being ischemic heart disease.

### Heart drawings and psychological status

We also investigated the hypothesis that damage drawn on the heart, larger height and area drawings, and greater difference in height and area between heart drawings would be associated with poorer psychological status as indicated by increased levels of anxiety, depression, and impact on emotional quality of life. The relationships between drawing height, area, as well as differences between the height and area of the “before heart failure” and “heart now” drawings and psychological measures were investigated using Pearson’s and Spearman’s correlations (Table 2).

The height and area of the heart drawings correlated significantly with several cardiac anxiety measures. Specific heart-related anxiety, as measured by the CAQ score, was significantly correlated with the heights of “before heart failure” drawings, heights of the “heart now” drawings, areas of the “before heart failure” drawings, and areas of the “heart now” drawings, showing medium to large associations. No significant relationship was found between height or area of the drawings and general anxiety or depression. However, there was a trend for a small association between greater depression and smaller drawings. This is a relationship opposite to the association shown between drawing height and anxiety and may suggest that as depression levels

Table 3  
Means and standard deviations for psychological status measures for patients who drew damage and those who did not draw damage

	Damage drawn ( <i>n</i> =25)	No damage drawn ( <i>n</i> =29)	<i>P</i>
Psychological factors			
CAQ	1.72 (0.56)	1.43 (0.64)	.09
HADS anxiety	7.20 (3.96)	5.00 (4.61)	.07
HADS depression	6.04 (2.79)	4.07 (2.76)	.01*
LHFQ emotional	10.32 (6.53)	7.93 (7.22)	.21
LHFQ physical	21.16 (10.51)	14.38 (10.71)	.02*
Illness perceptions			
Consequences	6.36 (2.51)	4.28 (2.40)	.003**
Timeline <sup>a</sup>	8.68 (2.27)	7.01 (3.30)	.04*
Personal control	4.34 (2.51)	6.12 (2.99)	.03*
Treatment control <sup>a</sup>	8.04 (2.26)	8.41 (1.94)	.52
Identity	5.34 (2.65)	3.59 (2.47)	.02*
Concern	7.00 (3.20)	6.76 (2.84)	.77
Coherence <sup>a</sup>	7.32 (2.73)	7.21 (3.05)	.89
Emotional representation	5.19 (2.98)	3.93 (3.08)	.14

<sup>a</sup> Mann–Whitney *U* tests were conducted.

\* *P* < .05.

\*\* *P* < .01.

increase, the height and area of the drawings decrease. No significant relationship was found between the LHFQ emotional scale and height or area of the drawings. Thus, the hypothesis that larger-sized drawings would be associated with poorer psychological status was supported in terms of specific anxiety about the heart but not general anxiety and depression or emotional quality of life.

To determine whether an association existed between damage drawn on the heart drawings and anxiety, depression, emotional quality of life, and physical quality of life, we conducted independent-groups *t* tests. Mean and standard deviation scores for these measures are indicated in Table 3. A significant difference was found in the mean scores of those who did and did not draw damage and scores on the HADS depression scale (*P* = .01, Cohen’s *d* = .71). Those people who drew damage on their heart scored significantly higher in depression than did those who did not draw damage. No significant difference was found for the

Table 2  
Correlations of height as well as area of heart drawings and measures of medical and psychological status

	Height			Area		
	Drawing height of heart before heart failure	Drawing height of heart now	Difference	Drawing area of heart before heart failure	Drawing area of heart now	Difference
Ejection fraction	.12	-.01	-.19	.13	.13	-.09
BNP level	.26	.37*	.32	.26	.45**	.42*
Sodium level	.04	-.21	-.32*	-.03	-.11	-.29*
CAQ	.28*	.38**	.20	.30*	.28*	.05
HADS anxiety	.01	.15	.20	.04	.06	.10
HADS depression	-.24	-.26	.01	-.16	-.21	-.10
LHFQ emotional	-.06	.04	.11	-.01	-.02	.01

Pearson’s correlations except for BNP level, difference in height of drawings, and that in drawing area variables, \**P* < .05; \*\**P* < .01.

anxiety measures or emotional quality of life. However, the HADS anxiety and CAQ measures indicated a trend that people who drew damage had higher mean anxiety scores as compared with those who drew no damage (Cohen's  $d=.64$ ).

#### *Heart drawings and functional status*

Functional status was evaluated using the LHFQ physical scale. The association between damage drawn and scores on the LHFQ physical scale was assessed using an independent-groups  $t$  test. People who drew damage had a significantly higher median score on the LHFQ physical scale as compared with those who did not draw damage and hence rated their functional status as poorer than did those who did not draw damage.

#### *Heart drawings and illness perceptions*

To evaluate whether larger drawings and greater difference in the height and area of the drawings were associated with negative illness perceptions, Pearson's and Spearman's correlation analyses were conducted. No significant correlation was found ( $P$  values ranged from .29 to .99). The association between negative illness perceptions and damage drawn on the heart was investigated using independent-groups  $t$  tests and Mann–Whitney  $U$  tests. The mean scores on each of the illness perception items are outlined in Table 3.

Significant differences were found between the patients who did and those who did not draw damage for perceptions of consequences (Cohen's  $d=.85$ ), timeline (Cohen's  $d=.59$ ), personal control (Cohen's  $d=.64$ ), and identity (Cohen's  $d=.68$ ). Compared with those who drew no damage, people who drew damage on their heart rated their illness to be more severely affecting their life, perceived a longer timeline for their heart condition, perceived themselves as having less control over their illness, and perceived more severe symptoms.

## **Discussion**

Coping with a chronic illness such as heart failure can have a major impact on the psychological status of patients. Understanding how patients' perceptions and moods are affected by illness is enhanced through the use of assessment tools that go beyond the limits of traditional pen-and-paper questionnaires. This study found that the drawings of patients with heart failure were able to add another dimension to the assessment of psychological status. In particular, the height and area of the patients' drawings of their heart reflected their level of anxiety about their condition, and drawings of damage on the heart were associated with depression, negative perceptions of their illness, and poor physical functioning. These two aspects of the drawings will be discussed further in turn.

The height and area of the heart were important factors in the patients' drawings. Participants in this study drew their heart significantly bigger in height when they depicted their heart with heart failure as compared with when they depicted it before their heart failure. In addition, when anxiety levels were compared across patients, a medium association was found between the height as well as area of the heart drawings (before and after heart failure) and levels of heart-related anxiety. Those who drew larger drawings of their heart had higher levels of heart-related anxiety. These findings are consistent with those of previous work showing that as the psychological significance of the object being drawn increases, the size of the drawings also increases [20,33]. Early research by Craddick [33] found that children's drawings of Santa Claus became larger as Christmas drew nearer, and more recent work with patients who had experienced a myocardial infarction found that those whose drawings increased in size over time experienced increased cardiac anxiety and reported slower return to work [20].

This study did not find that increases in height or area between the drawings before heart failure and those with heart failure were associated with anxiety. In comparison with the recent study by Broadbent et al. [20], which asked participants to draw pictures across different time points and found that anxiety levels of people changed across these times, this current study involved just one time point. As such, patients' anxiety level in this study would have been much the same for the drawing of each picture. Instead, differences in height and area between the drawings in this study are likely to reflect participants' perceptions of what has happened to their heart and may reflect the medical view that the heart becomes enlarged in heart failure [34]. This is supported by the finding that a greater difference in height between the drawings of the heart with and those of the heart without heart failure was associated with more severe heart failure as indicated by BNP and sodium levels. However, this study did not assess the influence of prior medical discussions with health professionals on participants' perceptions of their heart failure. Although it is difficult to measure the exact nature and extent of these medical discussions, they may operate as a potentially confounding variable and so could be usefully investigated in future research.

Damage was the other important feature identified in the patients' drawings of their heart with failure. A strong relationship was found between damage drawn and depression. Those people who drew damage had higher levels of depression and more negative beliefs about their illness as compared with those who did not draw damage. Negative beliefs included perceptions of greater consequences from their heart condition, a longer timeline for their illness, less personal control over the condition, and many more severe symptoms. These findings concur with those of the work conducted by Broadbent et al. [21], which found that damage drawn on the heart is indicative

of negative illness perceptions such as longer illness timeline and less control over the heart condition. A trend also suggested that as depression increased, drawing height and area decreased. This trend is contrary to predictions and to the relationship noted between heart-related anxiety and height as well as area of the heart drawings. It may be the case that depression has a contrasting effect on the size of the drawings as compared with the relationship between size and anxiety. However, this hypothesis needs to be investigated further.

Patients were more likely to draw damage on their heart when their heart failure had been caused by ischemic heart disease than other causes. This may suggest that patients perceive heart disease to cause damage to the heart rather than heart failure per se. Patients with other causes for their heart failure, such as high blood pressure and lung disease, may not associate these causes of heart failure with heart damage. This is supported by the finding that patients who drew damage did not have more severe heart failure as compared with those who did not draw damage.

Drawings appear to be a useful technique for identifying underlying perceptions and issues of importance to overall health status. A number of recent studies have found drawings as a useful adjunct means to explore patients' reactions to their illness in such conditions as heart disease [35], asthma [36], and chronic pain [37]. Obtaining a pictorial representation of patients' illness perceptions seems to have the potential to communicate idiosyncratic beliefs about an illness in a way that words may be unable to do. As a mechanism for evaluating illness perceptions, a simple drawing may have the potential to cut across language barriers, enabling health professionals to better understand perceptions and providing a platform to dispel erroneous beliefs and redirect unhelpful health behaviors.

## Acknowledgments

We thank Dr. Rob Doughty, Dr. Dariusz Korczyk, and Helen Walsh for their assistance with the study.

## References

- [1] Kannel WB, Belanger AJ. Epidemiology of heart failure. *Am Heart J* 1991;121:951–7.
- [2] The National Heart Foundation of New Zealand. Heart failure [cited 2005 July 15]. Available from: <http://www.nhf.org.nz>. 2004.
- [3] The Task Force for the Diagnosis and Treatment of Chronic Heart Failure of the European Society of Cardiology. Guidelines for the diagnosis and treatment of chronic heart failure: executive summary (update 2005). *Eur Heart J* 2005;26:1115–40.
- [4] Massie BM, Shah NB. Evolving trends in the epidemiologic factors of heart failure: rationale for preventive strategies and comprehensive disease management. *Am Heart J* 1997;133:703–12.
- [5] Bonita R, Beaglehole R. Primary prevention of cardiovascular disease in older New Zealanders. Wellington: National Health Committee, 1998.
- [6] MacMahon KMA, Lip GYH. Psychological factors in heart failure: a review of the literature. *Arch Intern Med* 2002;162:509–16.
- [7] Havranek EP, Ware MG, Lowes BD. Prevalence of depression in congestive heart failure. *Am J Cardiol* 1999;84:348–50.
- [8] Westlake C, Dracup K, Fonarow G, Hamilton M. Depression in patients with heart failure. *J Card Fail* 2005;11:30–5.
- [9] Jiang W, Kuchibhatla M, Cuffe MS, Christopher EJ, Alexander JD, Clary GL, et al. Prognostic value of anxiety and depression in patients with chronic heart failure. *Circulation* 2004;110:3452–6.
- [10] Stewart AL, Greenfield S, Hays RD, Wells K, Rogers WH, Berry SD, McGlynn EA, Ware JE. Functional status and well-being of patients with chronic conditions: results from the Medical Outcomes Study. *J Am Med Assoc* 1989;262:907–13.
- [11] Bosworth HB, Steinhauser KE, Orr M, Lindquist JH, Grambow SC, Oddone EZ. Congestive heart failure patients' perceptions of quality of life: the integration of physical and psychosocial factors. *Aging Ment Health* 2004;8:83–91.
- [12] Junger J, Schellberg D, Muller-Tasch T, Raupp G, Zugck C, Haunstetter A, et al. Depression increasingly predicts mortality in the course of congestive heart failure. *Eur J Heart Fail* 2005;7:261–7.
- [13] Carels RA. The association between disease severity, functional status, depression and daily quality of life in congestive heart failure patients. *Qual Life Res* 2004;13:63–72.
- [14] Zigmund AS, Snaith RP. The Hospital Anxiety and Depression Scale. *Acta Psychiatr Scand* 1983;67:361–70.
- [15] Rector TS, Spencer HK, Cohn JN. Patients' self-assessment of their congestive heart failure: Part 2 Content, reliability and validity of a new measure, the Minnesota Living with Heart Failure Questionnaire. *Heart Fail* 1987;3:198–209.
- [16] Weinman J, Petrie KJ, Moss-Morris R, Horne R. The Illness Perception Questionnaire: a new method for assessing illness perceptions. *Psychol Health* 1996;11:431–46.
- [17] Kearney KS, Hyle AE. Drawing out emotions: the use of participant-produced drawings in qualitative inquiry. *Qual Resum* 2004;4:361–82.
- [18] Weber SJ, Mitchell C. That's funny, you don't look like a teacher! Interrogating images and identity in popular culture. London: Falmer Press, 1995.
- [19] Riley S. The creative mind Art therapy. *J Am Art Ther Assoc* 2004;21:184–90.
- [20] Broadbent EA, Ellis CJ, Gamble G, Petrie KJ. Changes in patient drawings of the heart identify slow recovery following myocardial infarction. *Psychosom Med* 2006;68:910–3.
- [21] Broadbent EA, Petrie KJ, Ellis CJ, Ying J, Gamble G. A picture of health—myocardial infarction patients' drawings of their hearts and subsequent disability: a longitudinal study. *J Psychosom Res* 2004;57:583–7.
- [22] Beers MH, Jones TV, Berkwitz M, Kaplan JL, Porter R. The Merck manual of health & aging. Whitehouse Station, NJ: Merck Research Laboratories, 2004.
- [23] Hobbs FDR, Davis RC, Lip GYH. ABC of heart failure: heart failure in general practice. *Br Med J* 2005;320:626–9.
- [24] Yasue H, Yoshimura M, Sumida H, Kikuta K, Kugiyama K, Jougasaki M, et al. Localization and mechanism of secretion of B-type natriuretic peptide in comparison with those of A-type natriuretic peptide in normal subjects and patients with heart failure. *Circulation* 1994;90:195–203.
- [25] Hunt SA, Baker DW, Chin MH, Cinquegrani MP, Feldman AM, Francis GS, et al. ACC/AHA guidelines for the evaluation and management of chronic heart failure in the adult: executive summary. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Revise the 1995 Guidelines for the Evaluation and Management of Heart Failure). *J Am Coll Cardiol* 2001;38:2101–13.
- [26] Leier CV, Dei Cas L, Metra M. Clinical relevance and management of the major electrolyte abnormalities in congestive heart failure: hyponatremia, hypokalemia, and hypomagnesemia. *Am Heart J* 1994;128:564–74.

- [27] Hermann C. International experiences with the Hospital Anxiety and Depression Scale—a review of validation data and clinical results. *J Psychosom Res* 1997;42:17–41.
- [28] Eifert GH, Thompson RN, Zvolensky MJ, Edwards K, Frazer NL, Haddad JW, et al. The Cardiac Anxiety Questionnaire: development and preliminary validity. *Behav Res Ther* 2002;38:1039–53.
- [29] Middel B, Bouma J, van Sonderen E, Crijns H, van den Heuvel W. Psychometric properties of the Minnesota Living with Heart Failure Questionnaire (MLHF-Q). *Clin Rehabil* 2001;15:489–500.
- [30] Bennett SJ, Oldbridge NB, Eckert GJ, Embree JL, Browning S, Hou N, et al. Comparison of quality of life measures in heart failure. *Nurs Res* 2003;52:207–16.
- [31] Broadbent EA, Petrie KJ, Main J, Weinman J. The Brief Illness Perception Questionnaire. *J Psychosom Res* 2006;60:631–7.
- [32] Rasband W, (National Institutes of Health, USA) Images [Software on the internet]. Version 1.27z [cited 2005 August 25]. Available from: <http://rsb.info.nih.gov/ij/>.
- [33] Craddick RA. Size of Santa Claus drawings as a function of time before and after Christmas. *J Psychol Stud* 1961;12:121–5.
- [34] The National Heart Foundation of New Zealand. Living with heart failure. Auckland: The National Heart Foundation of NZ, 2004.
- [35] Guillemin M. Understanding illness: using drawings as a research method. *Qual Health Res* 2004;14:272–89.
- [36] Gabriels RL, Wamboldt MZ, McCormick DR, Adams TL, McTaggart S. Children's illness drawings and asthma symptom awareness. *J Asthma* 2000;37:565–74.
- [37] Turp JC, Kowalski CJ, O'leary N, Stohler CS. Pain maps from facial pain patients indicate a broad pain geography. *J Dent Res* 1998;77:1465–72.