Journal of Psychosomatic Research 94 (2017) 1–9

Contents lists available at ScienceDirect

Journal of Psychosomatic Research

DenHeart: Differences in physical and mental health across cardiac diagnoses at hospital discharge☆

Selina Kikkenborg Berg [a,b,*], Trine Bernholdt Rasmussen [a], Lars Thrysoee [c], Astrid Lauberg [d,h], Britt Borregaard [e], Anne Vinggaard Christensen [b], Ola Ekholm [f], Knud Juel [f], Jette Rolf Svanholm [g]

[a] Department of Cardiology, Gentofte University Hospital, Niels Andersens Vej 65, 2900 Hellerup, Denmark
[b] Department of Cardiology, Rigshospitalet, Copenhagen University Hospital, Blegdamsvej 9, 2100 Copenhagen, Denmark
[c] Department of Cardiology, Odense University Hospital, University of Southern Denmark, Sdr. Boulevard 29, 5000 Odense C, Denmark
[d] Department of Cardiology, Aalborg University Hospital, Hobrovej 18-22, 9000 Aalborg, Denmark
[e] Cardiothoracic- and Vascular Department, Odense University Hospital, Sdr. Boulevard 29, 5000 Odense C, Denmark
[f] National Institute of Public Health, University of Southern Denmark, Øster Farimagsgade 5A, 1353 Copenhagen, Denmark
[g] Department of Cardiology, Aarhus University Hospital, Palle Juul-Jensens Blv. 99, 8200 Aarhus N, Denmark
[h] Department of Cardiothoracic Surgery, Aalborg University Hospital, Hobrovej 18-22, 9000 Aalborg, Denmark

ARTICLE INFO

Article history:
Received 22 September 2016
Received in revised form 22 December 2016
Accepted 4 January 2017

Keywords:
Cardiology
Quality of life
Patient-centered outcomes research
Registries

ABSTRACT

Objective: To describe: (i) differences in patient reported physical and mental health outcomes at hospital discharge between a) cardiac diagnostic groups and b) cardiac patients and a national representative reference population and to describe (ii) in-hospital predicting factors for patient reported outcomes.
Methods: A national cross-sectional survey combined with national register data. From April 2013 to April 2014 all patients (n = 34,564) discharged or transferred from one of five Danish Heart Centres were invited to participate. 16,712 patients (51%) responded; 67% male and mean age 64 years. All diagnostic groups were represented similar to real life proportions. Patient reported outcome measures included: SF-12, Hospital Anxiety and Depression Scale, EQ-5D, Brief Illness Perception Questionnaire, HeartQoL and Edmonton Symptom Assessment Scale.
Results: Statistically significant differences were found in all patient reported outcomes across diagnostic groups. Listed from worst to best outcomes were heart failure, heart valve disease, ischemic heart disease, infectious heart disease, arrhythmia, congenital heart disease and heart transplant. Also "observation for cardiac disease" scored poorly on some aspects such as anxiety and treatment control. Compared to the reference population, cardiac patients had lower physical and mental health scores. Predicting factors for worse outcomes across diagnoses were female sex, older age, being unmarried, planned admission, longer hospital stay, and higher co-morbidity score.
Conclusions: This large nationwide study finds significant differences in patient reported outcomes across cardiac diagnostic groups, however the differences were small and did not reach minimal important difference. The total population of cardiac patients had significant and clinically relevant poorer scores on mental and physical health than the reference population. Predicting factors for poor outcomes were identified. It is the first study comparing all diagnostic groups within cardiology and it provides important benchmarks between diagnostic groups and future comparisons. This knowledge may help clinicians make better decisions about post-hospital care and prevention.

1. Introduction

The risk of poor health outcomes after the onset of cardiac disease is influenced by numerous clinical factors modifiable by disease monitoring, lifestyle changes and medication. However, diagnostic profile and patient reported outcomes seem to play an equally important role in secondary prevention [1].

1.1. Background

The central goals of health care are to help people live longer and live better. In cardiovascular health science the primary focus tends to be on

Abbreviations: B-IPQ, Brief Illness Perception Questionnaire; ESAS, Edmonton Symptom Assessment Scale; HADS, Hospital Anxiety and Depression Scale; ICD, implantable cardioverter defibrillator; MCS, mental component scale; PCS, physical component scale; QoL, quality of life; SE, standard error.

☆ Conflicts of interest and sources of funding: The study was funded by the Danish Heart Centres and the Novo Nordisk Foundation (NNF13OC0007229). The research presented was investigator initiated. The study funders played no role in the study. The authors report no conflicts of interest.

* Corresponding author at: Department of Cardiology, Rigshospitalet, Blegdamsvej 9, DK-2100 Copenhagen, Denmark.
E-mail address: selina@rh.dk (S.K. Berg).

http://dx.doi.org/10.1016/j.jpsychores.2017.01.003
0022-3999/

health behaviour (e.g. smoking and diet) and clinical health factors (e.g. blood pressure) as metrics of cardiovascular health [1]. These factors are of high importance; however, patient reported health status reflects the impact of disease and treatment on e.g. patients' symptom burden, functional status and quality of life (QoL), as perceived by the patient and is an important measure of health.

Previous studies have found associations between heart disease, self-reported health and morbidity and mortality, and that patient reported outcome measures can predict prolonged hospital stay, labour market affiliation, morbidity and mortality in cardiac patients [2–5]. QoL and anxiety scores seem to provide important prognostic information, independent of traditional clinical data. High QoL scores and low anxiety scores have been associated with longer survival in patients with e.g. ventricular arrhythmias and coronary artery disease [6–8]. Furthermore, psychosocial factors account for 39% of the risk of myocardial infarction, and an overwhelming 67% in women alone, whereas smoking accounts for 29%, hypertension 21% and lipids 45% [9]. However, no studies have investigated patient reported outcomes in all diagnostic groups within cardiology and comparisons are not possible due to different times of measurement, different instruments and lack of power. Furthermore, additional research is needed to better understand the determinants and the predicting factors of patients' health status [1].

The overall aim of the DenHeart survey was to gain knowledge about patient reported outcomes regarding health among cardiac patients at hospital discharge [10]. The study results will provide important benchmark for between-diagnostic comparison. Knowledge about patients' own perception of their health status and predicting factors can guide in-hospital and out-patient practice as well as general practitioners and local secondary prevention teams to make better decisions about post-hospital care to prevent mortality, disease progression and readmission and to make evidence based decisions about priorities in the use of resources. Comparing outcomes with a national representative reference population are useful benchmarks for realistic goal setting in health care and trial design.

1.2. Objectives

The objectives of this paper were to describe: (i) differences in patient reported outcomes at hospital discharge between a) cardiac diagnostic groups and b) cardiac patients and a national representative reference population and to describe (ii) in-hospital predicting factors for patient reported outcomes.

2. Methods

2.1. Study design

The DenHeart study was designed as a cross-sectional survey combined with national registry data. The methods and publication plan were thoroughly described in the published study protocol [10].

2.2. Setting and participants

Over one year (April 15th 2013 to April 15th 2014) all patients (34,564) discharged or transferred from the five Danish Heart Centres were asked to fill out a questionnaire at hospital discharge to evaluate patient reported outcomes across cardiac diagnostic groups.

2.2.1. Eligibility criteria

All patients were consecutively invited to participate. Patients under 18 years of age, patients without a Danish civil registration number and patients who did not understand Danish were excluded from the study. Reasons for non-response were registered.

2.2.2. Recruitment

Patients were asked to complete and return a questionnaire within 3 days of discharge and return it by mail. Patients were recruited by a ward nurse or by a research assistant nurse. All nurses at the Heart Centres, approximately 800, were informed about the study and procedures at ward meetings, guidelines were distributed and a website established (DenHeart.dk). The questionnaire was distributed with a postage prepaid envelope. Patients with repeated hospitalizations completed a questionnaire at each discharge. Only the first completed questionnaire was included for the present analyses.

2.2.3. Reference population

The reference population derives from the nationally representative Danish Health and Morbidity Survey 2013 [11]. The survey was based on a random sample of 25,000 adult Danes. In all, 14,265 individuals completed the questionnaire (57%).

2.3. Variables

The DenHeart questionnaire consisted of a series of well-validated questionnaires and a number of ancillary questions. The questionnaire consisted of 80 questions. It was tested for feasibility and took approximately 20 min to fill out. The following validated questionnaires were included: The Short Form-12 (SF-12), measuring overall health status, generating both a physical (PCS) and a mental component score (MCS) with higher scores indicating better health status [12]. A Cronbach's alpha of 0.87 and 0.84 for PCS and MCS respectively have been reported in a population of coronary heart disease patients [13]. The Hospital Anxiety and Depression Scale (HADS), a 14-item questionnaire that assesses levels of depression and anxiety in medically ill patients [14]. Scores of 8 to 10 suggest the presence of a mood disorder. Scores ≥ 11 indicate the probable presence of a mood disorder. HADS is a valid and internally consistent measure, with a mean Cronbach's alpha of 0.83 and 0.82 for the HADS-A and HADS-D respectively [15]. EQ-5D, a 6-item standardized instrument for use as a measure of current health status. Higher scores indicate better health status [16]. An overall Cronbach's alpha of 0.73 has been found in a population of coronary heart disease patients [13]. The Brief Illness Perception Questionnaire (B-IPQ), a short questionnaire that assesses cognitive and emotional representations of illness on the basis of eight items. A higher score on the B-IPQ reflects a more threatening view of illness. B-IPQ has good reliability and has shown good predictive validity among patients recovering from myocardial infarction [17]. HeartQoL, an illness specific questionnaire that measures QoL in cardiac patients and produces a global score and two subscales: a physical and an emotional scale with higher scores indicating better QoL status. The questionnaire has proven to be a reliable instrument with a Cronbach's alpha between 0.80 and 0.91 for the global score and each subscale [18,19]. The Edmonton Symptom Assessment Scale (ESAS), a 10 item questionnaire that allows patients to rate their symptoms on a visual numeric scale. Higher scores indicate the presence and intensity of the symptoms. Cronbach's alpha between 0.80 and 0.91 for the global score and each subscale [20]. The survey also included nine questions about health and health behaviour (height, weight, smoking, alcohol) from The Danish Health and Morbidity Survey [11], three questions about preparation for discharge from the Danish National Survey of Patient Experiences and one question regarding medication adherence.

Data from the following Danish national registers were collected on all identified patients: The Danish Civil Registration System, The Danish National Patient Register, Danish Education Registers, and Danish registers on personal income and transfer payments [21].

To combine questionnaire data with data from the registers all questionnaires were matched with a hospital discharge from the Danish National Patient Register. To calculate the number of possible responders, a list of all patients discharged from a Heart Centre in the study period was reviewed.

Responders were divided into seven diagnostic groups based on their ICD-10 primary action diagnosis obtained from the Danish National Patient Register. The diagnostic groups were defined as follows: ischemic heart disease: I20–I25, T823D, Z95.1, Z95.5; arrhythmia: I44–I46, I46.9, I47–I49, Z95.0,R00.0, R00.1, R00.2, R00.8A, T75.0, T75.4, T82.1, T82.8; heart failure: I11.0, I42.0–I43.8, I50, I51.7, R57.0; congenital heart disease: Q00–Q99, I27.8A, I27.9, I28.0; infectious heart disease: I30.0–I32.0, I33, I38.9–I39.0, I40.0–I41.8, I32.8, I39.8, I51.4, T82.6, T82.7; heart valve disease: I05.0–I06.0, I34.0–I37.2, I39.1, I39.2, I51.1A, Z95.2–Z95.4; heart transplant: T86.2–T86.3, Z94.1, Z94.3. Two further groups were defined: other diagnoses (e.g. pulmonary embolism with mention of acute cor pulmonale, primary pulmonary hypertension, thoracic aortic aneurysm without mention of rupture, benign neoplasm of the heart): D15.1, E78.0, E78.5, I10.9, I11.9, I26.0, I27.0, I27.2, I27.8, I27.9A, I51.0, I51.3B, I51.8, I51.9, I71.0-I71.4, I71.6, I71.9, J81.9, J96.0, J96.9, S25.0, S26.0, S26.8, S26.9, Z95.8, Z95.9 and observation for heart disease (patients discharged with a non-cardiac diagnose, e.g. observation for suspected myocardial infarction, chest pain, syncope and collapse): R01.1, R06.0, R07.1–R07.4, R42.9, R55.9, Z03.4, Z03.5, Z82.4.

Information on co-morbidity was obtained from the Danish National Patient Register and calculated 10 years back, not including the index discharge. Both primary and secondary diagnoses were included. We calculated the Tu comorbidity index [22] for all patients going back 10 years. The following diseases are included in the Tu score: congestive heart failure, cardiogenic shock, arrhythmia, pulmonary oedema, malignancy, diabetes, cerebrovascular disease, acute/chronic renal failure, chronic obstructive pulmonary disease. All diagnoses are weighted equal.

2.4. Sample size

34,564 cardiac patients discharged from national Heart Centres over one year were included in order to secure a high level of specificity.

2.5. Statistical methods

All statistical analyses of continuous outcomes were based on standard regression methods and the normal distribution. Age standardized means were calculated by using the age distribution among responders as a reference. The expected scores were calculated within groups defined for diagnosis, age and sex based on a regression model. To compare means across all diagnostic groups we used the F-test and for comparison of frequencies the Pearson χ^2-test was used.

Comparison data from the Danish reference population were obtained from the Danish Health and Morbidity Survey 2013 [11] and consisted of a representative sample of the Danish population. Data were collected via a self-administered questionnaire. Mean scores and proportions for the reference population were age standardized and tests for differences between responders and the reference population were adjusted for sex and age.

All regression analyses of patient reported outcomes (Table 3) were adjusted for sex, age, marital status, length of hospital stay, type of hospitalization, Tu co-morbidity score and diagnostic group. Linear regression was used for continuous outcomes and logistic regression was used for binary outcomes.

In all analyses observations with missing data were excluded. All analyses were conducted using SAS version 9.3.

2.6. Deviations from pre-specified protocol

Originally, the plan was to use weighting to deal with missing data in the analyses [10]. However, responders and non-responders were very similar in terms of age, sex, diagnoses and education. The patient reported outcomes were age standardized in order to make comparisons between groups more true to diagnostic differences.

2.7. Ethics approval

The study complies with the Declaration of Helsinki. According to Danish legislation, surveys do not have to be approved by an ethics committee system (H-4-2013-FSP) but rather by the Danish Data Protection Agency (2007-58-0015/30-0937). Use of register data was permitted by The Danish National Board of Health (FSEID-0001131). DenHeart is registered at ClinicalTrials.gov (NCT01926145) and approved by the Institutional Boards of the Heart Centres. Patients signed an informed consent.

3. Results

A total of 34,564 patients were discharged from April 15th 2013 to April 15th 2014. Most, 33,060 were eligible and 16,712 patients completed the questionnaire, Fig. 1. The response rate was 51%.

3.1. Demographic and clinical profile

Demographic information is presented for both responders and non-responders in Table 1. Characteristics seem to be similar with respect to age and clinical profile; however, males are slightly overrepresented as are married and higher income. Differences occur across diagnoses.

Mean age was 64 years, 67% were male, more than half were married and most had primary school incl. high school (35%) or short cycle higher education (45%). Regarding comorbidity, 44% had no comorbidities, 31% had one, 16% had two and 9% had three or more comorbidities, Table 1.

3.2. Differences between diagnostic groups in patient reported outcome at hospital discharge

Listed from worst to best overall patient reported outcomes were heart failure, heart valve disease, ischemic heart disease, infectious heart disease, arrhythmia, congenital heart disease and heart transplant. Significant differences between diagnostic groups were found between groups in all patient reported outcome domains. Table 2, however, the differences must be considered small as they do not reach minimal important difference between most of the groups which is suggested to be: SF-12: 2 points for PCS and 3 points for MCS [23], HADS: 1.5 points or 20% [24] and HeartQoL: 0.35 point [25,26]. Patients discharged with a non-cardiac diagnosis or without a diagnosis, labelled observation for heart diseases (typically discharged for further outpatient diagnostic work) had poorer outcomes, especially in anxiety and treatment control, comparable to heart failure and heart valve disease patients.

Approximately 32.12% of cardiac patients showed HADS scores reflecting possible anxiety disorder and 19.15% possible depression. The proportions with probable anxiety ranged from 27.68 to 32.68% except for heart transplant patients where the proportion was 11.68%. Depression was most prevalent among patients with heart failure (24.70%), while heart transplant (11.18%) and arrhythmia (16.66%) had the lowest proportions. Heart failure patients were more likely to report a high Symptom Distress Score and less good or poor physical shape whereas heart transplant and arrhythmia patients reported the best outcomes. A total of 5.73% of all responders forgot to take their medication more than once a week prior to hospitalization.

3.3. Cardiac patients vs. reference population

Compared to the reference population, cardiac patients reported statistically significant worse physical health measured on the SF-12 PCS (42.53 (SD 11.08) vs. 47.73 (SD 13.36), $p < 0.001$) and mental health measured on the SF-12 MCS (48.22 (SD 10.86) vs. 51.52 (SD

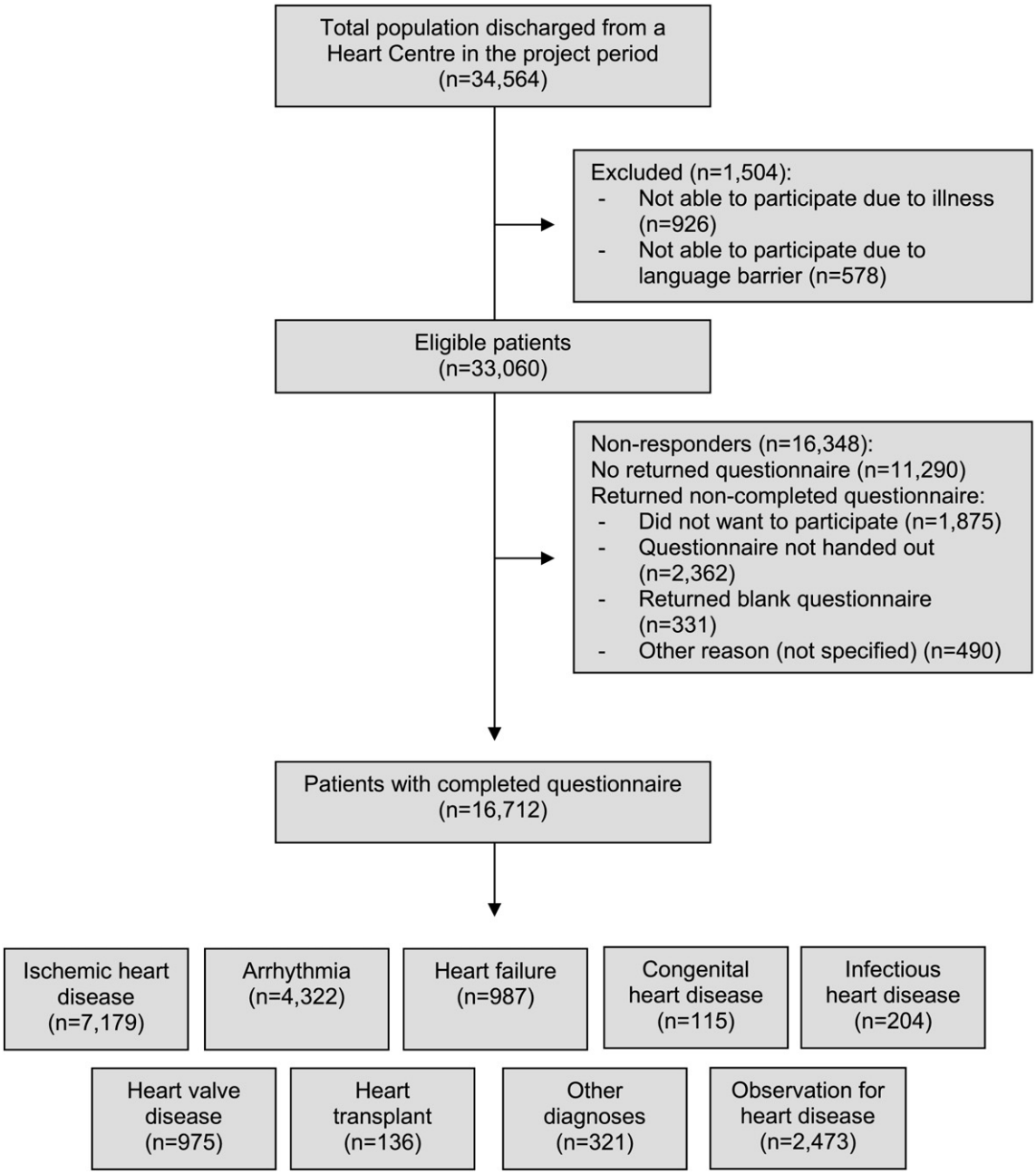

Fig. 1. Flow-chart.

14.70), $p < 0.001$). A higher proportion of cardiac patients also reported less good or poor physical shape (33% vs. 20%, $p < 0.001$) and more patients experienced feeling alone (27% vs. 21%, $p < 0.001$). However, few lacked someone to talk to (4% vs. 5%, $p = 0.08$).

3.4. Predictors of patient reported outcomes

Predictive factors of worse patient reported outcome scores were found across diagnoses to be female sex, older age, unmarried, longer hospital stay and higher co-morbidity score, whereas acute hospitalization was a predictor of better SF-12 PCS and better HeartQoL global score, Table 3.

After adjustment for sex, age, marital status, length of hospital stay, type of hospitalization and co-morbidity diagnostic differences in patient reported outcomes remain, Table 3.

4. Discussion

In summary, statistically significant differences were found in all patient reported outcomes across diagnostic groups. Listed from worst to best patient reported outcomes were heart failure, heart valve disease, ischemic heart disease, infectious heart disease, arrhythmia, congenital heart disease and heart transplant. The differences were very small and cannot be considered clinically relevant. Most diagnoses have similar scores with proportions of depression and anxiety around 20–30%. Patients discharged without a cardiac diagnose had poor scores in some outcomes e.g. anxiety and treatment control. Compared to the reference population patients had lower scores on physical and mental health. Looking at predicting factors for poor outcomes, worse patient reported outcomes were found across diagnoses to be predicted by female sex, older age, unmarried, longer hospital stay and higher co-morbidity score. Acute hospitalization was a predictor of better physical health and QoL at hospital discharge.

Table 1
Demographic and clinical data for all patients treated, responders/non-responders and according to diagnostic group.

	Responders/ non-responders	Ischemic heart disease Responders/ non-responders	Arrhythmia Responders/ non-responders	Heart failure Responders/ non-responders	Congenital heart disease Responders/ non-responders	Infectious heart disease Responders/ non-responders	Heart valve disease Responders/ non-responders	Heart transplant Responders/ non-responders	Other diagnoses Responders/ non-responders	Observation for heart disease Responders/ non-responders
Characteristics										
n	16,712/16,348	7179/6338	4322/3540	987/942	115/218	204/404	975/958	136/132	321/680	2473/3136
Male, %	67/62	73/67	65/60	73/70	47/56	75/68	66/58	74/79	61/61	53/53
Age, mean	64.3/64.5	65.5/66.3	63.6/65.2	65.4/66.0	43.9/41.8	59.4/58.5	71.2/71.9	51.2/54.4	61.4/65.8	61.5/59.8
Married, %	64/55	65/57	65/54	60/53	44/33	66/53	60/55	57/61	62/53	63/54
Educational level, %										
Basic school	31/38	32/41	27/34	34/38	39/42	28/31	40/41	26/44	24/38	32/36
Upper secondary or vocational school	43/39	45/39	42/38	45/40	36/36	43/39	39/35	40/36	49/40	42/39
Higher education	24/19	21/17	29/24	19/16	22/17	25/25	20/19	28/18	26/18	24/21
No information	2/4	2/4	2/5	2/6	4/5	4/5	2/5	6/2	2/4	2/4
Income, mean in 1000 DKK	229/210	224/207	247/220	237/200	203/185	218/230	198/204	206/240	207/199	226/207
Co-morbidity ten years back, %										
Hypertension	34/36	36/38	32/36	34/37	15/14	27/29	39/45	63/70	46/40	28/28
Ventricular arrhythmia	4/4	2/2	8/8	11/11	3/3	4/2	2/2	18/16	2/2	1/2
Ischemic heart disease	41/37	56/50	25/26	45/43	10/11	17/21	33/34	45/41	25/23	31/30
Myocardial infarction	17/17	24/25	11/11	24/20	2/5	6/6	10/12	27/20	4/8	9/11
PCI	16/14	26/23	8/7	15/13	2/1	3/4	10/8	34/51	7/7	8/9
CABG	4/3	5/4	3/2	6/6	2/0	6/4	4/4	2/2	2/3	2/2
Diabetes without complications	12/13	14/16	9/11	17/17	5/8	11/11	13/13	22/18	6/9	10/10
Heart failure	16/17	11/12	17/19	68/65	10/12	10/11	19/21	77/64	10/10	6/8
Renal disease	3/4	3/4	3/4	6/7	6/4	4/7	5/3	22/29	3/4	2/3
Chronic obstructive pulmonary disease	7/10	6/10	6/9	12/13	7/11	4/5	8/12	4/7	9/13	6/8
Tu co-morbidity score, %										
0	44/44	58/54	18/22	17/17	48/59	56/48	43/37	10/10	57/48	61/58
1	32/30	27/27	49/42	27/26	32/23	25/26	31/32	21/21	25/32	25/25
2	15/16	10/12	23/23	32/31	13/10	11/15	15/18	33/26	10/14	10/12
≥3	8/10	6/7	10/13	24/26	7/8	9/10	11/13	36/43	8/6	5/6
Life style factors, %[a]										
BMI < 18.5, %	1	1	1	2	6	3	1	3	2	2
BMI ≥ 25, %	66	70	63	64	46	57	59	55	71	64
BMI ≥ 30, %	24	26	23	27	14	14	21	18	23	24
Ever smoked, %	67	73	61	71	49	60	64	57	56	61
Smokes daily, %	13	15	11	11	10	12	8	5	10	15
Alcohol intake above high risk limit, %[b]	8	8	7	8	6	8	10	3	7	6

SE = standard error; PCI = percutaneous coronary intervention, CABG = coronary artery bypass graft, BMI = body mass index.

[a] Information about BMI, smoking and alcohol consumption was included in the DenHeart questionnaire. Therefore, these parameters are only presented for the responders.

[b] The Danish National Board of Health defines the high risk limit for alcohol consumption as a weekly intake of >21 standard drinks for men and >14 standard drinks for women.

4.1. Limitations

As the most seriously ill patients were not able to participate in the survey the responding patients may not be completely representative of the total target population. The proportions of patients in each diagnostic group are similar among responders and non-responders which indicate that no serious systematic errors in response occurred.

4.1.1. Confounding factors

Self-reported outcomes are by nature not objective and therefore, sources of bias may exist. In self-reporting of e.g. physical activity, alcohol and weight, social desirability bias can be an issue, as respondents answer according to what they believe is socially acceptable [27]. The validity and coverage of the Danish National Patient Register has been investigated and sources of errors when retrieving data from the register are e.g. issues regarding the right definitions, changes in coding over time and errors in or lack of registration. It is known internationally to be the most comprehensive of its kind and is a very important register for biomedical and public health research [28]. Multiple testing is always a concern in exploratory studies. A pre-planned protocol was followed.

4.1.2. Non-response

The patients treated at the Heart Centres are often aged and severely ill, which may be reflected in the response rate of 51%. In general, studies presenting patient reported outcomes are known to have a lower response rate than other studies [27]. Missing data was between 2 and 4% for most outcomes. For the SF-12 PCS and MCS it was higher at 19% and for the question regarding medication use missing data was 17%.

4.2. Interpretation

The proportions of patients reporting probable anxiety and depression and levels of perceived health found in the diagnostic groups are in line with previous reports [8,29–32].

The heart failure group had the worst overall patient reported outcome scores. Patients with heart failure are known to have high depression and anxiety rates of up to 30 and 40% [33,34]. Furthermore low QoL rates has previously been reported numerous times [35,36] and is reported to be lower than in patients with advanced cancer and amyotrophic lateral sclerosis [37]. Patients with heart failure have a chronic condition and high co-morbidity. They live in fear of losing a sense of control [38]. The association between depression and heart failure appears to be related both to the psychological aspects of severe heart disease, and to pathophysiological and psychosocial mechanisms. The presence of depression is associated with a worsening of the prognosis, and increased risk of death, re-hospitalization, and functional decline [39].

Following patients with heart failure, heart valve disease patients reported the worst patient reported outcomes. The co-morbidity burden in patients with valve disease is lower than among patients with heart failure and is comparable to both the arrhythmia and the heart transplant patients, who report better patient reported outcomes. However, patients with heart valve disease report high symptom distress and undergo cardiac surgery, from which, studies show, they recover slowly and suffer substantial complications [29].

Patients with ischemic heart disease also report scores in the worse half. They have one of the highest mean anxiety score. Patients with ischemic heart disease can experience post-traumatic stress related to anxiety and fear of dying [40]. However post-traumatic stress is also found in patients with e.g. heart failure and implantable cardioverter defibrillator [41,42].

Although infectious heart diseases, for the most part, are acute, transient afflictions, this diagnostic group reported noticeably poor patient reported outcomes. Included in this group are patients with infective endocarditis, who have undergone a lengthy and aggressive treatment [43,44]. Patients report considerably reduced physical functioning as well as psychological distress following treatment as well as low treatment control [45].

The group of patients with arrhythmia was placed in the upper part of best patient reported outcome scores at time of discharge from hospital. Compared to other research this is somewhat surprising. Withers et al. found a lower QoL due to considerable problems with fear and anxiety in patients with symptomatic cardiac arrhythmias [46]. A systematic review shows that patients with atrial fibrillation have significantly poorer QoL compared to healthy controls, the general population, and other patients with cardiac diseases [47]. None of the above studies were performed on discharge, suggesting a change in patient reported outcomes as time passes, which was also found in patients with pacemaker [48]. Patients with ICD have previously been found to have high levels of anxiety, up to 38% and depression, around 15–25% of patients. Furthermore, patients are struggling with the risk of sudden cardiac death and shock [49].

Patients with congenital heart disease were in the best end of the spectrum of patient reported outcome scores. According to Berghammer et al. even patients with single ventricle defects which are among the most complex congenital heart defects, have a feeling of being strong and healthy [50].

The patients with heart transplants had similar co-morbidity scores to heart failure patients; however their patient reported outcome scores were in the best end of the spectrum. Better patient reported outcome scores were also previously found in patients after heart transplant compared to outcomes of patients with aortic valve replacement and ventricular assist device [51]. Patients with heart transplant still experience burden of disease and reduced life expectancies [52], however their everyday symptoms might be fewer and less invalidating compared to other diagnostic groups. Another factor that must be considered is that the heart transplanted patients are seen in-hospital for regular check-ups, so they might not be admitted due to worsening of disease or for a procedure, which is the case for the other diagnostic groups. They therefore might be less stressed. Depression scores found in the DenHeart study is similar to those found 12 months after transplantation in another study 3.07 vs. 3.7 and anxiety scores are higher at discharge in DenHeart than after 12 months 3.39 vs. 5.0 [53].

Patients discharged with no cardiac diagnosis had poor patient reported outcomes. Uncertainty is very difficult for people to cope with [54] and these patients might still be experiencing a large symptom burden. Some of the patients might suffer from mental disorder or somatisation. This is a group that certainly needs attention after discharge and further analyses will be performed following this group in the registers to see if they suffer from cardiac disease, psychiatric disease or continue to live without a diagnosis.

Studies conducted 6–12 months after discharge have also found differences between various diagnostic groups and healthy controls e.g. patients with ICD [8], valve disease [29], and heart transplantation [30]. It is not surprising that these differences exist due to the burden of cardiac disease. For congenital heart disease both the SF-36 scores and the HADS scores have previously been found to be comparable to a reference population [55]. Mean values of healthy controls are useful benchmarks for realistic goal setting in health care and trial design.

Previous studies on selected diagnostic groups also point at female sex, higher age, living alone and co-morbidity as predictors of poor patient reported health [8,56,57]. Acute admission was a predictor of better physical health and QoL which may be explained by less comorbidity and recent onset of disease. Perceived health has previously been found to predict length of stay [5]. We now see the same tendency the other way around that patient reported outcomes

Table 2
Patient reported outcomes on health related quality of life, anxiety, depression and illness perception (age standardized).

	Responders	Ischemic heart disease	Arrhythmia	Heart failure	Congenital heart disease	Infectious heart disease	Heart valve disease	Heart transplant	Other diagnoses	Observation for heart disease	p*
n	16,712	7179	4322	987	115	204	975	136	321	2473	
SF-12, mean (SD)											
PCS	42.53 (11.08)	41.60 (10.66)	44.20 (10.61)	37.17 (10.58)	41.60 (10.67)	40.96 (10.59)	39.90 (10.65)	44.90 (10.62)	40.49 (10.59)	44.12 (10.64)	<0.001
MCS	48.22 (10.86)	48.46 (10.89)	48.56 (10.84)	46.40 (10.80)	48.81 (10.90)	47.15 (10.82)	47.06 (10.88)	53.41 (10.85)	48.88 (10.82)	47.87 (10.87)	<0.001
HADS											
HADS-A, mean (SD)	5.85 (4.22)	5.95 (4.21)	5.52 (4.19)	5.94 (4.18)	5.49 (4.22)	5.35 (4.19)	6.01 (4.22)	3.39 (4.20)	5.91 (4.19)	6.21 (4.20)	<0.001
HADS-A ≥ 8, %	32.12	32.98	29.69	32.68	27.88	27.68	32.24	11.68	32.54	34.86	<0.001
HADS-D, mean (SD)	4.28 (3.69)	4.34 (3.69)	3.92 (3.67)	5.14 (3.67)	4.03 (3.70)	4.41 (3.67)	4.67 (3.71)	3.07 (3.68)	4.72 (3.67)	4.21 (3.68)	<0.001
HADS-D ≥ 8, %	19.15	19.71	16.66	24.70	16.91	17.69	20.68	11.18	22.23	19.43	<0.001
EQ-5D, mean (SD)											
EQ-5D 5L crosswalk	0.76 (0.16)	0.76 (0.16)	0.70 (0.16)	0.73 (0.16)	0.77 (0.16)	0.73 (0.16)	0.74 (0.16)	0.82 (0.16)	0.73 (0.16)	0.76 (0.16)	<0.001
EQ-5D VAS	69.26 (19.79)	68.55 (19.65)	72.18 (19.56)	61.42 (19.53)	69.86 (19.71)	68.36 (19.55)	66.05 (19.70)	75.97 (19.59)	65.32 (19.54)	70.47 (19.61)	<0.001
B-IPQ, mean (SD)											
Consequences	4.57 (2.77)	4.62 (2.76)	4.37 (2.75)	5.57 (2.74)	4.37 (2.77)	4.77 (2.74)	5.16 (2.77)	3.54 (2.75)	5.04 (2.74)	4.15 (2.75)	<0.001
Timeline	5.14 (3.60)	5.18 (3.57)	5.03 (3.55)	7.17 (3.55)	5.25 (3.58)	4.66 (3.55)	4.65 (3.58)	6.45 (3.56)	5.42 (3.55)	4.53 (3.56)	<0.001
Personal control	5.84 (3.05)	5.93 (3.05)	5.85 (3.04)	5.44 (3.04)	6.48 (3.06)	6.13 (3.04)	5.74 (3.07)	7.77 (3.05)	5.69 (3.04)	5.64 (3.05)	<0.001
Treatment control	8.18 (2.32)	8.24 (2.32)	8.36 (2.30)	8.11 (2.30)	8.38 (2.32)	8.16 (2.30)	8.62 (2.32)	8.54 (2.31)	8.10 (2.30)	7.82 (2.31)	<0.001
Identity	4.47 (2.73)	4.44 (2.73)	4.44 (2.72)	5.28 (2.71)	4.21 (2.74)	4.36 (2.71)	4.62 (2.74)	3.50 (2.72)	4.60 (2.71)	4.28 (2.72)	<0.001
Concern	4.91 (3.03)	5.07 (3.01)	4.62 (3.00)	5.40 (3.00)	4.23 (3.02)	4.75 (3.00)	5.12 (3.03)	2.67 (3.01)	5.08 (3.00)	4.78 (3.01)	<0.001
Coherence	7.51 (2.72)	7.70 (2.68)	7.73 (2.67)	7.53 (2.67)	7.88 (2.69)	7.12 (2.67)	7.76 (2.69)	8.96 (2.68)	7.32 (2.67)	6.39 (2.68)	<0.001
Emotional representation	4.07 (3.03)	4.11 (3.02)	3.94 (3.00)	4.32 (3.00)	3.92 (3.03)	3.83 (3.00)	4.07 (3.03)	2.73 (3.01)	4.25 (3.00)	4.12 (3.01)	<0.001
HeartQoL, mean (SD)											
HeartQoL global	1.78 (0.78)	1.74 (0.76)	1.87 (0.76)	1.45 (0.76)	1.81 (0.76)	1.64 (0.76)	1.57 (0.77)	2.13 (0.76)	1.72 (0.76)	1.92 (0.76)	<0.001
HeartQoL physical	1.65 (0.88)	1.60 (0.85)	1.76 (0.84)	1.25 (0.84)	1.69 (0.85)	1.49 (0.84)	1.39 (0.85)	1.97 (0.85)	1.57 (0.84)	1.85 (0.85)	<0.001
HeartQoL emotional	2.10 (0.83)	2.09(0.83)	2.15 (0.83)	1.97 (0.83)	2.12 (0.83)	2.03 (0.83)	2.03 (0.83)	2.55 (0.83)	2.12 (0.83)	2.11 (0.83)	<0.001
ESAS, mean (SD)											31
Symptom Distress Score	19.96 (16.70)	20.64 (16.67)	17.29 (16.59)	24.37 (16.56)	18.48 (16.72)	21.58 (16.58)	22.51 (16.72)	14.09 (16.62)	21.04 (16.57)	20.13 (16.62)	<0.001
Physical shape											
Less good or poor, %	33.54	33.99	27.14	49.86	32.46	38.00	37.61	28.94	39.20	27.83	<0.001
Feeling alone											
Sometimes or often, %	26.69	27.04	25.23	27.60	33.69	22.77	25.81	27.70	28.12	28.32	0.126
Someone to talk to about problems or when in need of support											
No, never or almost never, %	4.02	4.19	3.99	3.85	2.47	2.72	3.69	2.09	3.47	4.20	0.761
Forgetting medication prior to hospitalization											
Daily or more than once a week, %	5.73	6.72	3.99	5.85	2.26	7.11	6.44	1.46	6.15	6.75	<0.001

HADS-A = Hospital Anxiety and Depression Scale -Anxiety; HADS-D = Hospital Anxiety and Depression Scale -Depression; PCS = physical component score; MCS = mental component score; B-IPQ = Brief Illness Perception Questionnaire; SD= standard deviation.
*Differences in means between all diagnostic groups were tested using the F-test. Differences in proportions between all diagnostic groups were tested by the Pearson χ^2- test.

Best **Middle** **Worst**

are predicted by length of stay which underpins a strong association between the two.

4.3. Generalizability

This national study was carried out in Denmark and international differences may exist in treatment as well as culture and social behaviour [9]. However, international guidelines for treatment are followed in Denmark and there is no reason to believe that the differences between diagnostic groups should differ much between countries. The response rate was 51% which is not unexpected in a population of severely ill patients. At the five including sites response rates varied from 37 to 58% and number of questionnaires that were not handed out varied from 5 to 16%. Response rates varied between diagnostic groups. However, responders and non-responders have similar characteristics in terms of demographic and clinical variables and the diagnostic groups represent the same proportion responders and all patients discharged pointing at no systematic error in non-response.

Table 3
In-hospital and demographic predictors of health-related quality of life, anxiety and depression and symptom burden at hospital discharge.

	PCS	MCS	HADS-A ≥ 8	HADS-D ≥ 8	EQ-5D 5L crosswalk	HeartQoL global	Symptom Distress Score
	β (95% CI)[a]	β (95% CI)[a]	OR (95% CI)[b]	OR (95% CI)[b]	β (95% CI)[a]	β (95% CI)[a]	β (95% CI)[a]
Women vs. men	−2.31 (−2.69; −1.92)[c]	−2.69 (−3.10; −2.28)[c]	1.65 (1.53;1.78)[c]	1.23 (1.13; 1.34)[c]	−0.03 (−0.04; −0.03)[c]	−0.19 (−0.21; −0.16)[c]	3.54 (2.97; 4.11)[c]
Age (years)	−0.15 (−0.16; −0.14)[c]	0.06 (0.04; 0.07)[c]	0.98 (0.979; 0.984)[c]	0.995 (0.992; 0.999)[c]	0.0003 (0.0001; 0.0005)[c]	−0.01 (−0.007; 0.005)[c]	−0.04 (−0.06; −0.01)[c]
Married vs. unmarried	1.27 (0.89; 1.64)[c]	1.55 (1.16; 1.95)[c]	0.90 (0.83; 0.96)[c]	0.80 (0.73; 0.87)[c]	0.02 (0.01; 0.02)[c]	0.12 (0.09; 0.14)[c]	−2.15 (−2.70; −1.60)[c]
Length of hospital stay (days)	−0.23 (−0.28; −0.18)[c]	−0.13 (−0.18; −0.08)[c]	1.02 (1.01; 1.02)[c]	1.02 (1.01; 1.03)[c]	−0.004 (−0.004; −0.003)[c]	−0.02 (−0.021; −0.015)[c]	0.30 (0.23; 0.37)[c]
Acute vs. planned hospitalization	1.08 (0.70; 1.45)[c]	0.36 (−0.04; 0.76)	1.06 (0.98; 1.14)	1.11 (1.01; 1.21)[c]	0.003 (−0.002; 0.008)	0.08 (0.05; 0.10)[c]	0.35 (−0.22; 0.91)
Tu co-morbidity index (score)	−1.36 (−1.62; −1.10)[c]	−0.73 (−1.01; −0.46)[c]	1.09 (1.04; 1.15)[c]	1.22 (1.15; 1.29)[c]	−0.01 (−0.02; −0.01)[c]	−0.10 (−0.12; −0.08)[c]	1.88 (1.49; 2.26)[c]
Diagnostic group							
Ischemic heart disease	1	1	1	1	1	1	1
Arrhythmia	3.53 (3.06; 4.00)[c]	0.76 (0.25; 1.26)[c]	0.76 (0.69; 0.83)[c]	0.70 (0.62; 0.78)[c]	0.03 (0.03; 0.04)[c]	0.20 (0.17; 0.23)[c]	−4.87 (−5.58; −4.17)[c]
Heart failure	−1.60 (−2.40; −0.81)[c]	−0.88 (−1.73; −0.03)[c]	0.82 (0.70; 0.96)[c]	0.95 (0.80; 1.13)	0.002 (−0.009; 0.013)	−0.12 (−0.17; −0.07)[c]	0.40 (−0.79; 1.56)
Congenital heart disease	1.22 (−0.84; 3.28)	2.14 (−0.05; 4.33)	0.55 (0.37; 0.84)[c]	0.68 (0.41; 1.13)	0.03 (0.002; 0.06)[c]	0.19 (0.06; 0.33)[c]	−4.90 (−8.05; −1.75)[c]
Infectious heart disease	0.73 (−0.96; 2.43)	−0.24 (−2.04; 1.57)	0.58 (0.41; 0.82)[c]	0.59 (0.39; 0.89)[c]	0.02 (−0.01; 0.04)	0.08 (0.03; 0.19)	−3.16 (−5.63; −0.70)[c]
Heart valve disease	−0.44 (−1.25; 0.38)	−0.74 (−1.61; 0.13)	0.87 (0.74; 1.02)	0.97 (0.81; 1.16)	−0.003 (−0.01; 0.008)	−0.08 (−0.13; −0.03)[c]	0.56 (−0.62; 1.74)
Heart transplant	7.76 (5.81; 9.70)[c]	7.25 (5.18; 9.32)[c]	0.22 (0.13; 0.35)[c]	0.30 (0.17; 0.52)[c]	0.11 (0.08; 0.14)[c]	0.66 (0.53; 0.78)[c]	−11.88 (−14.78; −8.99)[c]
Other diagnoses	−0.58 (−1.88; 0.73)	1.20 (−0.20; 2.59)	0.88 (0.68; 1.14)	1.12 (0.84; 1.15)	−0.02 (−0.04; −0.001)[c]	0.03 (−0.06; 0.12)	−0.43 (−2.37; 1.51)
Observation for heart disease	2.30 (1.76; 2.84)[c]	−0.18 (−0.75; 0.40)	0.97 (0.87; 1.08)	0.93 (0.82; 1.05)	0.01 (−0.002; 0.013)	0.18 (0.14; 0.22)[c]	−0.81 (−1.62; 0.01)

PCS = physical component score; MCS = mental component score; HADS-A = Hospital Anxiety and Depression Scale - Anxiety; HADS-D = Hospital Anxiety and Depression Scale – Depression; β = regression coefficient in general linear model, 95% CI = 95% confidence interval; OR = odds ratio.

[a] Linear regression model adjusted for sex, age, marital status, length of hospital stay, type of hospitalization, co-morbidity and diagnostic group.

[b] Logistic regression model adjusted for sex, age, marital status, length of hospital stay, type of hospitalization, co-morbidity and diagnostic group.

[c] Significance level set at 0.05.

4.4. Implications

There are obviously still issues regarding lifestyle, smoking and obesity that must be addressed. Overall, patients adhere to their medication instructions, however some may need support. Being ill might strengthen the social network as few responders lacked someone to talk to. Despite this, some patients still feel alone which is an independent predictor of morbidity and mortality [58].

As patient reported outcomes are known to be independent predictors of readmission and mortality in some patients, knowledge of them may help clinicians make better decisions about in-hospital and post-hospital care and prevention and prioritize resources based on evidence.

Even though statistically significant differences were found between groups, minimally important differences were not reached between most groups, indicating that screening for poor outcomes should be considered for all diagnostic groups.

For each diagnostic group, further secondary analyses will be performed to look for within-diagnostic group differences and the associations between patient reported outcomes at discharge and mortality, morbidity and readmission will be investigated [10].

Contributors

SKB conceived the idea for the study. All designed the study. KJ, OE and AVC performed the statistical analyses. SKB and AVC wrote the first draft of the manuscript. All revised the manuscript critically. All have given their final approval of the version to be published.

Acknowledgements

We would like to express our gratitude to the patients who took the time to participate in the survey. We would also like to thank the 800 cardiac nurses involved in the data collection and the Heart Centres: Rigshospitalet, Gentofte Hospital, Odense University Hospital, Aarhus University Hospital and Aalborg University Hospital for prioritizing this study in a busy clinic. Furthermore, we would like to acknowledge the DenHeart research expert committee for its guidance. The study was funded by the Danish Heart Centres and the Novo Nordisk Foundation. The research presented was investigator initiated. The study funders played no role in the study.

References

[1] J.S. Rumsfeld, K.P. Alexander, D.C. Goff Jr., M.M. Graham, P.M. Ho, F.A. Masoudi, et al., Cardiovascular health: the importance of measuring patient-reported health status: a scientific statement from the American Heart Association, Circulation 127 (22) (2013) 2233–2249 (Jun 4).

[2] T. Hoekstra, T. Jaarsma, D.J. van Veldhuisen, H.L. Hillege, R. Sanderman, I. Lesman-Leegte, Quality of life and survival in patients with heart failure, Eur. J. Heart Fail. (2012) (Sep 18).

[3] P.A. Heidenreich, J.A. Spertus, P.G. Jones, W.S. Weintraub, J.S. Rumsfeld, S.S. Rathore, et al., Health status identifies heart failure outpatients at risk for hospitalization or death, J. Am. Coll. Cardiol. 47 (4) (2006) 752–756 (Feb 21).

[4] K. Biering, T.T. Nielsen, K. Rasmussen, T. Niemann, N.H. Hjollund, Return to work after percutaneous coronary intervention: the predictive value of self-reported health compared to clinical measures, PLoS One 7 (11) (2012), e49268.

[5] A. Szekely, N.A. Nussmeier, Y. Miao, K. Huang, J. Levin, H. Feierfeil, et al., A multinational study of the influence of health-related quality of life on in-hospital outcome after coronary artery bypass graft surgery, Am. Heart J. 161 (6) (2011) 1179–1185.e2 (Jun).

[6] J.S. Steinberg, S. Joshi, E.B. Schron, J. Powell, A. Hallstrom, M. McBurnie, et al., Psychosocial status predicts mortality in patients with life-threatening ventricular arrhythmias, Heart Rhythm. 5 (3) (2008) 361–365 (Mar).

[7] J.A. Spertus, P. Jones, M. McDonell, V. Fan, S.D. Fihn, Health status predicts long-term outcome in outpatients with coronary disease, Circulation 106 (1) (2002) 43–49 (Jul 2).

[8] S.K. Berg, L.C. Thygesen, J.H. Svendsen, A.V. Christensen, A.D. Zwisler, Anxiety predicts mortality in ICD patients: results from the cross-sectional National Copenheart Survey with Register follow-up, Pacing Clin. Electrophysiol. 37 (2014) 1641–1650 (Sep 5).

[9] S. Yusuf, S. Hawken, S. Ounpuu, T. Dans, A. Avezum, F. Lanas, et al., Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries

(the INTERHEART study): case-control study, Lancet 364 (9438) (2004) 937–952 (Sep 11–17).
[10] S.K. Berg, J. Svanholm, A. Lauberg, B. Borregaard, M. Herning, A. Mygind, et al., Patient-reported outcomes at hospital discharge from Heart Centres, a national cross-sectional survey with a register-based follow-up: the DenHeart study protocol, BMJ Open 4 (5) (2014) (May 2, e004709-2013-004709).
[11] O. Ekholm, U. Hesse, M. Davidsen, M. Kjoller, The study design and characteristics of the Danish national health interview surveys, Scand. J. Public Health 37 (7) (2009) 758–765 (Sep).
[12] J. Ware Jr., M. Kosinski, S.D. Keller, A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity, Med. Care 34 (3) (1996) 220–233 (Mar).
[13] D. De Smedt, E. Clays, F. Doyle, K. Kotseva, C. Prugger, A. Pajak, et al., Validity and reliability of three commonly used quality of life measures in a large European population of coronary heart disease patients, Int. J. Cardiol. 167 (5) (2013) 2294–2299 (Sep 1).
[14] A.S. Zigmond, R.P. Snaith, The hospital anxiety and depression scale, Acta Psychiatr. Scand. 67 (6) (1983) 361–370 (Jun).
[15] I. Bjelland, A.A. Dahl, T.T. Haug, D. Neckelmann, The validity of the Hospital Anxiety and Depression Scale. An updated literature review, J. Psychosom. Res. 52 (2) (2002) 69–77 (Feb).
[16] R. Rabin, F. de Charro, EQ-5D: a measure of health status from the EuroQol Group, Ann. Med. 33 (5) (2001) 337–343 (Jul).
[17] E. Broadbent, K.J. Petrie, J. Main, J. Weinman, The Brief Illness Perception Questionnaire, J. Psychosom. Res. 60 (6) (2006) 631–637 (Jun).
[18] N. Oldridge, S. Hofer, H. McGee, R. Conroy, F. Doyle, H. Saner, The HeartQoL: part I. Development of a new core health-related quality of life questionnaire for patients with ischemic heart disease, Eur. J. Prev. Cardiol. 21 (2014) 90–97 (Jul 20).
[19] N. Oldridge, S. Hofer, H. McGee, R. Conroy, F. Doyle, H. Saner, The HeartQoL: part II. Validation of a new core health-related quality of life questionnaire for patients with ischemic heart disease, Eur. J. Prev. Cardiol. 21 (2014) 98–106 (Jul 20).
[20] V.T. Chang, S.S. Hwang, M. Feuerman, Validation of the Edmonton Symptom Assessment Scale, Cancer 88 (9) (2000) 2164–2171 (May 1).
[21] L.C. Thygesen, C. Daasnes, I. Thaulow, H. Bronnum-Hansen, Introduction to Danish (nationwide) registers on health and social issues: structure, access, legislation, and archiving, Scand. J. Public Health 39 (7 Suppl) (2011) 12–16 (Jul).
[22] J.V. Tu, P.C. Austin, R. Walld, L. Roos, J. Agras, K.M. McDonald, Development and validation of the Ontario acute myocardial infarction mortality prediction rules, J. Am. Coll. Cardiol. 37 (4) (2001) 992–997 (Mar 15).
[23] J.E. Ware Jr., M. Kosinski, J.B. Bjorner, D.M. Turner-Bowker, B. Gandek, M.E. Maruish (Eds.), User's Manual for the SF-36v2® Health Survey, second ed.Quality Metric Incorporated, 2007.
[24] M.A. Puhan, M. Frey, S. Buchi, H.J. Schunemann, The minimal important difference of the hospital anxiety and depression scale in patients with chronic obstructive pulmonary disease, Health Qual. Life Outcomes 6 (2008) (Jul 2, 46-7525-6-46).
[25] G.R. Norman, J.A. Sloan, K.W. Wyrwich, The truly remarkable universality of half a standard deviation: confirmation through another look, Expert Rev. Pharmacoecon. Outcomes Res. 4 (5) (2004) 581–585 (Oct).
[26] D. De Smedt, E. Clays, S. Hofer, N. Oldridge, K. Kotseva, A.P. Maggioni, et al., Validity and reliability of the HeartQoL questionnaire in a large sample of stable coronary patients: the EUROASPIRE IV Study of the European Society of Cardiology, Eur. J. Prev. Cardiol. 23 (7) (2016) 714–721 (May).
[27] S.D. Anker, S. Agewall, M. Borggrefe, M. Calvert, J. Jaime Caro, M.R. Cowie, et al., The importance of patient-reported outcomes: a call for their comprehensive integration in cardiovascular clinical trials, Eur. Heart J. 35 (30) (2014) 2001–2009 (Aug 7).
[28] E. Lynge, J.L. Sandegaard, M. Rebolj, The Danish National Patient Register, Scand. J. Public Health 39 (7 Suppl) (2011) 30–33 (Jul).
[29] K.L. Sibilitz, S.K. Berg, L.C. Thygesen, T.B. Hansen, L. Kober, C. Hassager, et al., High readmission rate after heart valve surgery: a nationwide cohort study, Int. J. Cardiol. 189 (2015 Jun 15) 96–104.
[30] I. Saeed, C. Rogers, A. Murday, Steering Group of the UK Cardiothoracic Transplant Audit. Health-related quality of life after cardiac transplantation: results of a UK National Survey with Norm-based Comparisons, J. Heart Lung Transplant. 27 (6) (2008) 675–681 (Jun).
[31] J. Junger, D. Schellberg, T. Muller-Tasch, G. Raupp, C. Zugck, A. Haunstetter, et al., Depression increasingly predicts mortality in the course of congestive heart failure, Eur. J. Heart Fail. 7 (2) (2005) 261–267 (Mar 2).
[32] F. Lesperance, N. Frasure-Smith, M. Talajic, M.G. Bourassa, Five-year risk of cardiac mortality in relation to initial severity and one-year changes in depression symptoms after myocardial infarction, Circulation 105 (9) (2002) 1049–1053 (Mar 5).
[33] D.K. Moser, C. Arslanian-Engoren, M.J. Biddle, M.L. Chung, R.L. Dekker, M.H. Hammash, et al., Psychological aspects of heart failure, Curr. Cardiol. Rep. 18 (12) (2016) 119 (Dec).
[34] R.K. Ghosh, S. Ball, V. Prasad, A. Gupta, Depression in heart failure: intricate relationship, pathophysiology and most updated evidence of interventions from recent clinical studies, Int. J. Cardiol. 224 (2016) 170–177 (Dec 1).
[35] O. Garin, M. Ferrer, A. Pont, M. Rue, A. Kotzeva, I. Wiklund, et al., Disease-specific health-related quality of life questionnaires for heart failure: a systematic review with meta-analyses, Qual. Life Res. 18 (1) (2009) 71–85 (Feb).
[36] J.R. Wu, T.A. Lennie, S.K. Frazier, D.K. Moser, Health-related quality of life, functional status, and cardiac event-free survival in patients with heart failure, J. Cardiovasc. Nurs. 31 (3) (2016) 236–244 (May–Jun).
[37] J. Xu, M.T. Nolan, K. Heinze, G. Yenokyan, M.T. Hughes, J. Johnson, et al., Symptom frequency, severity, and quality of life among persons with three disease trajectories: cancer, ALS, and CHF, Appl. Nurs. Res. 28 (4) (2015) 311–315 (Nov).
[38] Y.H. Jeon, S.G. Kraus, T. Jowsey, N.J. Glasgow, The experience of living with chronic heart failure: a narrative review of qualitative studies, BMC Health Serv. Res. 10 (2010) (Mar 24, 77-6963-10-77).
[39] G. Cardoso, B. Trancas, A. Luengo, D. Reis, Heart failure and depression: an association with clinical importance, Rev. Port. Cardiol. 27 (1) (2008) 91–109 (Jan).
[40] I. Malinauskaite, R. Slapikas, D. Courvoisier, F. Mach, B. Gencer, The fear of dying and occurrence of posttraumatic stress symptoms after an acute coronary syndrome: a prospective observational study, J. Health Psychol. 26 (2015) (Aug).
[41] H. Sawatari, T. Ohkusa, A. Rahamawati, K. Ishikawa, M. Tsuchihashi-Makaya, Y. Ohtsuka, et al., Left ventricular ejection fraction predicts severity of posttraumatic stress disorder in patients with implantable cardioverter-defibrillators, Clin. Cardiol. 39 (5) (2016) 263–268 (May).
[42] J. Ford, L. Rosman, K. Wuensch, J. Irvine, S.F. Sears, Cognitive-behavioral treatment of posttraumatic stress in patients with implantable cardioverter defibrillators: results from a randomized controlled trial, J. Trauma. Stress. 29 (4) (2016) 388–392 (Aug).
[43] L. Slipczuk, J.N. Codolosa, C.D. Davila, A. Romero-Corral, J. Yun, G.S. Pressman, et al., Infective endocarditis epidemiology over five decades: a systematic review, PLoS One 8 (12) (2013) e82665 (Dec 9).
[44] D.R. Murdoch, G.R. Corey, B. Hoen, J.M. Miro, V.G. Fowler Jr., A.S. Bayer, et al., Clinical presentation, etiology, and outcome of infective endocarditis in the 21st century: the International Collaboration on Endocarditis-Prospective Cohort Study, Arch. Intern. Med. 169 (5) (2009) 463–473 (Mar 9).
[45] T.B. Rasmussen, A.D. Zwisler, P. Moons, S.K. Berg, Insufficient living: experiences of recovery after infective endocarditis, J. Cardiovasc. Nurs. 30 (3) (2015) E11–E19 (May–Jun).
[46] K.L. Withers, K.A. Wood, G. Carolan-Rees, H. Patrick, M. Lencioni, M. Griffith, Living on a knife edge-the daily struggle of coping with symptomatic cardiac arrhythmias, Health Qual. Life Outcomes 13 (2015) (Jun 24, 86-015-0282-9).
[47] G. Thrall, D. Lane, D. Carroll, G.Y. Lip, Quality of life in patients with atrial fibrillation: a systematic review, Am. J. Med. 119 (5) (2006) (May, 448.e1-448.19).
[48] R.T. Barros, S.M. Carvalho, M.A. Silva, J.B. Borges, Evaluation of patients' quality of life aspects after cardiac pacemaker implantation, Rev. Bras. Cir. Cardiovasc. 29 (1) (2014) 37–44 (Jan–Mar).
[49] S.B. Dunbar, C.M. Dougherty, S.F. Sears, D.L. Carroll, N.E. Goldstein, D.B. Mark, et al., Educational and psychological interventions to improve outcomes for recipients of implantable cardioverter defibrillators and their families: a scientific statement from the American Heart Association, Circulation 126 (17) (2012) 2146–2172 (Oct 23).
[50] M.C. Berghammer, E. Brink, A.M. Rydberg, M. Dellborg, I. Ekman, Committed to life: adolescents' and young adults' experiences of living with Fontan circulation, Congenit. Heart Dis. 10 (5) (2015) 403–412 (Sep).
[51] C. Heilmann, J. Kaps, A. Hartmann, W. Zeh, A.L. Anjarwalla, F. Beyersdorf, et al., Mental health status of patients with mechanical aortic valves, with ventricular assist devices and after heart transplantation, Interact. Cardiovasc. Thorac. Surg. 23 (2) (2016) 321–325 (Aug).
[52] A. Conway, V. Schadewaldt, R. Clark, C. Ski, D.R. Thompson, L. Doering, The psychological experiences of adult heart transplant recipients: a systematic review and meta-summary of qualitative findings, Heart Lung 42 (6) (2013) 449–455 (Nov–Dec).
[53] R. Sanchez, E. Bailles, J.M. Peri, A. Bastidas, F. Perez-Villa, A. Bulbena, et al., Assessment of psychosocial factors and predictors of psychopathology in a sample of heart transplantation recipients: a prospective 12-month follow-up, Gen. Hosp. Psychiatry 38 (2016) 59–64 (Jan–Feb).
[54] J.C. McSweeney, L.L. Lefler, B.F. Crowder, What's wrong with me? Women's coronary heart disease diagnostic experiences, Prog. Cardiovasc. Nurs. 20 (2) (2005) 48–57 (Spring).
[55] O. Loup, C. von Weissenfluh, B. Gahl, M. Schwerzmann, T. Carrel, A. Kadner, Quality of life of grown-up congenital heart disease patients after congenital cardiac surgery, Eur. J. Cardiothorac. Surg. 36 (1) (2009) 105–111 (Jul, discussion 111).
[56] M.R. Reynolds, T. Lavelle, V. Essebag, D.J. Cohen, P. Zimetbaum, Influence of age, sex, and atrial fibrillation recurrence on quality of life outcomes in a population of patients with new-onset atrial fibrillation: the Fibrillation Registry Assessing Costs, Therapies, Adverse events and Lifestyle (FRACTAL) study, Am. Heart J. 152 (6) (2006) 1097–1103 (Dec).
[57] L. Wang, Y.Q. Wu, X. Tang, N. Li, L. He, Y. Cao, et al., Profile and correlates of health-related quality of life in Chinese patients with coronary heart disease, Chin. Med. J. 128 (14) (2015) 1853–1861 (Jul 20).
[58] J. Holt-Lunstad, T.B. Smith, M. Baker, T. Harris, D. Stephenson, Loneliness and social isolation as risk factors for mortality: a meta-analytic review, Perspect. Psychol. Sci. 10 (2) (2015) 227–237 (Mar).