Factors Associated With Depression and Anxiety for Community-Dwelling Patients With Heart Failure
A Retrospective Cohort Study

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Background: Depression and anxiety are common comorbidities in heart failure (HF) and are associated with adverse outcomes including unplanned hospitalization. However, there is insufficient evidence on the factors associated with depression and anxiety for community patients with HF to inform optimal assessment and treatment in this population. **Aim:** The aim of this study was to examine the prevalence of and factors associated with depression and anxiety in community-dwelling patients with HF. **Methods:** A retrospective cohort study of 302 adult patients given a diagnosis of HF referred to United Kingdom's largest specialist cardiac rehabilitation center, from June 2013 to November 2020. Main study outcomes were symptoms of depression using Patient Health Questionnaire-9 and anxiety using the General Anxiety Disorder 7-item scale. Explanatory variables included demographic and clinical characteristics and functional status from the Dartmouth COOP questionnaire: quality of life, pain, level of social activity and daily activities, and being bothered by emotional problems (feelings). Logistic regressions were performed to evaluate the association between demographic and clinical characteristics and depression and anxiety. **Results:** Of the sample, 26.2% reported depression and 20.2% had anxiety. Higher depression and anxiety were associated with difficulty in performing daily activities (95% confidence interval, 1.11–6.46 and 1.13–8.09, respectively) and being bothered by feelings (95% confidence interval, 4.06–21.77 and 4.25–22.46, respectively). Depression was associated with limitations in social activity (95% confidence interval, 1.06–6.34) and anxiety with distressing pain (95% confidence interval, 1.38–7.23). **Conclusion:** Findings indicate the importance of psychosocial interventions for patients with HF to minimize and manage depression and anxiety. Patients with HF may benefit from interventions targeted to maintain independence, promote participation in social activities, and optimally manage pain.

KEY WORDS: anxiety, cohort study, depression, heart failure, regression analysis

Heart failure (HF) is a complex progressive disease and is a major public health problem affecting 64.3 million people worldwide.[1] Prognosis for patients with HF is poor, and it is worsened by the presence of comorbidities such as depression and anxiety.[2] Prevalence of depression (up to 51%)[3–7] and anxiety (up to 72%)[8]

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is common in patients with HF and is associated with adverse outcomes such as increased hospitalization, high mortality, and poor quality of life (QOL).[9–11] The prevalence and impact of depression and anxiety in HF make it a priority to identify and manage these conditions, as asserted in the European Society of Cardiology 2021 HF guidelines.[12]

The British Heart Foundation estimates that annually more than 50 000 patients in the United Kingdom are discharged to community settings with life-limiting HF.[13] In 2020, a survey identified the top challenges for UK patients with HF as "anxiety, fear, or uncertainty about the future" (34%) and "feeling down, sad, or depressed" (32%).[13] However, although most patients with HF reside and receive care in the community, and depression and anxiety commonly deteriorate after hospital discharge,[14] research on depression and anxiety management in the community is limited. Previous studies that have examined the factors associated with poor mental health have mainly been conducted within inpatient settings with hospitalized patients in the acute stages of HF.[14–24] However, hospitalized patients are only a small percentage of this population, and there are reasons to believe that the psychological well-being of patients in the hospital and those in the community may differ. First, patients who are hospitalized after a serious cardiovascular event or acute deterioration are physically more unwell and medically unstable at this point compared with community patients. Acute illness requiring hospitalization has a significant impact on individuals' well-being.[13,25] Second, stressors associated with a hospital admission are likely to be different to those routinely faced by community patients who have to follow complex self-management regimens and cope with severe restrictions in daily living.[26–29] It is paramount that empirical research focuses on the psychological well-being of patients after discharge from hospital, especially given the lack of guidelines or resources on how professionals should best support HF patients with depression and anxiety in the community.[30]

Preventing and treating depression and anxiety in HF is vital to improve health outcomes and prevent complications, such as unplanned hospitalization and mortality.[9] To do so, however, requires an understanding of the risk factors in the development of depression and anxiety for community patients with HF. This is needed for optimal disease management and care.[14] To date, only 1 study of community patients with HF has focused on anxiety,[5] and studies of hospitalized patients too have focused predominantly on depression in HF rather than anxiety.[14–24,31–33] These studies also included a limited number of factors such as age, gender, marital status, New York Heart Association functional class, and social support.[4–6,34–38] The studies have shown inconsistent findings in terms of the associations found between, for example, age and ethnicity. Whereas some studies have found higher depression among younger patients with HF in the community,[4,7,37,39] other studies of inpatient populations have found an association with older patients (70 years or older).[16,40] Study authors also report differing findings concerning ethnicity, with some community studies reporting ethnicity (White, African American) is not associated with depression,[4] whereas others report that Black men with HF (34%) tend to have less depression than White men (54%).[7]

There is limited empirical evidence to guide the identification and treatment of depression and anxiety for patients with HF in the community. This hinders the delivery of appropriate care for this patient group. Some study authors of hospitalized patients have also examined relationships between previous history of depression, distress from HF symptoms, and self-care factors and depression.[15,16,22] However, authors of community-based studies have yet to examine these relationships. Given the huge physical burden of HF, few studies have focused on the association between specific functional limitations and depression and anxiety, or recognized the contribution of declining physical function such as breathlessness and poorer mental health.[14] Indeed, authors of only 1 study have examined the association between activities of daily living (ADLs) and depression,[22] and that study focused only on hospitalized patients with HF. However, it is clear that patients with HF in the community may potentially experience more difficulties in completing ADL and experience negative emotions and moods after discharge from hospital.[29] In addition, with the huge restrictions that HF symptoms can place on activity,[41] no authors of community- or hospital-based studies have previously assessed patients' ability to maintain their previous social activities. It is surprising that so few empirical studies have considered the contribution of these important clinical factors on patients' mental health.[27]

To improve outcomes for patients with HF, a better understanding of the clinical, psychological, and social factors associated with depression and anxiety is needed to inform optimal care and treatment. Therefore, the aims of this study were to (1) describe the clinical, psychological, social, and demographic characteristics of patients with HF in the community with depression and anxiety, and the rate of depression and anxiety in this population, and (2) examine the factors associated with depression and anxiety for patients with HF in the community.

Methods

Data Source

Authors of the retrospective cohort study used anonymous individual-level patient data from the National Audit of Cardiac Rehabilitation.[42] The National Audit

of Cardiac Rehabilitation is a clinical registry funded by the British Heart Foundation, and it is integrated with routine cardiac rehabilitation centers. The data set was derived from 2 specialist hospitals in heart and lung disease that form the largest specialist center in the United Kingdom and one of the largest in Europe. The data set was composed of people referred as outpatients for cardiac rehabilitation between June 2013 and November 2020. The database included a total of 17 766 cardiac patients. All patients with HF who were referred to attend the cardiac rehabilitation center were considered to be community patients with HF.

Study Population

Eligibility criteria for the cohort study included patients (1) 18 years older, (2) with an HF diagnosis identified as a previous event (medical history of HF) or as an initiating event for admission into an outpatient cardiac rehabilitation program—initiating event was defined as the primary diagnosis for which the patient was referred for the rehabilitation program, and (3) who had been screened for depression using the Patient Health Questionnaire-9[43] and/or anxiety using the General Anxiety Disorder 7-item scale[44] (Figure).

Outcomes of Interest

The main outcomes of the study were symptoms of (1) depression, measured using Patient Health Questionnaire-9, and (2) anxiety, measured using Generalized Anxiety Disorder-7.

The Patient Health Questionnaire-9 is a 9-item self-report scale to measure depression in clinical and non-clinical settings with high internal consistency (Cronbach α of 0.89). The Patient Health Questionnaire-9 has been found to diagnose major depression with sensitivity and specificity of 88%.[43] Each item is rated on a scale of 0 ("not at all") to 3 ("nearly every day") based on how much a symptom has bothered the person over the last 2 weeks, with a total score ranging from 0 to 27. In this study, scoring of ≥10 was used to indicate probable severe or major depressive disorder.[45]

The Generalized Anxiety Disorder-7 is a short 7-item self-report screening instrument used to measure the severity of generalized anxiety disorder and has high internal consistency (Cronbach α of 0.89).[44] Each item is rated on a scale of 0 ("not at all") to 3 ("nearly every day") based on how much a symptom has bothered a patient over the last 2 weeks, with a total score ranging from 0 to 21. In this study, scoring of ≥10 was used to indicate probable anxiety.[44]

Explanatory Variables

The explanatory variables were chosen for clinical relevance and their deleterious impact on well-being in HF, such as poor outcomes of mortality and unplanned hospitalization. For example, alcohol consumption[46–48] can increase the risk of depression and anxiety and lead to adverse outcomes in HF.[49] Explanatory variables also included demographic characteristics (eg, age, gender, marital status, ethnicity), clinical characteristics (eg, comorbidities, number of prescribed medicines), and generic functional status measured using the Dartmouth COOP questionnaire.[50] The subscales used from the Dartmouth COOP questionnaire included QOL, pain, limitation in social activity, limitation in daily activities (ADLs) due to physical and emotional problems, and being bothered by emotional problems (feelings) such as feeling depressed or anxious. The Dartmouth COOP questionnaire is a generic measure designed for clinical use in primary care with a range of different populations.[50] Having a history of depression or anxiety on referral to the cardiac unit was also included in the analyses to account for previous comorbid depression or anxiety that was not associated with HF.[5,51,52]
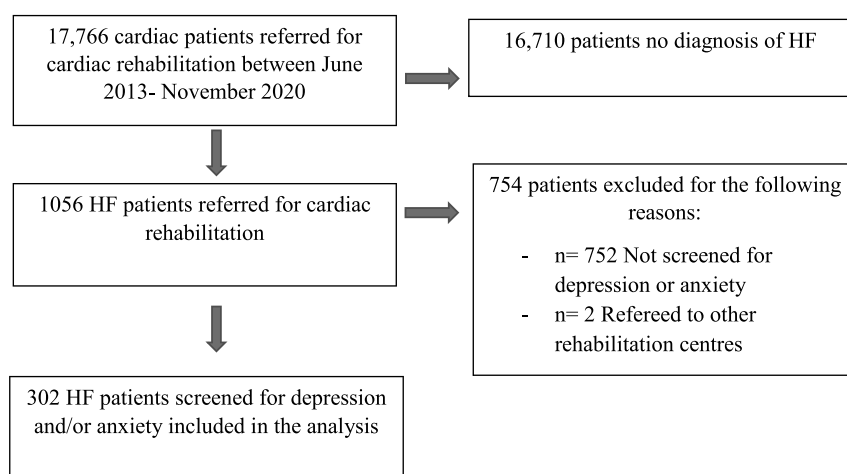
FIGURE. *Flow diagram of the cohort identification. HF, heart failure.*

Study variables were categorized for analysis purposes. The variables of the Dartmouth COOP questionnaire (social activity, daily activities, feelings, QOL, pain) were dichotomized as normal (score, 1–3) or poor (score, 4–5) informed by previous studies that used this categorization.[53,54] Alcohol consumption from the data set was categorized based on the National Institute for Health and Care Excellence guideline recommendation (level ≤ 14 = within the advised weekly limit and level ≥ 15 = exceeding the advised weekly limit).[55] Because of the small numbers of patients with depression consuming more than 14 units of alcohol per week, it was only possible to include alcohol consumption in the analysis of anxiety. Finally, given the high levels of multimorbidity in populations with HF[56] and its association with increased hospitalizations and mortality,[57,58] coupled with associated polypharmacy,[59–61] disease burden was examined in this study by calculating the number of comorbidities for each patient.[56]

Missing Data and Multiple Imputation

Fifty-nine percent (n = 179/302 for depression and 167/302 for anxiety) of patients had complete data. Marital status was missing for 22% of the sample and ethnicity for 15% of the sample. For all other variables, the percentage of missing data was less than 10%. Complete-cases data analysis would introduce its own biases due to selection based on completeness. A decision was therefore taken to undertake multiple imputation. This approach is used extensively in cross-sectional/retrospective cohort studies to reduce the risk of bias caused by missing data.[62–66] Hipple's proposed 2-stage imputation process was used.[67] The first stage requires a pilot analysis with a small-to-moderate number of imputations to obtain the fraction of missing information. Multiplying this measure (range, 0–1) by 100 provides an estimate of the number of imputed data sets required. Approximately 40% of patients were lost from the complete case regression so the number of imputations was set quite high at 40, which was more than adequate and exceeded the 20 required. Some diagnostic testing was performed to ensure that there were enough iterations within each imputation. A thousand iterations were more than enough to produce estimates that fluctuated at random, where no trends with increasing iteration numbers were apparent or had ceased well before the final iteration and where potential scale reduction was less than 1.05 for all variables.

Statistical Analysis

Descriptive analysis of participants' demographic and clinical characteristics was reported. Categorical variables (eg, gender, marital status, ethnicity) were summarized

using numbers and percentages. Univariable and multivariable logistic regressions were performed to evaluate the association between HF patients' demographic and clinical characteristics (independent variables) and depression and anxiety (dependent variables) defined using the thresholds for Patient Health Questionnaire-9 and Generalized Anxiety Disorder-7. Factors associated with depression were examined independently of anxiety, and factors associated with anxiety were examined independently of depression. Odds ratios and 95% confidence intervals (95% confidence intervals) were calculated for each independent variable and/or variable category. When a variable consisted of more than 2 categories, the Wald test for the overall effect was reported (χ^2, degrees of freedom, P value). Each patient characteristic was added to the model separately (unadjusted, univariable), and all were fitted simultaneously (adjusted, multivariable).

Results were pooled across the 40 imputed data sets. Unadjusted results are presented first followed by the adjusted results. A statistical test was deemed statistically significant if the probability of rejecting the null hypothesis was ≤.05. In the multivariable regression model for both depression and anxiety, the 95% confidence interval for the age group of 81 to 100 years was very wide. Diagnostics identified some collinearity between age, employment, and marital status. Further interrogation of the data found people 81 years and older were retired and more likely to be widows or widowers than younger patients. To address this collinearity, age groups of 71 to 80 years and 81 to 100 years were merged. There was still some evidence of collinearity between these variables but not sufficient to impact the overall findings (Supplemental Digital Content 1, Appendix 1, http://links.lww.com/JCN/A180). A sensitivity analysis based on complete cases was also conducted (Supplemental Digital Content 2, Appendix 2, http://links.lww.com/JCN/A181, and Supplemental Digital Content 3, Appendix 3, http://links.lww.com/JCN/A182). Data analysis was performed using IBM SPSS version 27.[68]

Results

Study Population

After applying the study eligibility criteria, 302 patients were included in the analysis (Figure). The sample demographic and clinical data are reported in Table 1. The mean (standard deviation) age of patients was 66 (14.6) years. Most (71.8%) were not working (unemployed or retired), and 68.8% were men. Patients were predominantly White (52.6%). Asian/Asian British formed the largest ethnic minority group (25.8%). Patients typically had ≥2 comorbidities (70.2%) and ≥6 prescribed medicines (51.0%) (Table 1).

TABLE 1 Demographic and Clinical Characteristics of the Screened Community-Dwelling Patients With Heart Failure (N = 302) Referred for Cardiac Rehabilitation

Demographic Characteristics	Total (n = 302) n (%)	Depression All[a] (n = 79) n (%)	Anxiety All[a] (n = 61) n (%)	Depression and Anxiety (n = 45) n (%)
Age, mean (SD), y	66.2 (14.6)	64.2 (13.2)	62.5 (14.3)	62.8 (12.7)
Median (IQR)	66.5 (22)	64 (19)	62 (18)	62 (17)
Gender				
Male	208 (68.8)	51 (64.6)	37 (60.7)	25 (55.6)
Female	92 (30.5)	28 (35.4)	24 (39.3)	20 (44.4)
Missing	2 (0.7)	0 (0.0)	0 (0.0)	0 (0.0)
Marital status				
Single	41 (13.6)	8 (10.1)	5 (8.2)	3 (6.67)
Married/permanent relationship	180 (59.6)	52 (65.8)	38 (62.3)	29 (64.44)
Widowed	15 (5)	4 (5.1)	4 (6.6)	2 (4.44)
Missing	66 (21.8)	15 (19)	14 (22.9)	11 (24.44)
Employment				
Employed	67 (22.2)	15 (19)	16 (26.2)	12 (26.7)
Unemployed	101 (33.4)	36 (45.6)	24 (39.3)	16 (35.6)
Retired	120 (39.7)	27 (34.2)	20 (32.8)	16 (35.6)
Missing	14 (4.6)	1 (1.3)	1 (1.6)	1 (2.2)
Ethnicity				
White	159 (52.6)	34 (43.0)	28 (45.9)	17 (37.7)
Asian or Asian British	78 (25.8)	23 (29.1)	14 (23)	12 (26.7)
Other ethnic groups	20 (6.7)	10 (12.7)	9 (14.7)	9 (20.0)
Missing	45 (14.9)	12 (15.2)	10 (16.4)	7 (15.6)
BMI				
Healthy	94 (31.2)	20 (25.3)	16 (26.2)	9 (20.0)
Underweight	2 (0.7)	0 (0.0)	0 (0.0)	0 (0.0)
Overweight	87 (28.8)	23 (29.1)	14 (23.0)	10 (22.2)
Obese	107 (35.3)	33 (41.7)	28 (45.9)	24 (53.4)
Missing	12 (4.0)	3 (3.8)	3 (4.9)	2 (4.4)
Alcohol consumption, units/wk				
0–14	267 (88.4)	72 (91.1)	54 (88.5)	39 (86.7)
>14	16 (5.3)	2 (2.5)	3 (4.9)	2 (4.4)
Missing	19 (6.3)	5 (6.3)	4 (6.6)	4 (8.9)
PHQ-9 depression categories				
Minimal depression	142 (47.0)			
Mild depression	80 (26.5)			
Moderate depression	49 (16.2)			
Moderately severe depression	24 (7.9)			
Severe depression	6 (2.0)			
Missing	1 (0.3)			
GAD-7 anxiety categories				
Minimal anxiety	178 (58.9)			
Mild anxiety	61 (20.2)			
Moderate anxiety	39 (12.9)			
Severe anxiety	22 (7.3)			
Missing	2 (0.7)			
No. prescribed medications				
Mean (SD)	5.9 (2.1)	6 (2.4)	6 (2.1)	5.9 (2.3)
Median (IQR)	6 (3)	6 (4)	6 (4)	6 (4)
Missing	25 (8.3)	6 (7.6)	4 (6.6)	4 (8.9)
No. comorbidities				
Mean (SD)	2.6 (1.8)	3.0 (2.0)	2.9 (2.0)	3.1 (2.1)
Median (IQR)	2 (3)	3 (3)	3 (3)	3 (3)
Missing	13 (4.3)	2 (2.5)	3 (4.9)	2 (4.4)
Type of comorbidities				
Angina	16 (5.3)			
Anxiety	23 (7.6)			
Depression	20 (6.6)			
Claudication	5 (1.7)			
Cancer	21 (7.0)			

(continues)

TABLE 1 Demographic and Clinical Characteristics of the Screened Community-Dwelling Patients With Heart Failure (N = 302) Referred for Cardiac Rehabilitation, Continued

Demographic Characteristics	Total (n = 302) n (%)	Depression All[a] (n = 79) n (%)	Anxiety All[a] (n = 61) n (%)	Depression and Anxiety (n = 45) n (%)
Chronic back problems	29 (9.6)			
Osteoarthritis	41 (13.7)			
Rheumatism	7 (2.3)			
Osteoporosis	7 (2.3)			
Chronic bronchitis	6 (2.0)			
Emphysema	7 (2.3)			
Asthma	28 (9.3)			
Diabetes	58 (19.2)			
Hypercholesterolemia/dyslipidemia	73 (24.2)			
Hypertension	93 (30.8)			
Stroke	26 (8.7)			
Erectile dysfunction	11 (3.6)			
Others	11 (3.6)			
Unknown	50 (16.6)			
History of comorbid depression or anxiety				
No comorbid depression or anxiety	267 (88.4)	64 (81)	46 (75.4)	
Having comorbid depression	15 (5.0)	8 (10.1)	8 (13.1)	
Having comorbid anxiety	15 (5.0)	6 (7.6)	5 (8.2)	
Having comorbid depression and anxiety	5 (1.6)	1 (1.3)	2 (3.3)	
QOL score (how have things been going)				
Good QOL	270 (89.4)	62 (78.5)	50 (82.0)	35 (77.8)
Poor QOL	29 (9.6)	17 (21.5)	11 (18.0)	10 (22.2)
Missing	3 (1)	0 (0.0)	0 (0.0)	0 (0.0)
Feelings: bothered by emotional problems such as feeling anxious and depressed				
Not bothered	248 (82.1)	43 (54.4)	31 (50.8)	18 (40)
Bothered by emotional feelings	50 (16.6)	36.0 (45.6)	30 (49.2)	27 (60)
Missing	4 (1.3)	0 (0.0)	0 (0.0)	0 (0.0)
Social activities: amount of limitation in social activities with family, friends, neighbors, or groups due to physical and emotional health				
Having limitation	233 (77.2)	35 (44.3)	22 (36.1)	20 (44.4)
Not having limitation	64 (21.2)	44 (55.7)	39 (63.9)	25 (55.6)
Missing	5 (1.6)	0 (0.0)	0 (0.0)	0 (0.0)
Daily activities: amount of difficulty in doing usual activities or task (ADLs), both inside and outside the house because of physical and emotional health				
Not having any difficulty	230 (76.2)	43 (54.4)	36 (59.0)	25 (55.6)
Having difficulty in usual activities	67 (22.2)	36 (45.6)	25 (41.0)	20 (44.4)
Missing	5 (1.6)	0 (0.0)	0 (0.0)	0 (0.0)
Having pain				
No pain	222 (73.5)	44 (55.7)	31 (50.8)	21 (46.7)
Having pain	77 (25.5)	35 (44.3)	30 (49.2)	24 (53.3)
Missing	3 (1.0)	0 (0.0)	0 (0.0)	0 (0.0)

Abbreviations: ADL, activities of daily living; BMI, body mass index; GAD-7, Generalized Anxiety Disorder-7; IQR, interquartile range; PHQ-9, Patient Health Questionnaire-9; QOL, quality of life.
[a]Includes patients with both depression and anxiety.

Demographic and Clinical Characteristics of Heart Failure Patients With Depression and Anxiety

Of the 302 screened for depression and anxiety, 26.2% of patients met the diagnostic criteria for severe or major depressive symptoms, whereas 20.2% had major anxiety symptoms (Table 1). Patients with depression and anxiety were typically older than 50 years (84.9% and 71.9%, respectively), male (64.6% and 60.7%, respectively), in a married/permanent relationship (65.8% and 62.3%, respectively), and unemployed (45.6% and 39.3%, respectively). In addition, patients with depression and anxiety had a mean (standard deviation) of 3 (2.0) comorbidities and had been prescribed a mean (standard deviation) of 6 medicines (2.4 and 2.1, respectively) (Table 1).

Factors Associated With Depression and Anxiety for Patients With Heart Failure

In the univariable logistic regression model, odd ratio for depression (Patient Health Questionnaire-9 ≥ 10) increased with rising number of comorbidities (odd ratio, 1.18; 95% confidence interval, 1.02–1.36). Patients with HF were more likely to have depression when they had poor QOL (odd ratio, 4.57; 95% confidence interval, 2.07–10.09) and were bothered by emotional problems (odd ratio, 12.30; 95% confidence interval, 6.12–24.75), as well as those who had pain (odd ratio, 3.41; 95% confidence interval, 1.96–5.96). Patients with HF were more likely to have depression if they experienced difficulty in maintaining social activity (odd ratio, 5.20; 95% confidence interval, 2.88–9.40) or in performing daily activities (odd ratio, 5.11; 95% confidence interval, 2.85–9.16) compared with patients with HF who were not experiencing these difficulties. Patients were less likely to be depressed when aged 71 to 100 years (odd ratio, 0.41; 95% confidence interval, 0.18–0.94) compared with patients aged 20 to 50 years.

In the multivariable logistical regression model, patients were more likely to have depression when they were bothered by emotional problems (odd ratio, 9.41; 95% confidence interval, 4.06–21.77), had limited social activity (odd ratio, 2.59; 95% confidence interval, 1.06–6.34), and had difficulty in performing ADLs (odd ratio, 2.68; 95% confidence interval, 1.11–6.46). Patients aged 71 to 100 years (odd ratio, 0.15; 95% confidence interval, 0.03–0.70) were less likely to have depression than patients aged 20 to 50 years (Table 2).

Results from the univariable logistic regression suggest that anxiety (Generalized Anxiety Disorder-7 ≥ 10) was more likely to occur among patients with poor QOL (odd ratio, 2.60; 95% confidence interval, 1.16–5.86), who were bothered by emotional problems (odd ratio, 10.44; 95% confidence interval, 5.30–20.58), who were suffering from moderate to severe bodily pain (odd ratio, 4.05; 95% confidence interval, 2.23–7.35), and who had difficulty in maintaining social activity (odd ratio, 2.68; 95% confidence interval, 1.44–5.00) or performing ADL (odd ratio, 3.31; 95% confidence interval, 1.79–6.11), and those who had previous comorbid depression (odd ratio, 4.49; 95% confidence interval, 1.78–11.33). Patients aged 71 to 100 years (odd ratio, 0.34; 95% confidence interval, 0.14–0.83) were less likely to have probable anxiety compared with patients aged 20 to 50 years (Table 3).

In the multivariable logistic regression model, anxiety was associated with a history of comorbid depression (odd ratio, 5.42; 95% confidence interval, 1.58–18.61), being bothered by emotional problems (odd ratio, 9.77; 95% confidence interval, 4.25–22.46), having pain (odd ratio, 3.16; 95% confidence interval, 1.38–7.23), and

having difficulty in performing ADLs (odd ratio, 3.03; 95% confidence interval, 1.13–8.09). Patients aged 71 to 100 years were less likely to experience anxiety than those aged 20 to 50 years (odd ratio, 0.15; 95% confidence interval, 0.03–0.76) (Table 3). Sensitivity analysis based on complete cases broadly confirms the main findings from the analysis of the imputed data (Supplemental Digital Content 2, Appendix 2, http://links.lww.com/JCN/A181, and Supplemental Digital Content 3, Appendix 3, http://links.lww.com/JCN/A182).

Discussion

This retrospective cohort study determined the rate of depression and anxiety in patients with HF referred for cardiac rehabilitation and identified important factors associated with depression and anxiety in this population that inform priorities for care and treatment.

The study identified high rates of both depression (26.2%) and anxiety (20.2%) in patients with HF in the community. Thus, more than 1:4 of patients with HF had depression, and 1:5 had anxiety. These rates are comparable with international studies that reported rates of depression in HF ranging from 11.1% to 51.1%[3–7] and anxiety ranging from 18%[5] to 33%.[3] This wide range of rates of depression and anxiety across research studies is likely attributed to variation in the diagnostic instrument/questionnaire used and methods of assessment used.[17] Consistent use of standardized validated instruments/questionnaires for assessing depression and anxiety in HF would allow for more accurate comparisons between different study populations.[17] For example, a systematic review by Easton et al[8] (2016) on the prevalence of anxiety in cardiac patients suggests that the Generalized Anxiety Disorder-7 is optimal for use in this population.

Higher depression and anxiety symptoms were associated with being bothered by emotional problems, having difficulty in performing ADLs, and a younger age (<71 years). In addition, depression was associated with having difficulty with social activities, and anxiety was associated with having pain and comorbid depression. Most of the factors associated with depression and anxiety in this study were therefore psychosocial, indicating the priority for psychological therapies for this patient group. This is reflected in 2021 European Society of Cardiology HF guidelines that highlight the importance of psychosocial interventions for the management of depression in HF.[12]

The finding that depression and anxiety were associated with being bothered by emotions has not been reported in previous studies. This found association may be in part due to the fact that patient scores on the "being bothered by emotional problems" on the COOP subscale may be closely related to other symptoms of depression and anxiety that are measured by the Patient Health Questionnaire-9 and Generalized Anxiety

TABLE 2 **Association of Demographic and Clinical Factors With Depression Among Community-Dwelling Patients With Heart Failure Using Logistic Regression Modeling (N = 302)**

Demographic and Clinical Variables	Depression No.[a] (%)	Univariable OR (95% CI)	P[b]	Multivariable OR (95% CI)	P[b]
Age, y		$(\chi^2 = 8.83, 3\ df, P = .032)$[c]	$(\chi^2 = 10.04, 3\ df, P = .018)$		
20–50 (ref)	12.0 (36.4)	1.00		1.00	
51–60	18.0 (24.7)	0.57 (0.24–1.39)	.22	0.35 (0.11–1.17)	.088
61–70	25.0 (36.8)	1.02 (0.43–2.41)	.97	0.69 (0.22–2.18)	.53
71–100	24.1 (18.8)	0.41 (0.18–0.94)	.035	0.15 (0.03–0.70)	.016
Gender					
Male (ref)	51.1 (24.4)	1.00		1.00	
Female	28.0 (30.1)	1.34 (0.78–2.31)	.30	0.87 (0.39–1.93)	.73
Marital status					
Single/widowed (ref)	14.5 (20.5)	1.00		1.00	
Married/permanent relationship	64.6 (27.9)	1.51 (0.75–3.02)	.25	1.43 (0.59–3.50)	.43
Employment status		$(\chi^2 = 5.73, 2\ df, P = .057)$	$(\chi^2 = 0.52, 2\ df, P = .76)$		
Employed (ref)	15.2 (22.0)	1.00		1.00	
Unemployed	36.5 (35.0)	1.91 (0.95–3.87)	.070	1.18 (0.47–2.93)	.73
Retired	27.5 (21.4)	0.97 (0.47–1.98)	.93	1.34 (0.39–4.59)	.64
Ethnic groups					
White (ref)	41.0 (22.3)	1.00		1.00	
Other ethnicity	38.1 (32.3)	1.66 (0.95–2.92)	.076	2.13 (0.98–4.63)	.056
BMI		$(\chi^2 = 3.09, 2\ df, P = .21)$	$(\chi^2 = 3.06, 2\ df, P = .22)$		
Healthy (ref)	20.7 (20.6)	1.00		1.00	
Obese	34.8 (31.4)	1.76 (0.93–3.35)	.082	2.05 (0.89–4.75)	.094
Overweight	23.7 (26.2)	1.37 (0.69–2.72)	.37	1.72 (0.72–4.12)	.22
No. medicines	n/a[d]	1.03 (0.91–1.17)	.63	0.94 (0.79–1.12)	.50
No. comorbidities	n/a[d]	1.18 (1.02–1.36)	.022	1.25 (0.99–1.58)	.065
History of comorbid depression					
No (ref)	70.1 (24.9)	1.00		1.00	
Yes	9.0 (45.0)	2.47 (0.98–6.22)	.054	1.89 (0.54–6.68)	.32
History of comorbid anxiety					
No (ref)	72.1 (25.6)	1.00		1.00	
Yes	7.0 (35)	1.57 (0.60–4.08)	.36	0.43 (0.10–1.82)	.25
QOL					
Good (ref)	62.1 (22.8)	1.00		1.00	
Poor	17.0 (57.4)	4.57 (2.07–10.09)	<.001	1.44 (0.47–4.39)	.53
Bothered by emotional problems					
No (ref)	43.1 (17.1)	1.00		1.00	
Yes	36.0 (71.7)	12.30 (6.12–24.75)	<.001	9.41 (4.06–21.77)	<.001
Having limitation in social activity					
No (ref)	44.1 (18.6)	1.00		1.00	
Yes	35.0 (54.3)	5.20 (2.88–9.40)	<.001	2.59 (1.06–6.34)	.037
Having difficulty in ADL					
No (ref)	43.1 (18.4)	1.00		1.00	
Yes	36.0 (53.4)	5.11 (2.85–9.16)	<.001	2.68 (1.11–6.46)	.028
Having pain					
No (ref)	44.0 (19.6)	1.00		1.00	
Yes	35.1 (45.4)	3.41 (1.96–5.96)	<.001	1.51 (0.70–3.25)	.30

Abbreviations: ADL, activity of daily living; BMI, body mass index; CI, confidence interval; df, degrees of freedom; n/a, not applicable; OR, odds ratio; QOL, quality of life; ref, reference group for estimation of the odds ratio.
[a]Due imputation numbers are reported with decimal places.
[b]P values highlighted in bold when less than .05.
[c]Overall effect of variables with 3 or more categories.
[d]Continuous variables.

Disorder-7.[69,70] It may also reflect the importance of patients' capacity to tolerate bothersome psychosocial health problems to maintain positive mental health. In terms of supporting patients with HF, it is useful to consider research suggesting that ineffective emotional regulation is a key component in the development and maintenance of depression and anxiety disorders.[71–76] Adapting to negative information about HF diagnosis and associated life challenges may require the use of emotional regulation skills.[77–79] Cognitive behavioral therapy, which focuses on supporting emotional regulation, may therefore be an effective treatment to consider for managing depression and anxiety in patients with HF.[75,80]

Optimal psychosocial assessment during routine HF care can help to identify patients struggling with emotional

TABLE 3 **Association of Demographic and Clinical Factors With Anxiety Among Community-Dwelling Patients With Heart Failure Using Logistic Regression Modeling (N = 302)**

Demographic and Clinical Variables	Anxiety, No.[a] (%)	Univariable, OR (95% CI)	P^b	Multivariable, OR (95% CI)	P^b
Age, y		($\chi^2 = 8.32$, 3 df, $P = .040$)[c]		($\chi^2 = 7.63$, 3 df, $P = .054$)	
20–50 (ref)	10.0 (30.3)	1.00		1.00	
51–60	18.1 (24.7)	0.76 (0.30–1.89)	.55	0.88 (0.26–3.04)	.84
61–70	17.0 (25.0)	0.77 (0.30–1.93)	.57	0.54 (0.15–1.91)	.34
71–100	16.3 (12.7)	0.34 (0.14–0.83)	.018	0.15 (0.03–0.76)	.022
Gender					
Male (ref)	37.1 (17.7)	1.00		1.00	
Female	24.3 (26.2)	1.65 (0.92–2.96)	.096	1.22 (0.54–2.78)	.63
Marital status					
Single/widowed (ref)	11.7 (16.6)	1.00		1.00	
Married/permanent relationship	49.7 (21.5)	1.38 (0.63–3.03)	.42	1.35 (0.52–3.50)	.54
Employment status		($\chi^2 = 2.13$, 2 df, $P = .34$)		($\chi^2 = 5.85$, 2 df, $P = .053$)	
Employed (ref)	16.2 (23.4)	1.00		1.00	
Unemployed	24.6 (23.6)	1.01 (0.49–2.09)	.98	0.39 (0.15–1.05)	.062
Retired	20.7 (16.1)	0.63 (0.30–1.31)	.22	1.28 (0.37–4.49)	.70
Ethnic groups					
White (ref)	33.4 (18.2)	1.00		1.00	
Other ethnicity	28.1 (23.8)	1.41 (0.77–2.59)	.27	1.25 (0.53–2.94)	.62
BMI		($\chi^2 = 4.28$, 2 df, $P = .12$)		($\chi^2 = 1.87$, 2 df, $P = .39$)	
Healthy (ref)	17.4 (17.3)	1.00		1.00	
Overweight	14.3 (18.8)	0.89 (0.41–1.94)	.78	0.76 (0.29–1.99)	.58
Obese	29.7 (26.8)	1.75 (0.89–3.44)	.10	1.44 (0.61–3.41)	.41
Alcohol consumption, units/wk					
<14 (ref)	58.2 (20.5)	1.00		1.00	
≥14	3.2 (17.6)	0.83 (0.23–3.01)	.78	1.40 (0.29–6.77)	.67
No. medicines, mean (SD)	n/a[d]	1.03 (0.90–1.19)	.64	1.04 (0.86–1.25)	.68
No. comorbidities, mean (SD)	n/a[d]	1.09 (0.93–1.28)	.27	1.35 (0.52–3.50)	.54
History of comorbid depression					
No (ref)	51.4 (18.2)	1.00		1.00	
Yes	10.0 (50.0)	4.49 (1.78–11.33)	.002	5.42 (1.58–18.61)	.007
History of comorbid anxiety					
No (ref)	54.4 (19.3)	1.00		1.00	
Yes	7.0 (35.0)	2.25 (0.86–5.92)	.099	1.09 (0.27–4.32)	.90
QOL					
Good (ref)	50.4 (18.5)	1.00		1.00	
Poor	11.0 (37.2)	2.60 (1.16–5.86)	.021	0.73 (0.22–2.36)	.60
Bothered by emotional problems					
No (ref)	31.4 (12.5)	1.00		1.00	
Yes	30.0 (59.8)	10.44 (5.30–20.58)	<.001	9.77 (4.25–22.46)	<.001
Having limitation in social activity					
No (ref)	39.1 (16.5)	1.00		1.00	
Yes	22.3 (35.6)	2.68 (1.44–5.00)	.002	0.84 (0.29–2.42)	.75
Having difficulty in ADL					
No (ref)	36.1 (15.4)	1.00		1.00	
Yes	25.3 (37.5)	3.31 (1.79–6.11)	<.001	3.03 (1.13–8.09)	.027
Having pain					
No (ref)	31.0 (13.8)	1.00		1.00	
Yes	30.4 (39.3)	4.05 (2.23–7.35)	<.001	3.16 (1.38–7.23)	.007

Abbreviations: ADL, activity of daily living; BMI, body mass index; CI, confidence interval; df, degrees of freedom; n/a, not applicable; OR, odds ratio; QOL, quality of life; ref, reference group for estimation of the odds ratio.
[a]Due imputation numbers are reported with decimal places.
[b]P values highlighted in bold when less than .05.
[c]Overall effect of variables with 3 or more categories.
[d]Continuous variables.

problems and guide effective psychosocial interventions and management.[12,81] In particular, to identify negative emotions or difficulty in adjusting to HF, healthcare professionals need to be attentive to patients' expressions indicating psychological struggles such as "learning to cope" and having "difficulty adjusting."[82] Equally, professionals should be aware of patients who have already experienced mental health issues before their HF diagnosis. In this study, for example, anxiety was found to be associated with a comorbid history of depression, which concurs with previous studies that have found that a history of previous mental illness (the type of disorder was unspecified by the

study) is associated with anxiety in a community population.[5] Professionals need to consider how to support patients with HF who may have a history of depression or indeed any other preexisting mental health issues, and further research is also needed to explore the impact of a diagnosis of HF on this potentially vulnerable population.

This study found that depression and anxiety were associated with difficulty in performing ADLs. Similarly, Freedland et al[22] (2003) reported that hospitalized patients with HF who were unable to perform self-care or other ADLs without assistance were at a higher risk of depression. Previous research has also shown that patients in the community who struggle to carry out physical tasks often have high stress, which in turn may increase their anxiety and depression levels as their independence is compromised.[83] Depression was also more prevalent among patients who had lower social activity in this study, a finding that has not been reported before in studies of community or hospitalized patients with HF. Previous studies have, however, identified an association between higher depression and lower social support for patients with HF.[6,84] Social support is essential to protect against depression.[85]

However, it is important to note that distressing physical HF symptoms often impede social activity[41] and can therefore potentially reduce social support.

Given that reduced social activity and social isolation can lead to adverse outcomes in HF,[41] it is critical to support patients with HF to maintain their independence and to participate in social activities that connect them to others. Multidisciplinary programs should encompass a comprehensive assessment across all domains of patients' physical, social, and psychological health, and they should be tailored to individual patients' needs.[86] Equally, the delivery of supportive interventions must be tailored for HF patients with compromised physical function and pain as well as those struggling with ADLs, who may be unable to attend face-to-face sessions. Use of virtual/online interventions may be helpful in this group. However, clinical trials examining the efficacy of online therapies for the management of mental health conditions in HF are so far limited.[87]

Relatedly, the physical limitations of HF may be felt most acutely by younger patients. This study found those 70 years and younger had higher odds of depression and anxiety compared with those 71 years and older. Findings relating to age and depression in this study support previous research that shows that patients with HF in the community with depression tend to be younger (below 60 to 65 years) than nondepressed patients,[4,7,37,39] whereas studies of hospitalized patients have reported that patients 70 years or older had higher depression than middle-aged patients.[16,40] An HF diagnosis for working-age patients may present a critical threat to their ability to support their families and carry out ADLs. Specifically, younger patients may need greater support, because they face the challenge of balancing HF disease restriction with finding a job or remaining employed, establishing meaningful relationships, attending to family duties, and maintaining financial security.[88]

Finally, this study found that anxiety was associated with both pain and a history of comorbid depression. The association between body pain and anxiety has not been previously reported in research focusing on hospitalized or community patients with HF. Rather, study authors have only reported an association between body pain and depression.[89,90] Pain is very common in patients with HF, with rates of 57% to 84.4% reported.[91–94] Pain can interfere with activity levels in HF[92] and worsen QOL.[93] Patients with HF experiencing pain also report worry, loss of control over their own life, and worries about being a burden to their family,[95] which in turn can increase their anxiety. Future interventions therefore need to consider ways of either reducing pain through optimizing their medication[96] and/or supporting patients to manage their pain using nonpharmacological interventions, such as relaxation techniques.[97]

Study Limitations

The data in this study were collected from the largest heart and lung specialist center in the United Kingdom. However, the specialist nature of the center may have implications for the representativeness of the sample for the wider population with HF, such as HF disease severity or complications requiring specialist intervention. In addition, the sample size in this study was small (n = 302), and a larger sample would have increased the power of the study, but the individual-level patient-reported data still have identified clinically important findings.

The cross-sectional design of this research also prevented further exploration of the causal relationships between depression and anxiety and demographic and clinical factors. Finally, the number of patients with complete data was just under 60%. However, given that the overall proportion of missing data across the whole data set was low (3.5%), a decision was taken to undertake multiple imputation. This served to reduce any biases that may have resulted from a complete case analysis, such as selection of patients based on their completeness of data.

Implications for Practice and Future Research

First, the reported rate of depression and anxiety emphasizes the importance of mental health assessment and management in the community. The findings have direct implications for patient health management because most of the factors can be easily identified and addressed with preventive health strategies. This study

What's New and Important

- Higher depression and anxiety scores were associated with difficulty in performing daily activities and depression with lower social activity in patients with HF. Practical support is needed to promote HF patients' independence and participation in activities that connect them to others.
- Being bothered by emotional problems was associated with higher depression and anxiety scores, and having pain and comorbid depression was associated with higher anxiety scores. Thus, patients with HF may benefit from psychological interventions that are targeted to improve their emotional regulation and their management of pain.
- Because most of the factors associated with depression and anxiety in this study were psychosocial, health and social care professionals need to collaborate to ensure rapid access to personalized psychological care and practical support for patients with HF.

highlights new factors that can improve patients' outcomes such as the management of pain and providing support with ADL. Collaboration between healthcare providers, social workers, and HF nurses is required to review HF patients' risk for depression and anxiety to enable prompt personalized psychological care and practical support.

Most of the patients in this study were identified as White. Few study authors have examined the association between ethnicity and depression and/or anxiety in HF.[4,7,18,22] Given the inconsistency of past findings, future research needs to clarify the association between different ethnic groups and depression and anxiety. As previously reported, studies have tended to focus on depression despite anxiety also being a major concern in this population. Therefore, larger studies are now required to investigate the factors associated with anxiety in HF to improve outcomes and help to guide healthcare professionals on the assessment and management of HF patients with depression and anxiety. Longitudinal studies are indicated to examine the factors associated with depression and anxiety as HF progresses and inform understanding on demographic and clinical factors that impact patients' mental status and inform interventions to reduce depression and anxiety.

Conclusion

Depression and anxiety are common among patients with HF. Routine screening of depression and anxiety with validated questionnaires within a holistic assessment is vital for patients with HF. Holistic assessment and person-centered care are cornerstones of optimal care and treatment in HF.[12] Holistic care may include measures targeted to manage psychosocial concerns, improve physical functioning such as ADLs, and optimally manage pain. By understanding the association

between demographic and clinical factors associated with depression and anxiety in HF, healthcare providers will be able to offer personalized mental health assessment and management.

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