The Prevalence of depression in outpatients attending a chronic heart failure with reduced ejection fraction clinic in a tertiary academic centre in Johannesburg, South Africa

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Abstract

**Background:** In high income countries depression is reported to affect at least one-fifth of patients with chronic heart failure (CHF). Mental health problems have been associated with frequent rehospitalisation and an increased risk of all-cause mortality. Despite the reported high prevalence of depression in CHF, there is a paucity of data on this subject from the developing world. The aim of the study was to determine the prevalence of depression, stress and anxiety in patients attending a dedicated chronic heart failure clinic.

**Methods:** A prospective study was conducted at an outpatient heart failure clinic, in a tertiary academic centre over a nine month period in 2016. The study participants completed a Depression, Anxiety and Stress (DASS-21) questionnaire to screen for the presence and severity of depression, anxiety and stress. Descriptive statistics and logistic regression analysis was used to identify predictors of depression.

**Results:** The study population comprised of 103 patients, predominantly female (62.1%) with a median age of 53 (interquartile range 38 – 61). Hypertension was the most common co-morbidity, reported in 35.9% of patients. Depression was reported by 54 (52.4%) with 12(11.7%) reporting extremely severe depression. Anxiety was diagnosed in 55 (53.4%) patients with extremely severe anxiety reported by 19 (18.4%) patients. Fifty patients (48.5%) were classified as stressed and only 8 (7.7%) had extremely severe stress. More than half of the patients (54.4%) were in New York Heart Association (NYHA) functional class I with a mean (SD) left ventricular ejection (LVEF) of 30.5 (11.1) %. The six-minute walk test (odds ratio (OR) -0.07, 95% confidence interval (CI) -0.01 – 0.00, p=0.012) and the Minnesota Living with Heart Failure score (OR 0.04, CI 0.02 – 0.01, p=0.001) were identified as independent predictors of depression.

**Conclusion:** The prevalence of depression and anxiety was found in over half of our patients attending the chronic heart failure clinic. In view of the high prevalence of psychosocial stressors in CHF, we recommend that mental health screening should be considered. Prospective, adequately powered, multicentre studies from developing countries investigating the impact of depression on heart failure hospitalisation and mortality are still required.
Background
Chronic heart failure (CHF) is a clinical syndrome that is associated with a significant reduction in the quality of life of the patients affected. Despite the reduction in mortality and improved morbidity with contemporary heart failure therapy, many patients still experience progressive disease and ultimately perish. Previous reports have suggested that heart failure accompanied by psychosocial stressors such as depression, anxiety and stress, is associated with an increased rate of heart failure rehospitalisation and mortality [1–3].

In the South African setting, the prevalence of depression and anxiety in heart failure remains unknown. We hypothesise that it is likely to be higher than that of patients residing in the developed world, due to confounding poor socioeconomic factors. This study aims to determine the prevalence of depression, anxiety and stress in patients diagnosed with chronic heart failure in a tertiary academic hospital in Johannesburg, South Africa.

Methods
We prospectively recruited 103 patients attending the heart failure outpatient clinic at the Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) between 01 January and 31 September 2016. All study participants were adults 18 years of age and older. All patients recruited into the study were interviewed by a single interviewer and provided with instructions on how to complete the English version of the Depression, Anxiety and Stress Scale (DASS-21) questionnaire. The patients enrolled in the study understood and could read English. The interviews were conducted while patients were awaiting their morning clinical consultation at the heart failure clinic.

The DASS-21 questionnaire is a validated tool designed to measure the emotional states of depression, anxiety and stress. Each scale contains seven items. The depression scale assesses dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/involvement, anhedonia and inertia, while the anxiety scale assesses autonomic arousal, skeletal muscle effects, situational anxiety and subjective experience of anxious affect. The stress scale assesses difficulty in relaxation, nervous arousal, irritability and lack of patience. The final score is obtained by multiplying the total score in each of the three scales by two [4].
We used the Minnesota Living with Heart Failure Questionnaire (MLHFQ) to evaluate the impact of heart failure on the patients. The MLHFQ is a disease-specific questionnaire for patients with heart failure comprising of 21 items rated on six-point Likert scales, representing different degrees of the impact of heart failure on health-related quality of life in the month prior, as perceived by the patient from 0 (none) to 5 (very much). The total score ranges between 0 and 105, where 105 represents the worst quality of life [5].

Blood pressure measurements were taken from the right upper arm before and after the six-minute walk test. The weight and height were also measured from each study participant. Data was collected using a structured questionnaire consisting of socio-demographic and clinical parameters. Demographic and clinical variables collected from the study participants included age, gender, date of birth, ethnicity, employment status, and symptoms of heart failure. The rest of the clinical data was obtained from the outpatient heart failure clinic file.

**Statistical analysis** Normally distributed continuous variables were summarized as the mean and standard deviation (SD). The median and interquartile ranges (IQR) were used for continuous variables with a skewed distribution. The Chi-square test was used to compare categorical variables. Univariable and multivariable logistic regression analyses were done to examine the independent association between predictor variables and depression. These predictors were reported as unadjusted odds ratios (ORs), with 95% confidence intervals (CI). Differences were considered statistically significant at a p-value < 0.05. All statistics were generated with STATA MP Version 13.0 (StataCorp. Texas).

**Results**
The study population comprised of 103 patients with a median age of 53 (IQR: 38-61) years. Sixty-four patients (62.1%) were female and (71.8%) were black. Hypertension was the most prevalent comorbidity, seen in 37 (35.9%) participants. Only 13 (12.6%) patients had a history of ischaemic heart disease. Unemployment was reported by 70 patients (67.9%). Patients in our study were overweight with a mean body mass index (BMI) of 29 ± 6.2 kg/m². More than half of the patients (54.4%) were in New York Heart Association (NYHA) functional class I with a mean (SD) left ventricular
ejection fraction (LVEF) of 30.5 ± 11.1%.

Of the study participants, 98 (95.1%) were treated with beta-blockers, 94 (91.2%) were on angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARB), 89 (80.2%) were treated with diuretics and 76 (73.7%) with mineralocorticoid receptor antagonists. The rest of the demographic and clinical data are reported in Table 1.

Fifty-four (52.4%) patients met the diagnostic criteria for depression, with severe and extremely severe depression reported in 10 (9.7%) and 12 (11.6%) patients respectively (Figure 1). The six-minute walk test (OR -0.07, CI -0.01 – 0.00, p=0.012) and the Minnesota Living with Heart Failure score (OR 0.04, CI 0.02 – 0.01, p=0.001) were identified as independent predictors of depression (Table 2).

Discussion

In this study, the prevalence of depression was found to be 52.4%. This is significantly high compared to most studies in the developed world. In a community-based study conducted in the United States of America, the prevalence of depression in patients with CHF was reported to be 17% [6]. Haworth et al. studied 100 out-patients with heart failure in the United Kingdom and found the prevalence rate for anxiety and depression to be 18% and 29%, respectively [7]. The higher prevalence of depression in our patients is likely influenced by educational and socioeconomic factors that are unique to populations in middle income countries. This hypothesis is supported by a study conducted in Pakistan, where the prevalence of depression in 170 patients with CHF was found to be 60% [8].

Anxiety and depression are common in CHF and should not be overlooked when managing these patients. This is particularly important since both conditions are associated with poor outcomes. Potential mechanisms linking depression, anxiety and heart failure outcomes include inflammation, autonomic dysfunction, platelet aggregation, endothelial dysfunction, poor diet, smoking and reduced physical activity [9]. Data on the prevalence of stress in CHF patients is lacking, although there is a well-established relationship between prolonged emotional or physical stress and activation of the autonomic nervous system, hence increasing the likelihood of myocardial infarction, arrhythmias, heart failure and sudden cardiac death [10, 11].
In our study, patients with depression had a higher mean MLHFQ score of 32 (27.9). A short six-minute walk distance and a high MLHFQ score were independent predictors of depression in patients with CHF. A longer distance walked during the six-minute walk test was associated with a reduced likelihood of suffering from depression. Other published predictors for depression in heart failure include a low socioeconomic status (OR 5.1, 95% CI 1.4 – 17.9), previous depressive episode, smoking, NYHA functional class and unmarried status [6, 12, 13]. In our patient data, the NYHA functional class was not an independent predictor of depression. Thirty-nine percent of NYHA functional class I heart failure patients were depressed in our study, implying the overlay of other factors such as the socioeconomic status in the aetiology of depression.

**Study Limitations**

This study was limited by a small sample size and patient enrolment from a single-medical centre. Patients were recruited over a short period of time and we only included in the study patients who could communicate in English. Although there is no data to suggest that the DASS-21 questionnaire over-estimates the burden of depression, we are mindful of the fact that the prevalence is largely influenced by the tool used to measure depression. Only one tool was used to assess for the presence of depression and patients were not subsequently interviewed by a psychologist nor a psychiatrist. This study was a cross-sectional analysis with no follow-up on the patients to assess for resolution of symptoms or measurement of outcomes such as rehospitalization and/or mortality.

**Conclusion**

Depression and anxiety were found in more than 50% of patients with chronic heart failure. Based on the findings of this study, mental health screening should be considered in all patients with chronic heart failure with appropriate referral pathways to psychologists and psychiatrists. We recommend that prospective, multicentre studies from low and middle income countries be conducted using multiple tools to screen for depression and investigate the impact of depression on heart failure hospitalisation and mortality.

**Declarations**

**Ethics approval and consent to participate** Research approval was granted by the Durban
University of Technology (DUT) Research Ethics Committee as JH was a bachelor of technology student registered at DUT and this study formed part of her research report. Permission to access patient records was obtained from the Charlotte Maxeke Johannesburg academic hospital authorities. All patients signed an informed consent form prior to participation in the study.

**Consent for publication** Not applicable.

**Availability of data and material** The dataset is available from the corresponding author upon request.

**Competing interests** None

**Funding** None

**Authors’ contributions:** Conception and design of the study: PM, NT, JH. Data collection: JH, DM and VM. Analysis and interpretation: NT, JH, DM and VM. Drafting or critical review of the article: PM, NT, EK, DM and VM.

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**Abbreviations**

ACE Angiotensin converting enzyme

ARB Angiotensin receptor blockers

CHF Chronic heart failure

CI Confidence intervals

CMJAH Charlotte Maxeke Johannesburg Academic Hospital

DASS Depression, Anxiety and Stress Scale

IQR Interquartile ranges

LVEF Left ventricular ejection fraction

MLHFQ Minnesota Living with Heart Failure Questionnaire

NYHA New York Heart Association

SD Standard deviation
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Tables

Table 1. Demographic and clinical characteristics of patients with chronic heart failure

| Variable              | Total (n=103) | No (n=49) | Yes (n=54) | p-value |
|-----------------------|--------------|-----------|------------|---------|
| **Depression**        |              |           |            |         |
| Age, years            | 53 (38-61)   | 50.8 (13.4) | 50.9 (14.5) | 0.992   |
| Females, n (%)        | 64 (62.1)    | 27 (55.1)  | 37 (68.5)  | 0.161   |
| Ethnicity, n (%)      |              |           |            | 0.923   |
| Black                 | 74 (71.8)    | 37 (75.5)  | 37 (68.5)  |         |
| White                 | 12 (11.6)    | 5 (10.2)   | 7 (12.9)   |         |
| Indian                | 11(10.7)     | 4 (8.2)    | 7 (12.9)   |         |
| Coloured              | 4 (3.9)      | 2 (4.1)    | 2 (3.7)    |         |
| Other                 | 2 (1.9)      | 1 (2.0)    | 1 (1.9)    |         |
| Employment status, n |              |           |            | 0.021   |
| unemployed            | 70 (67.9)    | 27 (55.1)  | 43 (79.6)  |         |
| part-time             | 9 (8.7)      | 5 (10.2)   | 4 (7.4)    |         |
**Vital signs**

|                     | Univariable regression |
|---------------------|------------------------|
| systolic bp (mmHg)  | 124 (110-137)          |
| diastolic bp (mmHg) | 73 (66-85)             |
| MAP (mmHg)          | 92.1 (13.9)            |
| pulse (bpm)         | 72 (64-79)             |
| MLHFQ score         | 16 (1-40)              |
| BMI (kg/m²)         | 29 (6.2)               |
| Six-minute walk test (m) | 350 (300-450)       |
| LVEF (%)            | 30.5 (11.1)            |

**NYHA class, n (%)**

| Class | NYHA class II | NYHA class III | Permanent employment | Six-minute walk test | MLHFQ score | Orthopnoea |
|-------|---------------|----------------|----------------------|----------------------|-------------|------------|
| I     | 56 (54.4)     | 35 (71.4)      | 21 (38.9)            |                      |             |            |
| II    | 33 (32.0)     | 10 (20.4)      | 23 (42.6)            |                      |             |            |
| III   | 14 (13.6)     | 4 (8.2)        | 10 (18.5)            |                      |             |            |

**Symptoms, n (%)**

| Symptom          | NYHA class II | NYHA class III | Permanent employment | Six-minute walk test | MLHFQ score | Orthopnoea |
|------------------|---------------|----------------|----------------------|----------------------|-------------|------------|
| orthopnoea       | 11 (10.7)     | 2 (4.1)        |                      |                      |             |            |
| dyspnoea         | 16 (15.5)     | 5 (10.2)       |                      |                      |             |            |
| PND              | 10 (9.7)      | 3 (6.1)        |                      |                      |             |            |
| fatigue          | 17 (16.5)     | 6 (12.2)       |                      |                      |             |            |

Dichotomous variables are represented as absolute numbers and percentages (%). Data showed a mean and standard deviation (SD) for continuous variables with a normal distribution and as a median and interquartile range (25th – 75th percentile) for continuous variables with a skewed distribution. BP = blood pressure; BMI = body mass index; MAP = mean arterial pressure; MLHFQ = Minnesota Living with Heart Failure Questionnaire; NYHA = New York Heart Association; PND = paroxysmal nocturnal dyspnoea; LVEF = left ventricular ejection fraction.

Table 2. Logistic regression analysis for predictors of depression

|                         | OR      | Univariable regression | 95% CI      | OF |
|-------------------------|---------|------------------------|-------------|----|
| NYHA class II           | 3.83    | 0.004                  | 1.53 - 9.60 |    |
| NYHA class III          | 4.17    | 0.029                  | 1.16 - 14.97|    |
| Permanent employment    | 0.26    | 0.008                  | 0.95 - 0.71 | - 1.22|
| Six-minute walk test    | 0.99    | 0.005                  | 0.99 - 0.99 | - 0.07|
| MLHFQ score             | 1.04    | 0.000                  | 1.02 - 1.06 | 0.0|
| Orthopnoea              | 4.69    | 0.056                  | 0.96 - 22.95| 1.8|

MLHFQ = Minnesota living with heart failure questionnaire; NYHA = New York Heart Association

**Figures**
Figure 1

Graph showing chronic heart failure patients with depression, anxiety and stress stratified according to the severity