

# The contribution of individual mental health and socioeconomic status to the evolution of elderly patients with chronic heart failure

## *Il contributo della salute mentale individuale e dello stato socioeconomico all'evoluzione dei pazienti anziani con insufficienza cardiaca cronica*

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**SUMMARY. Aim.** The purpose of this article is to assess the impact of comorbid depression on the outcome of elderly patients diagnosed with chronic heart failure (CHF). **Methods.** We conducted a prospective analysis of the outcomes of 251 patients, hospitalized throughout 2019 for an exacerbation of CHF. The sample was divided into two groups: group A - 153 patients with major depressive disorder (MDD); group B - 98 patients without clinical depression. We analyzed the associations between socioeconomic status (SES) and the severity of depressive symptoms, pharmacotherapy, readmission, and mortality rates within 30 days and at one year. We classified patients' SES according to residence, income, education level, and family support. Quality of Life (QL) total scores were also assessed. The severity of mental health complaints was evaluated using the Montgomery-Asberg Depression Ratings (MADRS) scale; individual somatic evaluation included the analysis of the alteration of the left ventricular ejection fraction (LVEF), as well as details regarding pharmacotherapy with angiotensin-converting enzyme (ACE) inhibitors and beta-blockers (BB). **Results.** The patient sample appeared uniform in terms of SES and CHF pharmacotherapy. The main differences were the presence of comorbid MDD, with 60.91% of patients having clinical depression. These patients also reported a lower QL, reduced LVEF, more frequent, and extended hospitalizations with an overall higher one-year mortality than patients without MDD. **Discussion.** Although depression is considered a risk factor for adverse outcomes in older adults with CHF, in our research, its impact was significantly associated with a reduced QL, but the association with a lower SES was inconclusive. **Conclusions.** MDD is a frequent comorbidity in patients with CHF, and is associated with a reduced LVEF and QL. Our results showed that, despite a similar therapeutic regimen, patients with comorbid MDD required more frequent, prolonged admissions and higher one-year mortality rates than those without MDD.

**KEY WORDS:** major depressive disorder, socioeconomic status, quality of life, chronic heart failure.

**RIASSUNTO. Scopo.** Lo scopo di questo articolo è di valutare l'impatto dello stato socioeconomico sull'esito di pazienti anziani con diagnosi di insufficienza cardiaca cronica (CHF), con e senza disturbo depressivo maggiore (MDD). **Metodi.** È stata condotta un'analisi prospettica sugli esiti di 251 pazienti anziani, ricoverati in ospedale nel 2019 con estromizzazione dell'insufficienza cardiaca cronica (CHF). Il campione è stato diviso in 2 gruppi: A - 153 pazienti con MDD e B - 98 pazienti senza MDD. Abbiamo valutato in entrambi i gruppi l'associazione tra stato socioeconomico del paziente (SES), gravità dei sintomi depressivi, terapia, riabilitazione e tassi di mortalità da 30 giorni a un anno. È stato classificato il SES dei pazienti in base a residenza, reddito, istruzione, sostegno familiare e abbiamo valutato i punteggi totali di Quality of Life (QL). I pazienti sono stati catalogati riguardo la gravità della MDD mediante la Scala di valutazione della depressione Montgomery-Asberg (MADRS), l'alterazione della frazione di eiezione ventricolare sinistra (LVEF), la prescrizione di inibitori dell'enzima di conversione dell'angiotensina (ACE) e i beta-bloccanti (BB) all'uscita. **Risultati.** Nonostante un SES simile e una terapia di CHF, al 60,91% dei nostri pazienti è stata diagnosticata la MDD. Avevano QL e LVEF più bassi, ricoveri più frequenti e più lunghi con mortalità di un anno più elevata rispetto ai pazienti senza MDD. **Discussione.** Sebbene MDD sia considerato un potenziale fattore di rischio per gli esiti negativi nelle persone anziane affette da CHF, da diversi studi, nella nostra ricerca, il suo impatto è stato determinato da una riduzione del QL, ma non correlata con un SES più basso. **Conclusioni.** MDD è comune tra i pazienti con CHF, essendo associato a una riduzione di LVEF e di QL. Nonostante una tale prescrizione terapeutica, i pazienti con MDD hanno tassi di ricovero più elevati, con una degenza più lunga in ospedale e con aspettativa di vita minore di un anno rispetto a quelli senza depressione.

**PAROLE CHIAVE:** disturbo depressivo maggiore, stato socioeconomico, qualità della vita, insufficienza cardiaca cronica.

## INTRODUCTION

Cardiovascular diseases (CVD) and major depressive disorder (MDD) represent frequent and challenging public health issues. The relation between CVD and MDD is intricate, as these pathologies share certain common socio-demographic, psychosocial, behavioral, and biological pathways<sup>1</sup>. Depression is usually associated with unhealthy habits, including smoking, excessive alcohol use, a sedentary lifestyle, poor diet, obesity, poor therapy adherence, as well as other cardiovascular risk factors, such as diabetes mellitus and dyslipidemia, with a higher impact on the elderly population<sup>2</sup>. The prevalence of chronic heart failure (CHF) continues to rise due to improved survival rates in ischemic heart disease (IHD) and reduced mortality rates in patients with established CHF<sup>3</sup>. Most patients with CHF are older than 65 years and suffer from comorbid MDD<sup>2</sup>. An acute exacerbation of CHF in this population is frequent, explaining why the personal and economic burdens of this disorder are increasingly relevant to healthcare planning and policy. Repeated hospitalizations are the principal contributor to the healthcare costs of patients with CHF<sup>4</sup>. It is a relatively common and ubiquitous reality that older people, especially those residing in rural areas, benefit from substantially lower incomes than adults still in employment, have less access to healthcare and, possibly, also lack adequate instrumental support, owing to various factors. There are concerns whether variations in CHF therapy, due to differences in individual socioeconomic status (SES) and inequity in terms of local health care providers, could influence the outcomes of these patients. However, to date, few studies have assessed the impact of patient SES on CHF care and, even less so, on CHF with comorbid MDD<sup>2,4,5</sup>. On account of these complicated circumstances, these patients are less likely to be treated by a specialist and to receive a timely and appropriate treatment according to the latest guidelines<sup>6,7</sup>. Globally, however, there are conflicting data regarding this topic. Hawkins et al. reported an adjusted risk of developing CHF associated with more significant socioeconomic deprivation to be consistently increased by 30-50%<sup>8</sup>, although Rathore et al.<sup>2</sup> when analyzing data from a large American Heart Failure project suggested that there was no independent association between income and quality of care during hospitalization. Other clinical and epidemiological studies investigating the association of CHF and depression suggested that MDD independently increases the cardiovascular risk 1.5-fold on average, compared with cardiac patients without clinical depression<sup>9-11</sup>. However, the standard of care during hospitalization in specialized departments should be similar, since the same standards of care are respected. It is suggested that significant differences occur after discharge from hospital, and this is where individual SES, including a lower-income *per capita*, reduced rates of social support, a higher prevalence of untreated clinical depression and neuropsychiatric stress, associated with other psychosocial factors, intervene, by limiting these patients' ability to manage their severe illness<sup>2</sup> adequately. This study aims to assess the impact of socioeconomic status and depression on the outcome of elderly patients diagnosed with CHF, with and without comorbid MDD. For this purpose, we longitudinally monitored their evolution, one year after the most recent hospitalization for an exacerbation of heart failure, starting from the premise

that all of them were adequately evaluated and treated during hospitalization, according to the latest European Guidelines recommendations, but that significant potential differences could occur after discharge from hospital, due to their individual SES and existence of comorbid depression.

## METHODS

Of 337 patients admitted for exacerbation of CHF in the Cardiology Ward of our general hospital between Jan-Dec 2018, we selected 251 participants older than 65 years, with a diagnosis of CHF with a reduced LVEF (lower than 39%). All of the patients that were included in the study signed written consent forms and were able to complete the European Quality of Life scale (EQ-5D-5L), as well as to answer the first two questions of the PHQ-9, Patient Health Questionnaire ("little interest or pleasure in doing things" and "feeling down, depressed or hopeless in the last two weeks"). Patients who gave definite answers to both these questions were further evaluated for depression, using the more complex Montgomery-Asberg Depression Ratings Scale (MADRS)<sup>12</sup>. Based on these results, our patients were divided into two study groups: Group A= 153 patients with comorbid depressive illness; Group B= 98 patients without depressive symptoms.

Patient samples were organized according to gender, residence (urban, rural), level of education (primary, high school or university studies), monthly income level (low, middle or high), and individual living circumstances (alone or with family support). Subsequently, all patients were evaluated based on the questionnaire results, assessment of LVEF, prescription of guidelines<sup>6</sup> recommended medication during hospitalization and at discharge, readmission for cardiovascular reasons within one year after discharge, and mortality due to cardiac causes within 30 days and one year after discharge. The prescription of ACE inhibitors or angiotensin receptor blocker (ARB) and BB during hospitalization and at discharge was considered mandatory in patients with an LVEF of under 39%, excluding those with documented contraindications to this therapy.

## Mental health evaluation

The Mental Health team of our hospital evaluated the presence and intensity of current depressive symptoms in all patients that had been referred for a low mood. The criteria for a major depressive episode include the presence of a depressed mood, lasting for a minimum of two weeks, associated with loss of interest or pleasure (anhedonia), and notable functional impairment. The clinical impression was corroborated with the results of objective psychometric assessment tools in order to more accurately gauge the presence and intensity of depressed mood or anhedonia (loss of interest or pleasure). For this purpose, we employed two questions of the Patient Health Questionnaire (PHQ-9) and the Montgomery-Asberg Depressions Ratings scale. The MADRS is a 10-item rating scale that aims to assess symptom variation in the previous seven days, as well as to evaluate the severity of depression based on the total score, with higher scores indicating greater severity of depressive symptoms<sup>12</sup>. The MADRS has high inter-rater reliability and correlates significantly with scores of other standard scales for depression, such as the HAM-D<sup>13</sup>. It is worth mentioning that none of the patients included in our study reported a previous history of mental illness.

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**Cardiological evaluation**

Following a rigorous anamnesis and clinical examination, an expert operator performed comprehensive echocardiography on all patients included in the study. The dimensions and function of cardiac cavities were evaluated by using the same ultrasound machine (Siemens Acuson Sequoia) according to Guidelines recommendations<sup>14</sup>. LVEF was assessed in a four-chamber view employing Simpson's biplane method.

**Statistical methods**

Data analysis was performed using v.25 of the SPSS (Statistical Package for the Social Sciences, Chicago, IL, USA). Continuous variables were presented as mean and standard deviation (SD) or median and interquartile range (IQR), and categorical variables were presented as frequency and percentages. The results of the normality test (Shapiro-Wilk) showed a non-gaussian distribution, which enabled us to continue using nonparametric tests. In order to evaluate the proportion of stenting indication, associated conditions, and risk factors (Table 1), we used Fisher's exact test. For the comparison of patients' characteristics (Table 1), we utilized the Mann-Whitney U test. A p-value of less than 0.05 was considered to indicate a statistically significant difference. The Ethics Committee of our General Hospital approved this study; participation was voluntary, without financial remuneration, and all patients signed a written informed consent before commencing the medical evaluation.

**RESULTS**

Our study was completed on 251 patients, with ages over 65 years (mean age 73.21±5.23 years), diagnosed with CHF with reduced LVEF (under 39%), with a predominance of female patients (54.98%), and the majority residing in urban areas (59.76%). Most of the participants reported a primary education level (54.3%). In terms of individual financial status, low and middle-income levels predominated (49.79% and 32.52%), with only 17.67% of patients reporting a high income. Depending on the presence or absence of MDD, as mental health comorbidity, we divided them into two groups: with and without MDD. Patients' demographical and clinical characteristics, alongside individual SES, the standard of care therapy, and outcomes are presented in Table 1. Concerning these factors, there were no statistical differences noted between the two groups. The mental health status of all patients was evaluated by using the EQ-5D-5L and MADRS scales, which indicated statistically significant differences (p<0.001) between the two groups (Table 1).

Group A consisted of a total of 153 patients with clinical diagnoses of CHF and MDD, including 68 men and 85 women, aged between 65 and 84 years (mean age 72.69±4.77 years). The diagnosed CHF in this group was mostly of ischemic etiology (93-60.78%), followed by one due to systemic hypertension (41 - 26.79%), valvular diseases, and cardiomyopathies (17 - 11.11%). The LVEF in group A ranged between 16% and 39%, with a median of 35 (30-38), which was significantly lower (p<0.001) than the values noted in group B (Table 1). Most patients, excepting those with clear contraindications, were prescribed ACE inhibitors and BB

Table 1. Demographic and clinical characteristics, therapy and outcomes in study groups.

Characteristics	Group A – 153 patients – 60.91%	Group B – 98 patients – 39.04%	p
Age	72.69 ± 4.77	73.73 ± 5.69	0.119
Gender: men women	68 – 44.44% 85 – 55.55%	45 – 45.91% 53 – 54.08%	0.819
Residence: urban rural	91 – 59.47% 62 – 40.52%	59 – 60.02% 39 – 39.79%	0.909
Level of education: University High school Primary	25 – 16.33% 43 – 28.10% 85 – 55.55%	17 – 17.34% 29 – 29.59% 52 – 53.06%	0.928
Income: Low Middle High	79 – 51.63% 48 – 31.37% 26 – 16.99%	47 – 47.95% 33 – 33.67% 18 – 18.36%	0.851
Family support: Yes No	71 – 46.40% 82 – 53.59%	48 – 48.97% 50 – 51.02%	0.475
EQ-5D-5L	42 (33-49)	55 (45-60)	<0.001
MADRS	40 (23.5-55)	3.5 (2-4)	<0.001
LVEF	35 (30-38)	37 (35-38)	<0.001
ACE inhibitors/ARB	145 – 94.77%	94 – 95.91%	0.671
Beta-blockers	146 – 95.42%	95 – 96.93%	0.543
Number of rehospitalizations	3 (2-4)	2 (1-2)	<0.001
Days of hospitalization	20 (13-28.5)	14 (7-15)	<0.001
Mortality at 30 days	15 – 9.8%	9 – 9.18%	0.852
Mortality at one year	49 – 36.29%	27 – 27.55%	0.031

*Legend:* EQ-5D-5L= European Quality of Life scale; MADRS= Montgomery-Asberg Depression Rating Scale; LVEF= Left ventricular ejection fraction; ACE= Angiotensin converting enzyme; ARB= Angiotensin receptor blocker.

pharmacotherapy, both during their inpatient stay as well as subsequently, as long-term therapy, following discharge. According to the severity of depressive symptoms, assessed through the MADRS scale, there were 31 patients (20.26%) suffering from mild depression, 41 (26.79%) with moderate forms, and 81 (52.94%) that reported levels consistent with severe MDD. There was no significant difference concerning the severity of MDD between genders, income, and education levels, but we evidenced significantly higher MADRS scores of 40 [4-55.25] in patients without family support, as compared to those with adequate house-hold help 15 [3-25] (Mann-Whitney U test; Z=-6.066; p<0.001). Although there were no significant differences regarding clinical investigations and pharmacotherapy during hospitalization, when compared to patients without depression, subjects from group A had a significantly higher rate of rehospitalization

and a longer length of admissions ( $p < 0.001$ ). There were no significant differences noted regarding the 30 days postdischarge mortality rates. However, at the one-year postdischarge follow-up session, we noticed a higher mortality rate ( $p = 0.031$ ) in group A (table 1). In this group, we also determined significant correlations between the severity of MDD, as assessed by the MADRS scale, the quality of life score ( $r = -0.827$ ; 95% CI[-0.871;-0.770];  $p < 0.001$ ), EF ( $r = -0.439$ ; 95% CI[-0.547;-0.313];  $p < 0.001$ ) and the number of rehospitalizations ( $r = 0.526$ ; 95% CI[0.414; 0.629];  $p < 0.001$ ). These patients also had higher mortality, both at 30 days, as well as at one-year postdischarge (Table 1 and Figure 1).

Group B consisted of 98 patients (45 men and 53 women), aged between 65 and 89 years (mean age  $73.73 \pm 5.69$  years). The LVEF for these patients was situated between 25 and 39%, with a median value of 37 (35-38). In terms of causes, ischemic etiology predominated (43 patients – 43.87%), followed by systemic hypertension (37 - 37.75%), valvular diseases, cardiomyopathies, and arrhythmias (11 - 11.22%). In terms of mental health status, the MADRS scores for all patients included in this group were less than six, which placed them in the category of patients without clinical depression. Group characteristics included a slightly higher but statistically significant LVEF, fewer hospital readmissions, and a lower number of hospitalization days. Although the 30-day mortality rate was similar to group A, we noticed significant beneficial differences at the one-year follow-up.

When discussing both groups, we analyzed the factors that influenced hospitalization and mortality rates. According to a multivariate linear regression model, we observed that more prolonged hospitalizations predicted an increased number of rehospitalizations by 0.119 for every extra day spent in hospital. This model explains 94.7% of the number of hospitalizations ( $R^2 = 0.947$ ). Similar results were obtained for the LVEF, where every reduction of 1% in LVEF leads to an increase in the number of hospitalizations by 0.011 (Table 2). Regarding the one-year mortality rates, we built a logistic regression model using the backward method and applied Akaike information criteria in order to determine the best model. The odds ratio and 95% confidence interval were calculated.

Consequently, we obtained a logistic regression model, which explained 61.6% of deaths in the first year ( $R^2 = 0.616$ ). An older age (1.4-fold), the male gender (14.3-fold), a reduced QL (0.9-fold), and LVEF (0.7-fold) were predictive factors for death in the first year postdischarge (Table 3).

## DISCUSSIONS

CHF represents a problematic health concern, with a prevalence that is increasing proportionately with the increase in life expectancy. This cardiac pathology is becoming progressively more frequent as people age and survival rates from IHD improve. CHF is a pervasive pathology, occurring in 10% of subjects older than 65 years, accounting for 5% of hospital admissions and 1–2% of all healthcare costs. As debated in the literature, older patients with significant CHF represent more than 80% of admissions for exacerbation of CHF globally<sup>2</sup>.

Our study was conducted on 251 patients, hospitalized for an exacerbation of CHF with a reduced LVEF. Clinical depression, of various severities, was a frequent mental health comorbidity, diagnosed in 60.95% of all patients, which

Table 2. Linear regression of number of hospitalization in the whole group.

Elements	B	SE	p	95% CI for B	
				Lower bound	Upper Bound
Hospitalization days	0.119	0.002	<0.001	0.115	0.123
LVEF%	-0.011	0.004	0.013	-0.002	-0.019

Legend: B= regression coefficient; SE= standard error; CI= confidence interval; LVEF= left ventricular ejection fraction.

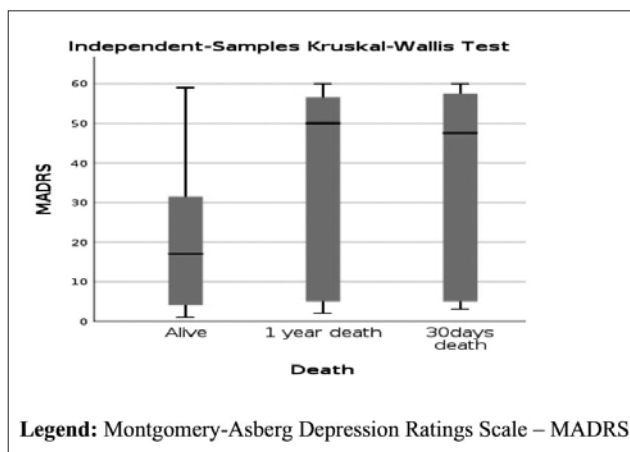


Figure 1. Mortality rates at 30 days and at one year in the whole group.

Table 3. Logistic regression analyzing of the one-year mortality in all patients.

Elements	B	SE	p	Odd Ratio	95% CI for Odd Ratio	
					Lower bound	Upper bound
Age	0.366	0.057	<0.001	1.442	1.290	1.611
Male gender	2.660	0.538	<0.001	14.301	4.979	41.081
EQ-5D-5L	-0.068	0.019	<0.001	0.934	0.900	0.969
LVEF	-0.296	0.057	<0.001	0.744	0.666	0.832

Legend: B= regression coefficient; SE= standard error; CI= confidence interval; EQ-5D-5L= European Quality of Life scale; LVEF= left ventricular ejection fraction.

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prompted us to divide them into two groups: patients with and without depression. Although there was no significant difference between the two groups, in terms of age, gender, residence, education, income, and therapy received in hospital and of that prescribed at discharge, our study noted that patients with comorbid MDD had a lower QL ( $p < 0.001$ ), a more reduced LVEF ( $p < 0.001$ ), higher hospitalization rates, with more extended inpatient stays ( $p < 0.001$ ), as well as higher one-year mortality (0.031) than those without clinical depression. We used a linear regression model to analyze factors that influence the number of hospitalizations and highlighted the impact of a reduced LVEF. On the other hand, utilizing a logistic regression, we studied the elements that influenced the one-year mortality and found that it was related to patients' age, male gender, the QL, and LVEF. By documenting a robust statistic correlation between scores on the MADRS and the EQ-5D-5L scale ( $r=0.827$ ), we evidenced that MDD strongly and negatively impacts QL, with an even more detrimental impact than LVEF ( $r=0.4390$ ,  $p < 0.001$ ).

The influence of MDD on the overall QL is an aspect that was debated in numerous studies that highlighted a more powerful influence of depressive symptoms on the QL than that of symptoms related to the severity of CHF, such as dyspnea, low exercise tolerance or angina<sup>7,17</sup>. It has been postulated that changes in the severity of MDD represent a strong predictor of 1-year health-related QL and mortality rates in patients with CVD<sup>7</sup>. Several studies and guidelines highlighted the association between MDD and CVD, suggesting that depression independently increases the risk of CVD 1.5-fold, on average<sup>1,15-17</sup>, and that depressive patients with IHD have a 2-3-fold increased risk of future fatal and non-fatal cardiac events than those without MDD<sup>18</sup>. In our study, patients with MDD reported inferior individual SES and less family support than those without depression; however, considering their mean income, the difference between the two groups was not statistically significant ( $p=0.851$ ). Neither were there any significant differences regarding medical care and pharmacotherapy received while in hospital between the two groups. However, patients with a lower SES had higher incidences of MDD, as well as more admissions<sup>19</sup>. Other studies have also reported slightly higher readmission rates for patients with lower SES, suggesting that they experience a less favourable course after hospital discharge, and have an increased one-year mortality<sup>8,15</sup>. Despite similar rates of ACE inhibitors or ARBs prescription, these patients are less likely to adhere to treatment recommendations, to request or be referred to regular cardiology reviews, or undergo LVEF assessments. Reduced access to outpatient care, albeit due to inequity in provision of healthcare, geographical location, adherence issues or logistical support, may also cause patients with a lower individual SES suffering with CHF, without adequate family support, to postpone medical care, until their condition has deteriorated to such a degree that hospitalization is necessary. Increased exposure to other precipitating conditions, such as lower quality of life, increased psychosocial stressors, and concomitant financial burdens, may also contribute to a higher readmission rate in patients with a lower SES<sup>2,4,8,9</sup>. A poor SES is associated with MDD, resulting in a considerable variation of QL and impairing the long-term outcomes among older people hospitalized for CHF. Regardless of the condition resulting in a worse evolu-

tion, these findings support the hypothesis that a low individual SES is associated with clinical depression and a reduced QL and should be considered as a risk factor for adverse outcomes in patients with CHF<sup>2</sup>. The adverse effects of MDD on the outcomes of CHF include reduced QL, frequent rehospitalizations, and increased mortality. Results from a recent meta-analysis suggest a twofold increase in mortality in CHF patients with comorbid depression, as compared to those with intact mental health. Despite conflicting results, antidepressant pharmacotherapy has not been shown to improve CVD outcomes in CHF patients. However, it does appear to ameliorate QL, suggesting that clinically depressed patients should be referred to mental health services, if symptoms are severe enough<sup>7,11,20</sup>, especially in the elderly, as it is a well-known fact that depression may precipitate cognitive decline<sup>21</sup>.

## CONCLUSIONS

Major depression is a frequent comorbidity among patients with CHF, is associated with a reduction of the left ventricular systolic function and a lower overall quality of life. Despite receiving similar care and pharmacotherapy regimens, patients with comorbid depressive illness appear to require higher hospitalization rates, with prolonged admissions and increased one-year mortality than those with unimpaired mental health.

*Conflict of interests:* the authors have no conflict of interests to declare.

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