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RESEARCH ARTICLE

Quality of life, sodium intake and cardiorespiratory fitness in heart failure: a longitudinal study

Omar Pereira de Almeida-Neto, omar.almeida@ufu.br
Federal University of Uberlandia, Brazil

Gianna Fiori Marchiori, gianna.marchiori@uftm.edu.br
Federal University of Triângulo Mineiro, Brazil

Izadora Vieira Araújo, izadora.araujo@ufu.br
Maria Eduarda de Pádua Alcântara, eduarda.padua@ufu.br
Federal University of Uberlandia, Brazil

Eneida Rejane Rabelo-Silva, eneidarabelo@gmail.com
Federal University of Rio Grande do Sul, Brazil

David de Souza Mendes, davidmendes@ufu.br
Federal University of Uberlandia, Brazil

Ercole Vellone, ercole.vellone@gmail.com
University of Rome Tor Vergata, Italy and
Wroclaw Medical University, Poland

Background: While adherence to a low-sodium diet and cardiorespiratory fitness (CRF) are important in heart failure (HF) management, their effects on health-related quality of life (HRQoL) remain unclear. This study evaluated the influence of CRF, sodium intake adherence and demographic and clinical variables on HRQoL, cardiovascular mortality and hospitalisation in individuals with HF.
Methods: A longitudinal study assessed outpatients at baseline (T0) and every six months (T1, T2) through telemonitoring. Data were analysed using R. Spearman's correlation examined associations between demographic/clinical variables, CRF, sodium intake, hospitalisation and mortality. Variables with significant correlations were included in stepwise multiple regression. Repeated measures ANOVA was used to assess changes over time in HRQoL.
Results: A total of 81 patients were included at T0, 74 at T1 and 72 at T2. Sodium intake adherence remained below the good adherence cutoff (≥40 points) across all timepoints. Mean CRF was 3 metabolic equivalents (METs). No significant change in sodium intake or CRF was

observed over time. Actively working individuals had a 16.5-fold higher risk of mortality, even after adjusting for sex and age, possibly due to limited healthcare access, occupational stress, comorbidities and treatment nonadherence. The HRQoL physical domain was significantly associated with demographic, clinical and functional factors, including gender, obesity, NYHA class, HF severity and CRF ($p<0.01$).

Conclusion: CRF, gender, obesity, New York Heart Association class and HF severity predicted HRQoL's physical domain. Being actively employed was strongly associated with mortality risk. Despite consistently low adherence to sodium intake recommendations, no association was found with health-related quality of life.

Keywords cardiorespiratory fitness • diet • sodium restricted • heart failure • quality of life

Key messages

- Adherence to a low-sodium diet was not associated with health-related quality of life in patients with heart failure over time.
- Higher cardiorespiratory fitness was associated with better physical quality of life.
- Being actively employed significantly increased the risk of mortality in patients with heart failure.
- Time since diagnosis was not related to improvements in health behaviours.

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Introduction

Heart failure (HF) is a chronic condition with significant implications for patients' health-related quality of life (HRQoL). The existing literature indicates that HF negatively impacts cardiac function and can lead to multiple complications, directly affecting the physical and emotional health of affected individuals (Lins et al, 2015; Aguiar et al, 2021; Marcondes-Braga et al, 2021).

The relationship between cardiorespiratory fitness (CRF), typically measured as peak oxygen consumption (VO_2) and clinical outcomes in HF patients is documented and associated with cardiovascular mortality and hospitalisation, but not with HRQoL (Schon, 2022).

Parallel to CRF, exceeding sodium intake is also recognised as a cause of HF decompensation (Barilli et al, 2017; Spineti, 2019; Bezerra et al, 2020; Sousa et al, 2020; Korkmaz and Ardahan, 2021; Mill et al, 2021). Excessive sodium consumption leads to fluid retention and extracellular volume expansion, resulting in systemic and pulmonary congestion (Barilli et al, 2017; Bezerra et al, 2020; Mill et al, 2021).

In many countries, particularly in South America, sodium intake far exceeds clinical recommendations, exacerbating complications associated with HF (Barilli et al, 2017; Spineti, 2019; Bezerra et al, 2020; Sousa et al, 2020; Korkmaz and Ardahan, 2021; Mill et al, 2021). Despite the importance of sodium control in the diet of HF patients,

current literature offers limited evidence on how adherence to a low-sodium diet, CRF, clinical and demographical variables, affects HRQoL and clinical outcomes (Spineti, 2019; Sousa et al, 2020; Korkmaz and Ardahan, 2021).

It is hypothesised that patients with low CRF and poor adherence to a low-sodium diet may experience worse HRQoL. This hypothesis is supported by indirect evidence in the literature, but lacks direct confirmation, making this study crucial for advancing knowledge in the field (Barilli et al, 2017; Sousa et al, 2020).

By filling this gap, this study will not only enhance understanding of the predictive factors for clinical outcomes in HF but will also provide valuable insights for clinical practice, offering guidance for more effective and personalised therapeutic strategies.

The aim of this study was to examine how clinical and demographic variables, CRF and adherence to a low-sodium diet influence HRQoL, mortality and hospital readmissions in patients with HF.

Methodology

This is a prospective longitudinal observational study, approved by institutional research ethics committee and following the recommendations of the Checklist for Reporting Results of Internet E-Surveys guidelines and Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) (see supplemental file 1) and carried out at the Cardiology Outpatient Clinic of the Hospital of Uberlandia-Minas Gerais state, Brazil, from January 2020 to December 2022.

All participants provided informed consent prior to enrollment, ensuring their voluntary participation and understanding of the study procedures.

Patients were selected during routine outpatient visits, with inclusion criteria based on clinical parameters relevant to heart failure management. Exclusion criteria included hospitalisation within the last 30 days to ensure clinical stability, and failure to answer three telemonitoring calls on alternate days, which could indicate cognitive impairments, socioeconomic barriers or limited phone access.

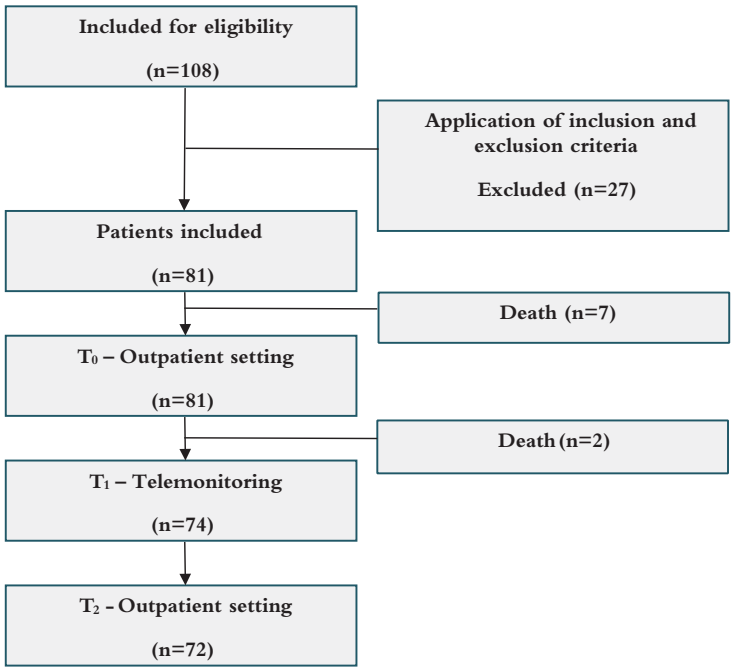
Although alternative contact methods, such as reaching out to family members, were attempted, these criteria may have introduced selection bias by excluding patients who might have benefited from the study, particularly older individuals or those facing logistical challenges. Additionally, excluding patients who missed the third in-person evaluation (T2) could further bias the sample towards healthier participants or those with fewer barriers to follow-up.

These factors should be considered when interpreting the study's results. Assessments were performed at baseline (T0) and at two subsequent time points (T1, T2), with six-month intervals, through telemonitoring (Figure 1).

In the first outpatient assessment (baseline – T0), a clinical and socioeconomic questionnaire was applied, which had been validated for face and content in a previous study (Silva et al, 2018). The psychometric properties, including reliability and construct validity, were assessed in that study, which was conducted with a population similar to the one in our study. The questionnaire included variables such as sex, race/ethnicity, religion, marital status, age, left ventricular ejection fraction, comorbidities, engagement in physical activity and participation in a cardiac rehabilitation programme.

The 'Minnesota Living with Heart Failure Questionnaire' (MLHFQ) was also used to assess HRQoL. It consists of 21 items that assess limitations frequently associated with the extent to which HF prevents patients from living as they would like. Respondents

Figure 1: Descriptive flowchart of the number of participants at each moment of the follow-up

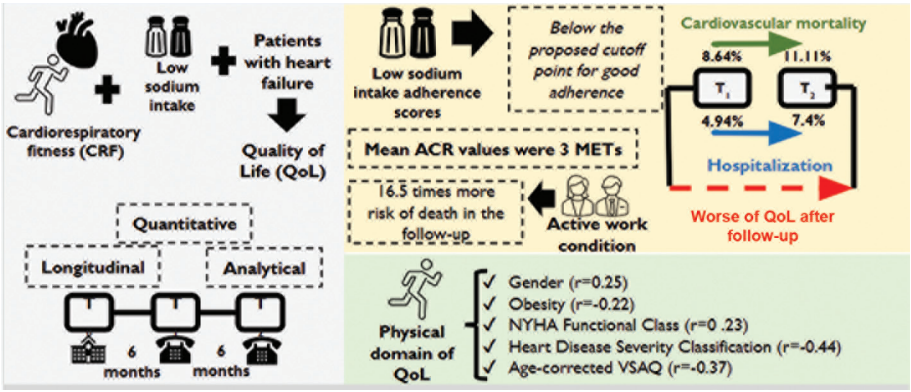


are instructed to consider the previous month when answering the questions. Each item is scored on a scale from 0 (no) to 5 (very much), where 0 indicates no limitation and 5 represents maximum limitation. The questionnaire includes a physical dimension (items 1 to 7, 12 and 13), which is strongly related to symptoms such as dyspnea and fatigue, with a score ranging from 0 to 45. The emotional dimension (items 17 to 21) has a score range of 0 to 25. The remaining items (8, 9, 10, 11, 14, 15 and 16), which do not follow a consistent pattern of responses, are not grouped into a separate dimension but contribute to the overall score. This set of general items has a possible range of 0 to 35. The total score is calculated by summing all items, resulting in a range from 0 to 105. Higher total scores indicate a greater negative impact of HF symptoms on the patient's health-related quality of life (Rector and Cohn, 1992).

Cardiorespiratory fitness was assessed using the 'Veterans Specific Activity Questionnaire' (VSAQ) instrument, which estimates physical capacity in metabolic equivalents (METs) and consists of 13 items that identify the level of specific daily activity associated with symptoms of cardiovascular disease. It consists of a list of activities in progressive order of intensity according to metabolic equivalents (1 MET = approximately 3.5 ml O2/kg/min) (Myers et al, 1994).

To assess adherence to low sodium intake, the 'Dietary Sodium Restrict Questionnaire' (DSRQ) instrument was applied, which is composed of 27 statements that assess the following: Attitude and Subjective Norm (patient's beliefs regarding the results of performing a restricted diet of sodium and the importance of others approving or disapproving such conduct); Perceived Behavioral Control (patient's ability to identify facilitators and barriers related to sodium restriction in the diet); and Dependent Behavioral Control (presence or absence of resources and impediments to following a sodium-restricted diet). The interpretation of the instrument is based

Figure 2: Quality of life, sodium intake and cardiorespiratory fitness in heart failure: a longitudinal study



on cutoff points considered satisfactory for adequate adherence to low sodium consumption. The scores that indicated satisfactory adherence were ≥40 points for the 'Attitude and Subjective Norm' subscale; ≤8 points for the 'Perceived Behavioral Control' subscale; and ≤3 points for the 'Dependent Behavioral Control' subscale (d'Almeida et al, 2019).

The sample size calculation was based on an expected determination coefficient (R^2) of 0.13 in a linear regression model with four predictors, as supported by previous studies involving quality of live behaviours in patients with HF. We assumed a significance level (type I error) of $\alpha = 0.05$ and a type II error rate (β) of 0.10, corresponding to a statistical power of 90 per cent ($1 - \beta = 0.90$). Based on these parameters, the minimum required sample size was calculated to be 81 participants.

Analyses were conducted using the R environment (a language and environment for statistical computing). Descriptive statistics summarised the data through measures of central tendency and proportions. Changes over time in the physical, emotional, unspecific and total domains of HRQoL at three time points (T0, T1 and T2) were analysed using repeated measures ANOVA. Spearman's correlation test assessed associations between demographic and clinical variables, adherence to a low-sodium diet, and cardiorespiratory fitness with hospitalisation and mortality outcomes.

Variables showing significant associations ($p < 0.05$) were selected for regression modelling. Binary logistic regression was performed to identify independent predictors of mortality, and multiple linear regression was used to examine factors associated with the physical domain of HRQoL. Interaction terms between cardiorespiratory fitness and sodium intake adherence were not included in the regression models; thus, only independent effects were assessed. Correlation strengths were classified as weak ($0 < r < 0.3$), moderate ($0.3 \leq r < 0.5$) or strong ($r \geq 0.5$), with statistical significance set at $p < 0.05$ (Cohen, 1988).

Results

The study included 81 patients at baseline (T0), 74 patients at T1 and 72 patients at T2, as shown in Figure 1. Follow-up losses occurred due to death, with seven patients dying during T1 and two patients dying during T2.

Mortality rates were calculated separately at two time points (T1/T2) after baseline (T0). In T1, deaths occurred in 8.64 per cent (n=7) of the sample, with an increase to 11.11 per cent (n=9) in T2. The incidence of new hospitalisations during clinical follow-up was 4.94 per cent (n=3) in T1 and 7.4 per cent (n=5) in T2.

There was a higher proportion of women (n=42; 51.85 per cent) who self-declared white (n=36; 44.44 per cent) or brown (n=31; 38.27%), with a predominant marital status of married (n=46; 56.79 per cent), Catholic (n=52; 64.20 per cent) and retired (n=72; 88.89 per cent). The mean age of the participants was 66.75 ± 10.84 years, and the ejection fraction was 40.88 ± 11.97 per cent. High blood pressure, coronary disease and cardiac arrhythmias were the most prevalent comorbidities, affecting 82.72 per cent, 30.86 per cent and 35.80 per cent of the patients, respectively. The practice of physical activity (n=5) and the inclusion of patients in physical rehabilitation programmes (n=1) were extremely low.

The values referring to adherence to low sodium consumption were below the cutoff points that classify good adherence at follow-up (T0: 32.06 ± 5.99 Attitude and Subjective Norm; 12 ± 5 Perceived Behavioural Control and 9 ± 5 Dependent Behavioural Control; T1: 32 ± 9 Attitude and Subjective Norm; 15 ± 5 Perceived Behavioural Control and 9 ± 8 Dependent Behavioural Control; T2: 32.19 ± 7.18 Attitude and Subjective Norm; 11 ± 7; Perceived Behavioural Control and 7 ± 6 Dependent Behavioural Control).

Cardiorespiratory fitness was assessed using the VSAQ instrument with correction of scores according to age, according to the equation METs = 4.7 + 0.97 (VSAQ) – 0.06 (age). Most patients were classified as critically ill (VO2= 16 to 18 ml/kg/min) at all follow-up times, with an increase in severity over time (T0=83.95 per cent; T1=85.13 per cent; T2=87.5 per cent), as described in Table 1.

The physical domain of the health-related quality of life instrument showed a slight improvement between T0 and T2, at 26 ± 14 points and 25.75 ± 8.53 points, respectively. Overall, the total quality of life score worsened in this clinical construct over time, with 51.90 ± 15.58 at T0 increasing to 54.71 ± 15.61 points at T2, as shown in Table 2.

Spearman's correlation analysis revealed that demographic variables, cardiorespiratory fitness and adherence to a low-sodium diet were negatively and moderately correlated with death and hospitalisation under active work conditions ($r=-0.35$, $p<0.01$). Additionally, the use of statins showed a positive, moderate correlation with these outcomes ($r=0.26$, $p<0.01$).

Table 1: Estimated and age-corrected cardiorespiratory fitness according to the VSAQ nomogram of study participants over time

Time	Variables	Median±IQ
T0 (n=81)	VSAQ	3 ± 2
	VSAQ age-corrected	3 ± 2
T1 (n=74)	VSAQ	3 ± 2
	VSAQ age-corrected	3 ± 3
T2 (n=72)	VSAQ	3 ± 2
	VSAQ age-corrected	3.5 ± 3

Notes: IQ: interquartile range; IQ: interquartile range; VSAQ: Veterans Specific Activity Questionnaire; T0: outpatient screening baseline; T1: telephone monitoring; T2: outpatient screening.

Table 2: Participants' health-related quality of life over time

Time	Physical domain (mean±SD)	Emotional domain (mean±SD)	Unspecific domain (mean±SD)	Total score (mean±SD)	p-value (ANOVA)*
T0	26±14	10.57±5.86	16.14±4.47	51.90±15.58	0.011
T1	24.59±8.30	9.80±5.12	16.86±5.37	51.20±16.83	
T2	25.75±8.53	10±9	18.75±4.38	54.71±15.61	

Notes: T0: outpatient screening baseline; T1: telephone monitoring; T2: outpatient screening; SD: standard deviation.

However, in the logistic regression model, only mortality remained independently associated with work status. As shown in Table 3, patients with heart failure who reported being actively employed had a significantly higher risk of death. Specifically, being employed was associated with an estimated 16.5-fold increase in mortality risk compared to those not working. Conversely, unemployed individuals had a substantially lower predicted risk. For example, the estimated probability of death among actively working individuals was 59.9 per cent, compared to 8.3 per cent among retirees. Given the small sample size and number of events, these findings should be interpreted with caution and warrant confirmation in larger, prospective studies.

Table 3: Estimation of the parameters of the logistic regression models for the dependent variable (death) in relation to working conditions

Models	Selected variables	β	SE	p value	Odds ratio	95% CI odds ratio	
						LL	UL
	With job	2.80	1.01	0.005	16.50	2.29	118.88
	Unemployed	1.30	1.23	0.291	3.67	0.328	40.93
Death	Retired	-2.40	0.426	<0.01	0.09	0.04	0.21
	Model Chi-square: χ 2=8.015; df=2; p value=0.018						

Notes: β: model parameter; SE: standard error; df: degree of freedom; CI: confidence interval; χ2: chi-square statistics; LL: lower limit; UL: upper limit.

Based on the estimated multiple regression equation and the values of its parameters, the scores in the physical domain of the MLHFQ were higher for the group of female patients, with a difference of 3.2 points compared to males. Regarding the relationship between the physical domain and CRF values corrected for age and obtained using the VSAQ nomogram, it was observed that higher CRF values were associated with lower MLHFQ physical domain scores, indicating better HRQoL in individuals with greater functional capacity (Table 4).

In the regression analysis, baseline MLHFQ physical domain scores (T0) were used to predict health-related quality of life at 12 months (T2), avoiding inflation of explanatory power by excluding intermediate time points. The model explained 65.2 per cent of the variance in physical HRQoL. Female patients had worse HRQoL than males (32.1 versus 29.8 points; $p<0.001$). Age ($\beta=-0.043$, $p<0.001$) and aortic diameter ($\beta=-0.068$, $p=0.010$) were negatively associated with cardiorespiratory fitness, reflecting age-related functional decline and possible vascular impact. Worse physical HRQoL also correlated with lower fitness ($\beta=-0.027$, $p<0.001$). Clinical status predicted higher physical domain scores: moderately ill (+2.05 points) and low capacity sedentary patients (+3.07 points), both $p<0.001$. Low VIF values (<1.5) indicate no multicollinearity, supporting model robustness. These results emphasise the importance of clinical and functional factors in physical quality of life variation (Table 4).

Table 4: Results of the regression model adjustment using the stepwise criterion for predicting the physical domain of HRQoL and cardiorespiratory fitness

Coefficients	Estimates	Standard error	t	VIF	p value	R^2
HRQoL physical (TO)						62,5%
Women	32.10	2.90	11.07	1.03	<0.001	
Male	29.80	3.10	9.61		<0.001	
Cardiorespiratory fitness						
Age (years)	–0.043	0.011	–3.91	1.33	<0.001	
Aorta (mm)	–0.068	0.029	–2.34	1.18	0.010	
MLHFQ physical	–0.027	0.070	–2.08	1.15	<0.001	
Moderately ill	2.050	0.380	5.39	1.31	<0.001	
Low physical capacity sedentary people	3.071	0.460	8.09	1.10	<0.001	

Notes: VIF: total model variance; R^2: coefficient of determination; VSAQ: Veterans Specific Activity Questionnaire; MLHFQ: Minnesota Living with Heart Failure Questionnaire.

Discussion

This study evaluated the influence of demographic variables, cardiorespiratory fitness and adherence to low sodium intake on the incidence of death, readmission and HRQoL of patients with heart failure over the course of clinical follow-up.

Regarding the demographic profile, there was a predominance of elderly people, females and patients who self-declared white. It is believed that the increase in the life expectancy of patients with HF is mainly due to access to technological innovations in health (Vaughan et al, 2021; Sicras-Mainar et al, 2022).

The predominance of females is not consistent with data available in the international scientific literature, in which the highest prevalence of patients with HF treated at health services is male. Although the higher cardiovascular risk in black individuals is known, the higher prevalence of whites in the study can be explained since the colour is self-declared, based on the subjective perception of the patient, and not necessarily a classification that matches their colour (Lopes et al, 2019; P.C. Silva et al, 2021).

The clinical profile of the sample aligns with previous studies, with most patients presenting HF with reduced ejection fraction (LVEF <50 per cent) and NYHA functional classes II or III, reflecting mild to moderate functional limitations (Blacher, 2019; Han et al, 2021; Marcondes-Braga et al, 2021; Santana et al, 2021).

Regarding the evaluated clinical constructs, general studies investigated adherence to low sodium intake, cardiorespiratory fitness and quality of life individually. The studies that used the described instruments were analysed in a non-associated way and, in most cases, through cross-sectional and methodological studies for the creation, validation and cross-cultural adaptation of these instruments to the Portuguese language (Cohen, 1988; Souza et al, 2018).

Most studies applied the instrument to acutely decompensated patients during hospitalisation and not in an outpatient or home environment, a hypothesis that may explain the optimised results during hospitalisation since the diets to be prescribed and offered by the hospital service are specific to the decompensation condition of the disease, and the clinical picture itself makes the patient, possibly surrounded by the fear and insecurity of the current health condition, have better

adherence scores (Chaves and Oliveira Carlos, 2018; Sousa et al, 2019; 2020; Mill et al, 2021; Oliveira, 2021).

The adherence to a low-sodium diet was not significantly associated with either HRQoL or mortality. This negative finding is original and clinically relevant, as it challenges assumptions about the direct impact of sodium adherence on these outcomes and suggests that other factors may play a more prominent role in shaping patient trajectories.

Regarding cardiorespiratory fitness, no longitudinal studies were found in patients with HF for comparison; however, a previous study showed that patients with coronary artery disease obtained values like those in the present research (Rohde et al, 2018; Marcondes-Braga et al, 2021).

The scores obtained in this study for the HRQoL outcomes indicate that the evaluated sample experienced greater losses directly related to the disease compared to the literature. C.C. Silva et al (2021) reported an average physical HRQoL a bit higher whereas our study found this to be significantly lower, suggesting more pronounced disease impact in our sample (P.C. Silva et al, 2021). This discrepancy may be attributed to several factors, such as differences in patient characteristics, disease severity or healthcare settings.

According to the regression model, active work conditions increased the chance of death by 16.5 times. Although the type of work activity performed can negatively influence the outcome of cardiovascular diseases, these data deserve to be investigated in more depth in future studies. Nevertheless, in the regression model, women had a lower quality of life than men did, similar to published data (Santos et al, 2016).

Likewise, the classification of heart disease, changes in aortic diameter and low cardiorespiratory fitness scores indicated that the physical limitations imposed by HF over time are mainly responsible for the worsening of episodes of dyspnea and fatigue (Calixtre et al, 2017; Silva et al, 2018).

Study limitations

This study has several limitations. The lack of prior longitudinal research on low sodium intake and cardiorespiratory fitness in Brazilian heart failure outpatients highlights the need for further studies with longer follow-up. Its single-centre design limits generalisability. The follow-up period, though sufficient to detect interesting outcomes, should be extended in future research.

Selection bias may have occurred due to excluding patients who missed three phone calls, potentially affecting older, cognitively impaired or socioeconomically disadvantaged individuals, who tend to have worse health outcomes. This exclusion likely biased the sample towards healthier, more adherent patients. Future studies should consider more inclusive follow-up strategies, like repeated calls or caregiver contact.

Finally, the small sample size and limited mortality events, especially given the strong link found between employment status and mortality, highlight the exploratory nature of this finding and the need for larger, longer studies to confirm it.

Conclusions

This study evaluates the clinical and proposed constructs in an associated way using a longitudinal design. It is important to note that the analysis was based on multiple

regression models, rather than more advanced longitudinal statistical methods such as generalised linear mixed models (GLMM) or linear mixed-effects modeling (LMM).

The death rate increased from 8.64 per cent at T1 to 11.11 per cent at T2, a result that corroborates the progressive and degenerative course of the disease over time. HF hospitalisation rates also increased from 4.94 per cent in T1 to 7.4 per cent in T2. It was observed that active work conditions were a negative predictor of death.

Adherence to low sodium intake was not associated with quality of life, however, cardiorespiratory fitness was a negative predictor of the physical domain HRQoL over time. Specifically, our analysis focused on the difference in VSAQ scores between T2 and T1 to evaluate how changes in cardiorespiratory fitness influenced the physical domain of HRQoL. Although this method does not represent a fully longitudinal model, it provides valuable insights into temporal changes in cardiorespiratory fitness and HRQoL.

Compared with males, females had worse quality of life scores. The results presented in this study demonstrate that clinical evaluation combined with assessments of cardiorespiratory fitness and low sodium consumption constitute an important tool for assessing the health-related quality of life of patients with HF.

ORCiD IDs

Omar Pereira de Almeida Neto https://orcid.org/0009-0008-6108-2990
Gianna Fiori Marchiori https://orcid.org/0000-0001-6363-0059

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Conflict of interest

The authors declare that there is no conflict of interest.

References

Aguiar, N.M., Junior, P.S.L.A., Silva, C.S., Santos, I.L.F., Silva, D.L., Freitas, J.V.R., et al (2021) Avaliação da qualidade de vida dos pacientes com insuficiência cardíaca, *Revista Eletrônica Acervo Científico*, 32(1): e8404, doi: 10.25248/reac.e8404.2021

Barilli, S.L.S., D'Almeida, K.S.M., Trojahn, M.M., Souza, G.C., Aliti, G.B. and Rabelo-Silva, E.R. (2017) Knowledge, barriers and attitudes toward dietary sodium in patients with decompensated heart failure, *Journal of Nursing Education and Practice*, 8(1): 98–106, doi: 10.5430/jnep.v8n1p98

Bezerra, S.M.M.S., Lopes, B.S., Bomfim, P.P., Belo, R.M.O., Nascimento, M.O., Araújo, H.V.S., et al (2020) Attitudes, beliefs and barriers for adherence to the hyposodic diet in patients with heart failure, *Revista Gaúcha Enfermagem*, 41(1): 1–10, doi: 10.1590/1983-1447.2020.20190304

Blacher, M.G. (2019) *Revisão sobre a avaliação clínica na insuficiência cardíaca: uma comparação objetiva entre as classes funcionais I e II da New York Heart Association*, Universidade Federal do Rio Grande do Sul, UFRGS, http://hdl.handle.net/10183/202793.

Calixtre, E.M., Nardi, C.G., Prado, F.A.A., Mancini, G.F., Silva, K.F.M., Almeida, E., et al (2017) Avaliação da função cardiopulmonar e da qualidade de vida de pacientes submetidos à ventilação não invasiva associada a um programa de reabilitação, *Revista Saúde e Meio Ambiente*, 4(1): 1–18.

Chaves, L.N.F. and Oliveira Carlos, D.M. (2018) Estado nutricional e qualidade de vida de pacientes candidatos a transplante cardíaco, *Revista Brasileira em Promoção da Saúde*, 31(1): 1–13, doi: 10.5020/18061230.2018.6483

Cohen, J. (1988) *Statistical Power Analysis for the Behavioral Sciences*, Routledge, doi: 10.4324/9780203771587

d'Almeida, K.S.M., Barilli, S.L.S., Souza, G.C. and Rabelo-Silva, E.R. (2019) Cut-point for satisfactory adherence of the dietary sodium restriction questionnaire for patients with heart failure, *Arquivos Brasileiros de Cardiologia*, 112(2): 165–70, doi: 10.5935/abc.20190011

Han, M.M., Zhao, W.S., Xu, X.R., Wang, X., Li, K.B., Dang, C.J., et al (2021) Fração de Ejeção do Ventrículo Esquerdo Aumentada, Diminuída ou Estável ao Longo do Tempo em uma Série de 626 Pacientes com Insuficiência Cardíaca que Receberam Tratamento Médico, *Arquivos Brasileiros de Cardiologia*, 117(4): 639–47, doi: 10.36660/abc.20200250

Korkmaz, E.K. and Ardahan, M. (2021) Psychometric properties of the Turkish version of the dietary sodium restriction questionnaire, *Journal of Cardiovascular Nursing*, 36(4): 366–73, doi: 10.1097/JCN.0000000000000741

Lins, T.C.B., Valente, L.M., Sobral Filho, D.C. and Barbosa e Silva, O. (2015) Relação entre a frequência cardíaca de recuperação após teste ergométrico e índice de massa corpórea, *Revista Portuguesa de Cardiologia*, 34(1): 27–33, doi: 10.1016/j.repc.2014.07.006

Lopes, M.A.C.Q., Oliveira, G.M.M.D., Ribeiro, A.L.P., Pinto, F.J., Rey, H.C.V., Zimerman, L.I., et al (2019) Diretriz da Sociedade Brasileira de Cardiologia sobre Telemedicina na Cardiologia–2019, *Arquivos Brasileiros de Cardiologia*, 113(5): 1006–56, doi: 10.5935/abc.20190205

Marcondes-Braga, F.G., Moura, L.A.Z., Issa, V.S., Vieira, J.L., Rohde, L.E., Simões, M.V., et al (2021) Atualização de tópicos emergentes da Diretriz Brasileira de Insuficiência Cardíaca–2021, *Arquivos Brasileiros de Cardiologia*, 116(6): 1174–212, doi: 10.36660/abc.20210367

Mill, J.G., Malta, D.C., Nilson, E.A.F., Machado, I.E., Jaime, P.C., Bernal, R.T.I., et al (2021) Factors associated with salt intake in the Brazilian adult population: national health survey, *Ciência & Saúde Coletiva*, 26(2): 555–67, doi: 10.1590/1413-81232021262.37492020

Myers, J., Do, D., Herbert, W., Ribisl, P. and Froelicher, V.F. (1994) A nomogram to predict exercise capacity from a specific activity questionnaire and clinical data, *The American Journal of Cardiology*, 73(8): 591–6, doi: 10.1016/0002-9149(94)90340-9

Oliveira, R.D.M.D. (2021) *Consumo de alimentos ultraprocessados por indivíduos com insuficiência cardíaca atendidos ambulatorialmente*, Universidade Federal do Rio Grande do Norte, UFRN.

Rector, T.S. and Cohn, J.N. (1992) Assessment of patient outcome with the Minnesota Living with Heart Failure questionnaire: reliability and validity during a randomized, double-blind, placebo-controlled trial of pimobendan, *American Heart Journal*, 124(4): 1017–25, doi: 10.1016/0002-8703(92)90986-6

Rohde, L.E.P., Montera, M.W., Bocchi, E.A., Clausell, N.O., Albuquerque, D.C. and Rassi, S. (2018) Diretriz Brasileira de Insuficiência Cardíaca Crônica e Aguda, *Arquivos Brasileiros de Cardiologia*, 111(3): 436–539, doi: 10.5935/abc.20180190

Santana, J.G., Aras, M.G., Nascimento, L. and Júnior, R.A. (2021) Comparação entre classificação funcional e fração de ejeção em pacientes com insuficiência cardíaca na Doença de Chagas, *Arquivo Brasileiro de Cardiologia: imagem cardiovascular*, 34(3): 1–5, doi: 10.47593/2675-312X/20213403eabc137

Santos, J.F.S., Lima, A.C.R., Mota, C.M.D., Gois, C.F.L., Brito, G.M.G. and Carvalho Barreto, I.D. (2016) Qualidade de vida, sintomas depressivos e adesão ao tratamento de pessoas com hipertensão arterial, *Enfermagem em Foco*, 7(2): 17–21, doi: 10.21675/2357-707x.2016.v7.n2.787

Schon, C.F. (2022) *Resultados à longo prazo da reabilitação cardíaca na aptidão cardiorrespiratória de pacientes com insuficiência cardíaca*, Universidade Federal do Rio Grande do Norte, UFRN.

Sicras-Mainar, A., Sicras-Navarro, A., Palacios, B., Varela, L. and Delgado, J.F. (2022) Epidemiology and treatment of heart failure in Spain: the HF-PATHWAYS study, *Revista Española de Cardiología (English Edition)*, 75(1): 31–8, doi: 10.1016/j.rec.2020.09.033

Silva, C.C., Medeiros Lucena, R. and de Araújo Medeiros, C. (2021) Mapeamento da ocorrência da insuficiência cardíaca com síndrome metabólica em serviço ambulatorial de referência do estado de Pernambuco, *Revista Eletrônica da Estácio Recife*, 7(3): 1–16.

Silva, J.P.L.N., Novaes, L.F.M., Santos, L.C.R.D., Galindo, B.P., Cavalcante, M.A., Araújo, B.C.G.D., et al (2018) Effects of conventional and virtual reality cardiovascular rehabilitation in body composition and functional capacity of patients with heart diseases: randomized clinical trial, *International Journal of Cardiovascular Sciences*, 31(6): 619–29, doi: 10.5935/2359-4802.20180071

Silva, P.C., Almeida Neto, O.P. and Resende, E.S. (2021) Epidemiological profile, cardiopulmonary fitness and health-related quality of life of patients with heart failure: a longitudinal study, *Health and Quality of Life Outcomes*, 19(129): 1–9, doi: 10.1186/s12955-020-01634-3

Sousa, M.M.D., Gouveia, B.D.L.A., Almeida, T.D.C.F., Freire, M.E.M. and Santos Oliveira, V.S.H. (2019) Crenças de pessoas com insuficiência cardíaca relacionadas à ingesta de sal, *Revista de Enfermagem da UERJ*, 27(1): e44197, doi: 10.12957/reuerj.2019.44197

Sousa, M.M.D., Gouveia, B.D.L.A., Almeida, T.D.C.F., Freire, M.E.M., Melo, F.D.A.B.P.D. and Oliveira, S.H.D.S. (2020) Evidence related to sodium restriction in patients with heart failure, *Revista Brasileira de Enfermagem*, 73(4): 1–8, doi: 10.1590/0034-7167-2018-0874

Souza, M.C.G.C., Mendes, A.L.D.R.F., Santos, G.C.M., Brito, F.C.R., Morais, V.D. and Silva, F.R. (2018) Estado nutricional e aceitação da dieta por pacientes cardiopatas, *Motricidade*, 14(1): 217–25.

Spineti, P.P.D.M. (2019) Evaluating sodium restriction in heart failure, *Arquivos Brasileiros de Cardiologia*, 112(2): 171–2, doi: 10.5935/abc.20190017

Vaughan, A.S., George, M.G., Jackson, S.L., Schieb, L. and Casper, M. (2021) Changing spatiotemporal trends in county-level heart failure death rates in the United States, 1999 to 2018, *Journal of the American Heart Association*, 10(4): e018125–50, doi: 10.1161/JAHA.120.018125