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Marital status and living condition as predictors of mortality and readmissions among African Americans with heart failure

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ABSTRACT

Socioeconomic factors, including social support, may partially explain why African Americans (AA) have the highest prevalence of heart failure and with worse outcomes compared to other races. AA are more likely to be hospitalized and readmitted for heart failure and have higher mortality. The purpose of this study is to determine whether the social factors of marital status and living condition affect readmission rates and all-cause mortality following hospitalization for acute decompensated heart failure (ADHF) in AA patients.

Methods: Medical records from 611 AA admitted to Einstein Medical Center Philadelphia from January, 2011 to February, 2013 for ADHF were reviewed. Patient demographics including living condition (nursing home residents, living with family or living alone) and marital status (married or non-married -including single, divorced, separated and widowed) were correlated with all-cause mortality and readmission rates.

Results: In this cohort (53% male, mean age 65 ± 15, mean ejection fraction 32 ± 16%) 25% (n = 152) of subjects were unmarried. Unmarried patients had significantly higher 30-day readmission rates (16% vs. 6% p = 0.0002) and higher 1-year mortality (17% vs. 11% p = 0.047) compared with married patients. Fifty percent (n = 303) of subjects were living with family members, while 40% (n = 242) and 11% (n = 66) were living alone or in a nursing facility, respectively. Patients living with family members had significantly lower 30-day readmission rates when compared with those living alone or in a nursing facility (7% vs 21% vs. 18% p = <0.0001). Furthermore, they had the lowest 1-year mortality (14% vs 32% for nursing facility patients and 17% for those living alone (p = 0.0007). After controlling for traditional risk factors (age, gender, body mass index, peak troponin I, left ventricular ejection fraction, B-type natriuretic peptide, hypertension, diabetes mellitus, hyperlipidemia, and coronary artery disease), being married was an indpendent predictor of 1-year mortality (OR 0.50 p = 0.019) and living alone for 30-day readmission (OR 2.86 p = <0.001).

Conclusion: The socioeconomic factors of marital status and living condition significantly correlated with mortality and 30-day readmission rate in AA heart failure patients. Specifically, being married and living with family independently predict lower mortality and fewer readmissions. Surprisingly, living in a nursing facility was associated with significantly higher mortality than living alone or with family.

1. Introduction

In 2010, approximately 5.1 million Americans were diagnosed with heart failure (HF), and HF prevalence is expected to increase by 25% by 2030 [1]. Of all ethnicities in the United States, African Americans (AA) have the highest risk of developing HF, occurring in about 4.6 per 1000 person-years [2]. Additionally, AA present with HF symptoms at an earlier age [3] and have significantly worse outcomes compared to the general population [4–8]. AA are more likely to be hospitalized and readmitted for heart failure than other races [7] and are 45% more likely to die or have a decline in functional status compared to whites [8]. Socioeconomic factors have been implicated in this racial disparity, but there are few studies that highlight its impact on morbidity and mortality. A study involving 753 patients of which 29% were African Americans found that AA had a significantly longer delay in seeking medical treatment compared to other races (p = 0.019) and a higher readmission rate (p = 0.001) [10]. Another study involving 40,000 patients of which 18% were African Americans showed that patients with lower income, most of which were AA, was a significant predictor

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of hospital readmission [10]. While these racial discrepancies are multifactorial in origin, numerous studies have identified socioeconomic factors as a key driver of these disparities [4]. These factors may account for delay in seeking medical attention, poor insight and awareness of disease burden, and non-compliance with medications, exercise and follow-up appointments [5,9–13].

Positive social support has been associated with improved quality of life [14], better medication adherence [12,15], lower readmission rate [12,15–17], and higher expertise in HF self-care [18]. Having a spouse or lifetime partner is the highest form of social support and two prospective studies demonstrated that HF patients with a spouse or partner have a lower readmission and mortality rate and a higher event free survival [16–17]. However, these studies were 71–86% Caucasians. This study aims to determine the effect of social support in the form of marital status and living arrangement on readmission and mortality following a hospitalization for acute decompensated heart failure, specifically in the underrepresented African American population.

1.1. Patients and methods

All adult AA subjects (age > 20) who were hospitalized at Einstein Medical Center Philadelphia between January 1, 2011 and Feb. 28, 2013 with a primary discharge diagnosis of acute decompensated heart failure were included in the study. Demographic and clinical information were abstracted from electronic medical records. Chronic medical conditions were defined by either physician documentation of the condition or treatment with appropriate medical therapy. Marital status and living condition were self-reported by the patients. Marital status was classified as either married or non-married (including single, divorced/separated, or widowed subjects); or living alone, living with family members or spouse, or living in a nursing home. Vital status was determined at study end (August 31, 2015) via query of the Social Security Death Index (SSDI) and review of hospital records.

The primary endpoint was all-cause mortality. The secondary end point was readmission rate within 30-day, 90-day or 365 days after discharge. This project was approved by the Institutional Review Board of the Einstein Healthcare Network (IRB number 4733).

1.2. Statistical analysis

Demographics and clinical characteristics were summarized using descriptive statistics. Continuous variables were expressed as mean ± standard deviation and analyzed using either one-way analysis of variance (ANOVA) with Tukey post-hoc correction or Students' t-test. Categorical variables were expressed as percentage (number) and compared using chi-squared test. The cohort was stratified by either marital status or living condition. Survival and readmission rates were compared using the Kaplan–Meier method. A logistic regression model was used to evaluate the association between marital and living status with all-cause mortality and 30-days readmission rates after controlling for traditional risk factors (age, gender, body mass index, peak troponin I, left ventricular ejection fraction, B-type natriuretic peptide, hypertension, diabetes mellitus, hyperlipidemia, and coronary artery disease). Results were considered statistically significant for p values less than 0.05. All statistical analyses were performed using the SPSS version 20.

2. Results

2.1. Patient demographics

A total of 611 AA patients admitted from January 1, 2011 to February 28, 2013. Mean age was 66 ± 15 years (median age was 67); 53% were men. The median follow-up time from the index admission was 3.2 years (maximum follow-up 4.6 years). The mean left ventricular ejection fraction (LVEF) was 32% and the mean B-type natriuretic peptide (BNP) on admission was 1112 ± 980 pg/ml. The overall mortality rate in the study was 28.6% (175).

2.1.1. Marital status

Twenty-five percent (n = 152) of the subjects were married and 75% percent (n = 459) unmarried. As shown in Table 1, married subjects were significantly older (68 vs. 65 p = 0.047) and had a higher prevalence of coronary artery disease (47% vs. 36% p = 0.012). Other co-morbid conditions such as hypertension, diabetes mellitus, dyslipidemia, chronic kidney disease, and obstructive sleep apnea, were similar in the 2 groups. There was no statistical difference in their left ventricular ejection fraction, peak serum troponin I and B-type natriuretic peptide measurement. Guideline-based medical therapy for heart failure was also comparable between the groups.

Thirty day mortality was similar in unmarried (4%) and married (3%) patients. However, long term survival was significantly higher in married individuals (Table 3, Fig. 1A). Non-married patients also had a statistically higher 30-day (16%) and 90-day readmission rate (33%) compared to married patients (6% and 16% respectively p = 0.0002) (Table 3, Fig. 1B).

2.1.2. Living condition

Approximately 50% (n = 303) of subjects were living with family members while 39% (n = 242) and 11% (n = 66) were living alone or in a nursing facility, respectively. As shown in Table 2, co-morbid conditions, including hypertension, dyslipidemia, chronic kidney disease, obstructive sleep apnea, and coronary artery disease, were similar across all 3 groups. Patients living at the nursing facility were older (p < 0.001) and had a higher prevalence of diabetes mellitus (p = 0.041) compared to those living alone or with family members. There was no statistical difference in left ventricular ejection fraction, peak serum troponin I and B-type natriuretic peptide measurement among them. Likewise, medical therapy was also similar between groups.

Mortality (30-day, 90-day and 1-year) was significantly higher in nursing home patients (8%, 15%, and 32%) compared to patients living alone (3%, 5%, and 17%) and those living with family members (3%, 6%, and 14%) (p = 0.0007) (Table 3, Fig. 2A). Patients living alone or in nursing homes had similar 30-day readmission rates (21% and 18% respectively) which were significantly higher than those living with family (6.9% p < 0.0001) (Table 3). Interestingly at 1 year, the readmission rate was similar to those living with family members and those at nursing homes (Fig. 2B).

2.2. Multivariate analysis

To prove whether social factors of marital status and living condition were independent predictors of readmission and mortality, they were included in a multivariate logistic regression analysis. After adjusting for age, gender, BMI, peak troponin I, left ventricular ejection fraction, BNP, and traditional risk factors (hypertension, diabetes mellitus, hyperlipidemia, and coronary artery disease); marital status was independently associated with a lower 1-year all-cause mortality (OR 0.50 p = 0.019, Table 4). Living alone was independently associated with a higher 30-day readmission rate (OR 2.86 p < 0.001). (See Table 5.)

3. Discussion

Our study is one of the first to examine how social factors affect mortality and readmission rate for AA with heart failure. We found that AAs living alone have a higher readmission rate and married patients had a lower mortality. Interestingly, those living in nursing homes had a highest mortality.

We hypothesized that social factors are significant determinants of outcomes in the AA HF population. Consistent with that, we found

Table 1
Characteristics of patients grouped according to marital status.

	Married (n = 152)	Not married (n = 459)	Statistical comparison
Demographic			
Age — year	68 ± 13	65 ± 16	p = 0.047
Male — % (no.)	58% (88)	51% (235)	p = 0.161
BMI	31 ± 10	30 ± 10	p = 0.706
General medical history			
Hypertension — % (no.)	93% (142)	94% (432)	p = 0.700
Diabetes mellitus — % (no.)	60% (91)	54% (246)	p = 0.189
Dyslipidemia — % (no.)	49% (74)	45% (205)	p = 0.399
Chronic kidney disease — % (no.)	35% (53)	36% (164)	p = 0.922
Obstructive sleep apnea — % (no.)	13% (19)	14% (66)	p = 0.685
Coronary artery disease — % (no.)	47% (72)	36% (163)	p = 0.012
Medications at presentation			
Loop diuretics — % (no.)	89% (135)	87% (397)	p = 0.577
ACE inhibitors/angiotension receptor blockers — % (no.)	72% (109)	71% (324)	p = 0.837
Beta-blockers — % (no.)	89% (135)	85% (392)	p = 0.577
Aldosterone antagonists — % (no.)	10% (15)	11% (53)	p = 0.656
Imdur & hydralazine — % (no.)	45% (69)	40% (185)	p = 0.297
Clinical metrics			
Left ventricular ejection fraction — %	34 ± 15	32 ± 16	p = 0.124
B-type natriuretic peptide — pg/ml	1115 ± 924	1101 ± 982	p = 0.881
Peak troponin level — ng/ml	0.13 ± 0.21	0.24 ± 1.18	p = 0.260
Length of stay — days	5 ± 5	6 ± 6	p = 0.501

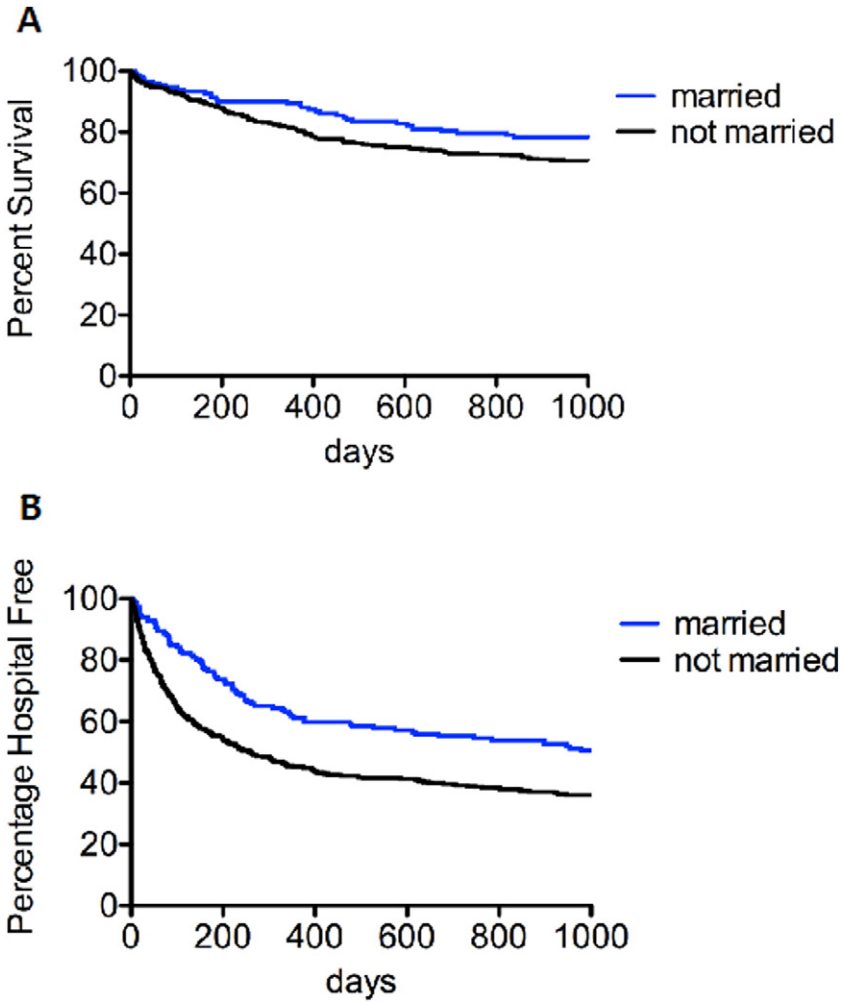

Fig. 1. Kaplan Meier survival estimates of survival (A) and hospital-free survival (B) for patients stratified by marital status.

Table 2
Characteristics of patients grouped according to living condition.

	Living alone (n = 242)	Living with family (n = 303)	Living at nursing home (NH) (n = 66)	Statistical comparison
Demographic				
Age — year	65 ± 14	64 ± 15	74 ± 14	p < 0.001 overall p < 0.001 alone v. NH p < 0.001 family v. NH
Male — % (no.)	59% (142)	51% (155)	50% (26)	p = 0.015 overall p = 0.021 alone v. NH
BMI	30 ± 10.2	31 ± 10.2	30 ± 10.0	p = 0.483 overall
General medical history				
Hypertension — % (no.)	94% (228)	93% (281)	98% (65)	p = 0.202 overall
Diabetes mellitus — % (no.)	51% (123)	56% (169)	65% (43)	p = 0.041 overall p = 0.043 alone v. NH
Dyslipidemia — % (no.)	41% (100)	45% (136)	65% (43)	p = 0.003 overall p = 0.003 alone v. NH p = 0.012 family v. NH
Chronic kidney disease — % (no.)	34% (83)	34% (104)	45% (30)	p = 0.203 overall
Obstructive sleep apnea — % (no.)	15% (36)	14% (42)	11% (7)	p = 0.673 overall
Coronary artery disease — % (no.)	38% (93)	37% (111)	47% (31)	p = 0.294 overall
Medications at presentation				
Loop diuretics — % (no.)	87% (211)	87% (264)	86% (57)	p = 0.984 overall
ACE inhibitors/angiotension receptor blockers — % (no.)	69% (166)	71% (215)	79% (52)	p = 0.271 overall
Beta-blockers — % (no.)	83% (201)	88% (266)	91% (60)	p = 0.143 overall
Aldosterone antagonists — % (no.)	12% (31)	10% (33)	6% (4)	p = 0.298 overall
Imdur & hydralazine — % (no.)	40% (98)	45% (136)	30% (20)	p = 0.085 overall
Clinical metrics				
Left ventricular ejection fraction — %	31 ± 16	32 ± 16	37 ± 16	p = 0.019 overall p < 0.05 alone v. NH
B-type natriuretic peptide — pg/ml	1054 ± 900	1129 ± 1009	1180 ± 1021	p = 0.510 overall
Peak troponin level — ng/ml	0.23 ± 1.11	0.21 ± 1.07	0.13 ± 0.20	p = 0.797 overall
Length of stay — days	5 ± 5	6 ± 5	7 ± 9	p = 0.086 overall

both being married and living with family to be protective factors. This study parallels similar observations in other studies with predominantly Caucasian populations [11–13]. Thus, the importance of social support is global and not race-specific. The AA population maybe more affected by these factors secondary to the higher prevalence of patients unmarried or living alone. In our study, only 25% of the sample population are married or had a live-in partner, which was substantially less when compared to 50–81% for Caucasians [11–12,16–17,19–21]. Moreover, the percentage of AA subjects who lived alone (40%) in our cohort was significantly higher than the general population of the United States of the same age group (27%) [11].

Many physicians believe that disposition to nursing homes may provide better care to patients with poor social support. Yet, surprisingly we found significantly higher mortality among heart failure patients on their first year at nursing homes. This is similar to what was found by Allen et al. where HF patients discharged to a skilled nursing facility (SNF) had higher rates of adverse events compared to those discharged elsewhere [22]. In their study of 15,459 patients of which 81% are white 24% were discharged to SNF. Patients discharged to SNF had a significantly higher 1-year mortality (53.5%) compared to those discharged home (29.1%, p < 0.0001) [22]. In our cohort, patients discharged to SNF were significantly older, predominantly female and had a higher percentage of diabetes mellitus and dyslipidemia. Moreover, these patients also had co-morbid conditions that merited being discharged to SNF, such as ambulatory dysfunction, cognitive decline, failure to thrive and incapacity for self-care at home that are not measured and may be confounding factors in the analyses of our study. This association has significant economic and policy-making implications. HF is the leading cause of hospitalization and re-hospitalization among Medicare patients [23]. The rate of HF patients getting discharged to SNF have been steadily increasing [24] in an effort to decrease adverse outcomes and it accounts for a significant portion of the Center for Medicare and Medicaid Services (CMS) budget which is expecting to spend $40.4 billion for nursing care facilities [25]. With the lack of data regarding the value and utility of SNF care in reducing these outcomes, including mortality, further studies are needed to bridge this gap of knowledge.

We have established that social support is important after discharge in AA HF. Unfortunately there is still no definite way for physicians to provide social support. We tried by sending patients to nursing homes but clearly it did not have that desired effect. As part of the guidelines, limitations of post-discharge support and barriers to care such are those focused in our study should be addressed with equal significance as guideline directed medical therapy before hospital discharge, at the first post-discharge visit and in subsequent follow-up visits [26]. A multidisciplinary program with the physician, social worker and the patient with their family which aim to address all these issues before discharging the patient may aid in decreasing morbidity and mortality. This study along with other prognostic data should be made available to patients and their family to help plan their transition of care and disposition. Moving forward. It is going to be critical for us to create novel ways to provide these patients with adjunctive care to supplement their lack of social support. Other options such as discharge to home with home health services, cardioMEMS HF System and other home based portable HF technologies may help. Further studies that provide outcomes data regarding home HF monitoring programs and other innovative care systems could offer patients better alternatives.

Table 3
Primary and secondary outcomes.

	Living Alone	Living with Family	Living at Nursing Home	Married	Not married
Outcome measure	(n = 242)	(n = 303)	(n = 66)	(n = 152)	(n = 459)
30-day readmission rate	21% (50)	7% (21)	18% (12)	6% (9)	16% (73)
90-dat readmission rate	36% (86)	21% (64)	36% (24)	15% (23)	33% (149)
30-day mortality	3% (7)	3% (10)	8% (5)	3% (4)	4% (18)
90-day mortality	5% (13)	6% (17)	15% (10)	5% (8)	7% (32)
1-year mortality	17% (42)	14% (42)	32% (21)	11% (16)	17% (79)

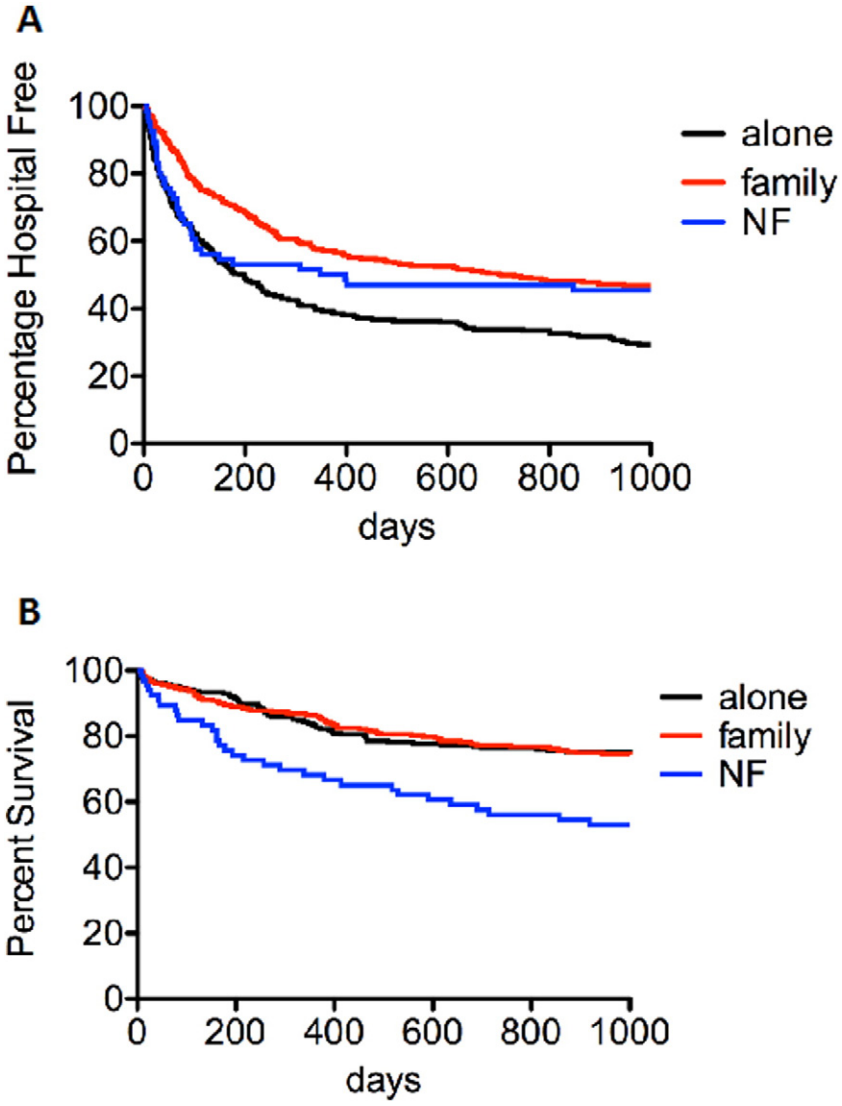

Fig. 2. Kaplan Meier survival estimates of survival (A) and hospital-free survival (B) for patients stratified by living condition.

3.1. Limitations of the study

Apropos of retrospective studies, we cannot know for sure if we collected all clinically relevant data for every patient. We also did not know whether patients were discharged to a skilled nursing facility (temporary) or nursing home (long-term care). A more complete analysis of this population may show that they are different. Finally, this study included both patients with low ejection fraction and those with preserved ejection fraction. It would be interesting if the same trends hold for a homogenous group of patients with only one or the other.

Table 4
Multivariate predictors of 1-year all-cause mortality by logistic regression.

Variable	Adjusted odds ratio (95% confidence interval)	P value
Age	1.04 (1.02–1.06)	<0.001
Gender	0.98 (0.63–1.53)	0.937
BMI on admission	0.99 (0.96–1.01)	0.283
Peak troponin I	1.08 (0.91–1.29)	0.397
Left ventricular ejection fraction	1.00 (0.98–1.01)	0.884
BNP on admission	1.00 (1.00–1.00)	0.232
Hypertension	1.30 (0.47–3.56)	0.615
Diabetes mellitus	1.44 (0.88–2.37)	0.149
Hyperlipidemia	0.94 (0.58–1.52)	0.809
Coronary artery disease	1.55 (1.01–2.39)	0.046
Living alone	0.69 (0.43–1.10)	0.121
Married	0.50 (0.31–0.90)	0.019

Table 5
Multivariate predictors of 30-day readmission rate by logistic regression.

Variable	Adjusted odds ratio (95% confidence interval)	P value
Age	1.01 (0.99–1.03)	0.269
Gender	1.24 (0.71–2.17)	0.450
BMI on admission	0.98 (0.95–1.01)	0.180
Peak troponin I	1.02 (0.82–1.26)	0.891
Left ventricular ejection fraction	1.01 (0.99–1.03)	0.338
BNP on admission	1.00 (1.00–1.00)	0.507
Hypertension	0.87 (0.27–2.76)	0.807
Diabetes mellitus	1.05 (0.56–1.98)	0.876
Hyperlipidemia	1.05 (0.56–1.95)	0.886
Coronary artery disease	1.55 (0.90–2.68)	0.117
Living alone	2.86 (1.59–5.14)	<0.001
Married	0.47 (0.19–1.118)	0.087

4. Conclusion

The socioeconomic factors of marital status and living condition significantly correlated with mortality and 30-day readmission rate in AA heart failure patients. Specifically, being married and living with family independently predict lower mortality and fewer readmissions. Surprisingly, living in a nursing facility was associated with significantly higher mortality than living alone or with family.

Conflict of interest

The authors have no conflicts of interest to report.

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