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Correlation between marital status and the prognosis of older patients with cerebrovascular disease in intensive care units: A retrospective cohort study

Jun Xie[1] | Chong Li[1,2] | Min Shi[3]

[1]Department of Respiration, First People's Hospital of Changzhou, Third Affiliated Hospital of Soochow University, Changzhou, China

[2]Changzhou Forth People's Hospital, Changzhou, China

[3]Department of Gastroenterology, Changzhou Maternal and Child Health Care Hospital, Changzhou, China

Correspondence
Chong Li, Changzhou Forth People' Hospital of Changzhou, Hong-he Road No.68, Changzhou, China; Department of Respiration, The First People's Hospital of Changzhou, Third Affiliated Hospital of Soochow University, Ju-qian Road No.185, Changzhou, China.
Email: lichongczsdyrmyy@163.com

Abstract

Background and Aims: Marital status has been shown to be associated with mortality, but evidence in critically ill elder intensive care unit (ICU) patients with cerebrovascular diseases (CeVD) is limited. This study was to explore the correlation between marital status and the prognosis of patients with CeVD aged 65 years and over in the ICU.

Methods: In the present study, 3564 patients were enrolled in the Medical Information Mart for Intensive Care IV database (version 2.2). Patients were divided into four groups based on marital status: married, single, divorced, and widowed. The primary outcome was all-cause mortality as patients were followed up for 3-, 6-, 9-, and 12-month. All-cause mortality risk for patients with different marital status was compared. Univariate and multivariable logistic regression analyses, survival curves and stratified analyses were performed to determine the correlation between marital status and mortality in critically ill patients with CeVD aged ≥65 years.

Results: Of the patients, 51.2% (1825/3564) were married, followed by 23.8% (847/3564) were widowed, 18.2% (647/3564) were single, and 6.9% (245/3567) were divorced. Compared with the married, the unmarried had a higher proportion of female ($p < 0.001$), older ($p < 0.001$), and less proportion of mechanical ventilation ($p = 0.045$). Multivariate analyses showed that no differences were observed for mortality risk among different marital statuses ($p > 0.05$), while at late follow-up, widowed had a significance higher mortality risk than the married (9-month: odds ratio [OR]: 1.30, 95% confidence interval [CI]: 1.05–1.61, $p = 0.02$; 12-month: OR: 1.38, 95% CI: 1.12–1.71, $p = 0.003$). Stratified analyses indicated a stable correlation between marital status and 12-month mortality rate in sub-analysis for gender ($p = 0.46$) and age ($p = 0.35$).

Conclusion: Marital status is associated with long-term prognosis in older patients with CeVD admitted to ICU. Widowed people should receive more societal attention irrespective of sex or age.

KEYWORDS

cerebrovascular diseases, elderly, intensive care unit, widowed

1 | INTRODUCTION

Cerebrovascular disease (CeVD) results from alterations of brain vasculature, which contains intracerebral hemorrhage, subarachnoid hemorrhage, and cerebral infarction.[1,2] This is a major public health problem, which is the second-leading cause of death.[3] In 2019, 6.55 million deaths were directly related to stroke directly, and 143 million years of quality of life were lost globally.[3] Moreover, the age-standardized stroke-related mortality rate and disability-adjusted life-years are 3.6 and 3.7 times higher in the World Bank low-income group than the high-income group in 2019, respectively.[3] It imposes substantial medical burdens on individuals, families and society. Therefore, knowing the risk factors related to the prognosis for CeVD is of prime importance.

Although surgical and pharmacological therapies have advanced, functional rehabilitation after CeVD remains limited.[4] Marital status, as a common factor influencing social support, is reported to be associated with disease prognosis.[5,6] In an Asia retrospective observational study, the CeVD-related mortality rate among the unmarried is higher than among the married.[7] However, a Danish study evaluates stroke case-fatality and marital status and finds this survival advantage is not observed in the married.[5] Therefore, the results are inconsistent and need further investigation. Additionally, compared with the general population, patients admitted to the intensive care unit (ICU) have life-threatening situations and complex comorbidities, leading to high mortality. The relationship between marital status and mortality in older ICU patients with CeVD remains unclear.

In this study, the correlation between marital status and the prognosis in critically ill patients aged ≥65 years with CeVD was explored.

2 | MATERIALS AND METHODS

2.1 | Study design, area and period

It is a retrospective cohort study, which data were extracted from the Medical Information Mart for Intensive Care IV (MIMIC-IV). The MIMIC-IV database is a single-center data from Beth Israel Deaconess Medical Center (BIDMC) that contains information relating to patients admitted to critical care units between 2008 and 2019. The latest version is released on 06-01-2023, with version number v2.2. The author (M. S.) was permitted to extract data from this database (ID: 37938369). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were used.[8]

2.2 | Source and study of population

The source population was all patients admitted to hospital at the BIDMC. The study population was all patients admitted to ICUs at the BIDMC.

2.3 | Inclusion and exclusion criteria

The inclusion criterion was diagnosis with CeVD based on ICD-9 (430–438) and ICD-10 (I60–I69) codes. The exclusion criteria were as follows: younger than 65 years old, repeated admission, ICU stay time less than 24 h, and patients with missing data. A flowchart of the patient screening process is shown in Figure 1.

2.4 | Sample size determination

A statistical determination of sample size was not calculated. The retrospective nature of the study predetermines the sample size.

2.5 | Sampling technique and procedure

All eligible patients were included.

2.6 | Dependent variable

Dependent variable was survival status (alive or dead). Starting from admission to the ICU, the patients were followed up for 12 months or until death. The outcomes were divided into four different nodes at 3, 6, 9, and 12 months. All-cause mortality was calculated by counting the number of deaths within 3, 6, 9, and 12 months after admission to the ICU.

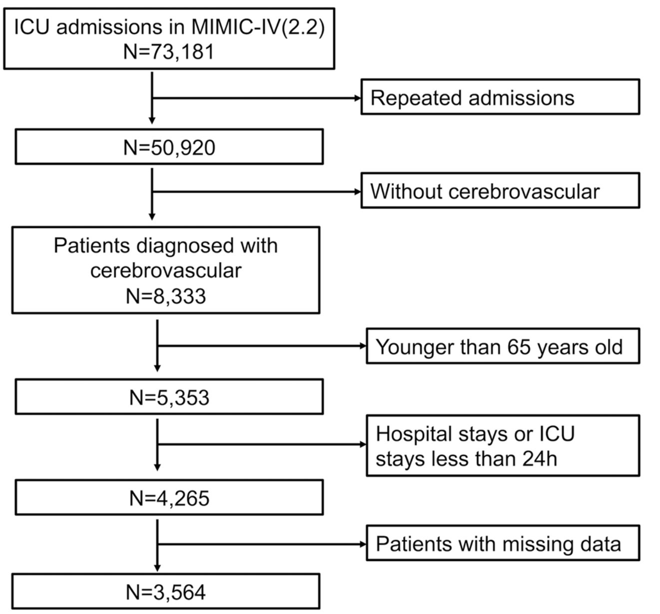


FIGURE 1 Flowchart of patient inclusion and exclusion criteria.

2.7 | Independent variables

The independent variables were: sociodemographic variables (age, sex, and marital status), first-day severity of illness (sequential organ failure assessment, Glasgow Coma Scale, Acute Physiology Score III, Charlson comorbidity index), first-day laboratory tests (white blood cell, red blood cell, platelet, red blood cell distribution width, hematocrit, hemoglobin, creatinine, glucose, potassium, sodium), first-day vital signs (temperature, heart rate, respiratory rate, SpO_2, mean arterial blood pressure, systolic blood pressure, diastolic blood pressure), smoking history, diabetes status, and mechanical ventilation status were extracted from the database.

2.8 | Data collection methods and procedures

All variables, except mechanical ventilation, were extracted from the first day of admission to the ICU. The mechanical ventilation status was based on whether patients received mechanical ventilation during hospitalization.

2.9 | Data quality assurance

Two investigators screened and analyzed the data according to the inclusion and exclusion criteria, and finally pooled the results to ensure the consistency of the results.

2.10 | Statistical analysis

Distribution normality was evaluated using the Shapiro–Wilk normality test. Continuous variables were presented as means and standard or median (25th–75th percentile), and categorical variables as proportions. Descriptive statistics were used to summarize the baseline demographic and clinical variables. Differences between married and unmarried in baseline data analysis were compared using the *t*-test or Wilcoxon rank-sum test for continuous variables and the chi-square test for categorical variables. Logistic regression analyses were conducted to compare the mortality among the different marital statuses. Data are presented as odds ratios (ORs) and 95% confidence intervals (CIs). All factors with a p-value < 0.05 in univariate analysis were included in the multivariate analysis. Kaplan–Meier (K–M) curves and log-rank tests were used to assess the probability of survival for different marital status.[9]

Next, prespecified subgroups include stratification by baseline sex (male or female) and age (65–79 or ≥80 years), which were performed using a stratified log-rank test, whereas OR with 90% CI was estimated using a stratified logistic regression model.[10,11]

Statistical analysis, excluding stratified analysis, was performed using *R*, version 4.2.2. The packages used included *tableone*, version 0.13.0; *autoReg*, version 0.3.0; *survminer*, version 0.4.9. Stratified analysis was conducted using *SPSS* software (IBM *SPSS* 26.0; *SPSS* Inc.). Two-sided p-values were calculated, and p-values < 0.05 were considered as statistically significant.

2.11 | Ethical considerations

The collection of patient information and creation of the research resource were reviewed by the Institutional Review Board at the BIDMC, which granted a waiver of informed consent and approved the data-sharing initiative. Informed consent was not required, as none of the patients could be identified. Thus, ethics exemption was granted by the Ethics Committee from the lead author's institution (First People's Hospital of Changzhou).

3 | RESULTS

3.1 | Patients characteristics

In total, 3564 patients were included in this study. Figure 1 shows the flow of the inclusion and exclusion procedures. As shown in Table 1, more than 50% of the patients were married (1825/3564), followed by widowed patients, 23.8% (847/3,564). The proportions of females (50.6%) and males (49.4%) in the total study population were similar; however, the proportion of females in the married subgroup (35.3%) was lower than that in the unmarried subgroup (66.6%) with p-value < 0.001. The overall median age (quartile 1, quartile 3) was 78 years (71, 85), and the median age of the unmarried subgroup was 4 years older than that of the married subgroup. Moreover, the proportion of patients receiving mechanical ventilation was higher in the married subgroup than in the unmarried subgroup (35.6% vs. 32.4%) with $p = 0.045$.

3.2 | Survival analysis

Figure 2 displays the K–M survival curves with log-rank tests for 12-month overall survival. The overall survival rate for 3-month in the married, divorced, single, and widowed subgroup was 0.77 (95% CI: 0.75–0.79), 0.74 (95% CI: 0.69–0.80), 0.74 (95% CI: 0.71–0.78), 0.65 (95% CI: 0.62–0.69), respectively; the overall survival rate for 12-month in the married, divorced, single, and widowed subgroup was 0.70 (95% CI: 0.68–0.72), 0.66 (95% CI: 0.61–0.72), 0.65 (95% CI: 0.62–0.69), 0.54 (95% CI: 0.51–0.57), respectively. There was a dramatic difference in survival among all marital status groups ($p < 0.001$).

3.3 | Univariate and multivariate logistic regression analysis

Supporting Information: Tables S1–S4 show the detailed results of logistic regression analysis for predicting 3-, 6-, 9-, and 12-month mortality in the whole cohort. Table 2 was extracted from

TABLE 1 Baseline characteristics from the cohort of older patients with cerebrovascular admitted to the ICU.

Variables	Overall (*N* = 3564)	Married (*N* = 1825)	Unmarried (*N* = 1739)	Divorced (*N* = 245)	Single (*N* = 647)	Widowed (*N* = 847)	*p* Value*
Demographics							
Gender							<0.001
Male	1762 (49.4)	1181 (64.7)	581 (33.4)	85 (34.7)	284 (43.9)	212 (25.0)	
Female	1802 (50.6)	644 (35.3)	1158 (66.6)	160 (65.3)	363 (56.1)	635 (75.0)	
Age	78.0 [71.0, 85.0]	76.0 [71.0, 83.0]	80.0 [73.0, 87.0]	76.0 [70.0, 82.0]	75.0 [70.0, 83.0]	84.0 [78.00, 89.0]	<0.001
Severity of illness							
SOFA	3.0 [2.0, 5.0]	3.0 [2.0, 5.0]	3.0 [2.0, 5.0]	3.0 [2.0, 5.0]	3.0 [2.0, 5.0]	3.00 [2.0, 5.0]	0.99
GCS	14.0 [12.0, 15.0]	14.0 [12.0, 15.0]	14.0 [12.0, 15.0]	14.0 [13.0, 15.0]	14.0 [12.0, 15.0]	14.0 [11.0, 15.0]	0.129
APSIII	39.0 [30.0, 51.0]	38.0 [29.0, 50.0]	41.0 [31.0, 53.0]	35.0 [27.0, 50.0]	40.0 [30.0, 53.0]	42.0 [32.0, 54.0]	<0.001
CCI	7.0 [5.0, 8.0]	7.0 [5.0, 8.0]	7.0 [5.00, 9.0]	7.0 [5.0, 8.0]	7.0 [5.0, 8.0]	7.0 [6.0, 9.0]	<0.001
Laboratory results							
WBC (10^9/L)	10.0 [7.6, 13.4]	9.9 [7.5, 13.1]	10.1 [7.6, 13.8]	10.3 [7.4, 13.9]	10.1 [7.7, 13.6]	10.0 [7.6, 13.9]	0.102
RBC (10^{12}/L)	3.90 [3.3, 4.4]	3.9 [3.3, 4.4]	3.9 [3.4, 4.4]	3.9 [3.4, 4.5]	4.0 [3.5, 4.4]	3.8 [3.3, 4.3]	0.648
Platelet (10^9/L)	206.0 [157.0, 262.0]	196.0 [152.0, 249.0]	214.0 [163.0, 274.0]	210.0 [160.0, 262.0]	214.0 [167.5, 272.5]	215.0 [161.0, 276.0]	<0.001
RDW (%)	14.0 [13.2, 15.2]	13.9 [13.1, 14.9]	14.2 [13.4, 15.4]	14.2 [13.3, 15.3]	14.2 [13.4, 15.3]	14.2 [13.4, 15.4]	<0.001
Hematocrit (%)	35.5 [30.7, 39.8]	35.7 [30.7, 40.0]	35.3 [30.6, 39.6]	35.9 [31.1, 40.2]	35.8 [31.2, 39.8]	34.7 [30.0, 39.1]	0.183
Hemoglobin (g/dL)	11.7 [10.0, 13.2]	11.8 [10.0, 13.3]	11.6 [9.9, 13.1]	11.9 [10.3, 13.3]	11.8 [10.1, 13.1]	11.4 [9.7, 13.0]	0.019
Creatinine (mg/dL)	1.0 [0.8, 1.3]	1.0 [0.8, 1.3]	1.0 [0.7, 1.3]	0.9 [0.7, 1.2]	1.0 [0.7, 1.3]	1.0 [0.7, 1.3]	0.069
Glucose (mg/dL)	130.0 [107.0, 163.0]	129.0 [107.0, 162.0]	130.0 [106.0, 163.0]	126.0 [106.0, 152.0]	134.0 [108.0, 172.0]	128.0 [104.0, 161.0]	0.949
Potassium (mmol/L)	4.1 [3.8, 4.5]	4.1 [3.8, 4.5]	4.1 [3.7, 4.5]	4.0 [3.7, 4.4]	4.1 [3.7, 4.6]	4.1 [3.8, 4.5]	0.629
Sodium (mmol/L)	139.0 [137.0, 142.0]	139.0 [137.0, 142.0]	139.0 [137.0, 142.0]	139.0 [137.0, 141.0]	139.0 [136.0, 142.0]	139.0 [137.0, 142.0]	0.53
Vital signs							
Temperature (°C)	36.7 [36.4, 37.0]	36.7 [36.40, 36.90]	36.7 [36.4, 37.0]	36.7 [36.4, 37.0]	36.7 [36.4, 37.1]	36.7 [36.4, 37.0]	0.164
HR (bpm)	80.0 [70.0, 93.0]	80.0 [70.0, 91.0]	81.0 [70.0, 95.0]	80.0 [70.0, 93.0]	81.0 [70.0, 96.0]	80.0 [70.0, 94.0]	0.011
RR (bpm)	18.0 [15.0, 22.00]	17.0 [15.0, 21.0]	18.0 [15.0, 22.0]	18.0 [15.0, 21.0]	18.0 [15.0, 22.0]	18.0 [15.0, 22.0]	<0.001
SpO_2 (%)	98.0 [96.0, 100.0]	98.0 [96.0, 100.0]	98.0 [95.0, 100.0]	98.00 [96.0, 100.0]	98.00 [95.0, 100.0]	98.0 [95.0, 100.0]	0.003
MBP (mmHg)	87.0 [76.0, 99.0]	87.0 [76.0, 99.0]	86.0 [75.0, 99.0]	86.0 [75.0, 97.0]	87.0 [76.0, 101.0]	86.0 [74.0, 98.5]	0.185
SBP (mmHg)	135.0 [117.0, 152.0]	135.0 [117.0, 152.0]	135.0 [118.0, 153.0]	134.0 [115.0, 151.0]	137.0 [119.0, 155.0]	135.0 [116.5, 152.0]	0.395

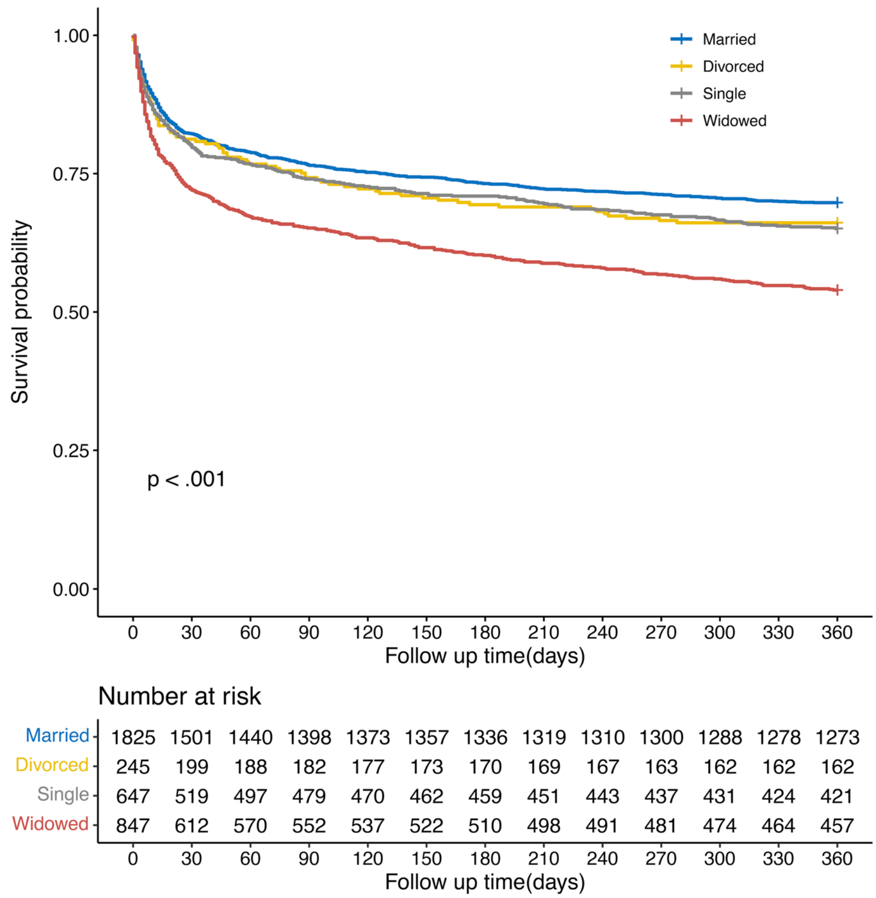
TABLE 1 (Continued)

Variables	Overall (*N* = 3564)	Married (*N* = 1825)	Unmarried (*N* = 1739)	Divorced (*N* = 245)	Single (*N* = 647)	Widowed (*N* = 847)	*p* Value*
DBP (mmHg)	67.5 [57.0, 80.0]	68.0 [57.0, 80.0]	67.0 [57.0, 80.0]	68.0 [57.0, 79.0]	68.0 [58.0, 82.0]	66.0 [55.0, 78.0]	0.264
Diabetes status							0.426
No	2389 (67.0)	1235 (67.7)	1154 (66.4)	177 (72.2)	397 (61.4)	580 (68.5)	
Yes	1175 (33.0)	590 (32.3)	585 (33.6)	68 (27.8)	250 (38.6)	267 (31.5)	
Smoking status							<0.001
No	2582 (72.4)	1269 (69.5)	1313 (75.5)	169 (69.0)	502 (77.6)	642 (75.8)	
Yes	982 (27.6)	556 (30.5)	426 (24.5)	76 (31.0)	145 (22.4)	205 (24.2)	
MV status							0.045
No	2351 (66.0)	1175 (64.4)	1176 (67.6)	159 (64.9)	429 (66.3)	588 (69.4)	
Yes	1213 (34.0)	650 (35.6)	563 (32.4)	86 (35.1)	218 (33.7)	259 (30.6)	

Abbreviations: APSIII, Acute Physiology Score III; CCI, Charlson comorbidity index; DBP, diastolic blood pressure; GCS, Glasgow Coma Scale; HR, heart rate; ICU, intensive care unit; MBP, mean arterial blood pressure; MV, mechanical ventilation; RBC, red blood cell; RDW, red blood cell distribution width; RR, respiratory rate; BP, systolic blood pressure; SOFA, sequential organ failure assessment; WBC, white blood cell.

**p* Value is between married and unmarried.

FIGURE 2 Comparison of overall survival rates among different marital status groups in the older intensive care unit patients with cerebrovascular.



Supporting Information: Tables S1–S4 to present the relationship between marital status only and overall mortality at different follow-up nodes. Univariate analyses revealed that the mortality risk in the widowed subgroup was significantly higher than that in the married subgroup at all different follow-up nodes ($p < 0.001$). At the 3-, 6-, and 9-month follow-up, no statistically significant differences were observed among the married, divorced and single subgroups ($p > 0.05$).

TABLE 2 Univariable and multivariable logistic regression analysis of marital status for predicting mortality in older patients with cerebrovascular admitted to the ICU.

Mortality	Univariable OR (95% CI, *p*-value)	Multivariable OR (95% CI, *p*-value)
Dependent: mortality_3_month		
Married	Ref.	Ref.
Divorced	1.13 (0.83–1.53, $p = 0.45$)	1.08 (0.76–1.54, $p = 0.68$)
Single	1.14 (0.93–1.40, $p = 0.21$)	1.01 (0.79–1.28, $p = 0.96$)
Widowed	1.74 (1.46–2.08, $p < 0.001$)	1.19 (0.95–1.48, $p = 0.13$)
Dependent: mortality_6_month		
Married	Ref.	Ref.
Divorced	1.21 (0.90–1.61, $p = 0.21$)	1.20 (0.85–1.69, $p = 0.29$)
Single	1.12 (0.92–1.37, $p = 0.27$)	0.98 (0.78–1.24, $p = 0.87$)
Widowed	1.81 (1.52–2.14, $p < 0.001$)	1.22 (0.98–1.51, $p = 0.08$)
Dependent: mortality_9_month		
Married	Ref.	Ref.
Divorced	1.25 (0.94–1.65, $p = 0.13$)	1.27 (0.91–1.77, $p = 0.17$)
Single	1.19 (0.98–1.44, $p = 0.08$)	1.06 (0.84–1.33, $p = 0.63$)
Widowed	1.88 (1.59–2.23, $p < 0.001$)	1.30 (1.05–1.61, $p = 0.02$)
Dependent: mortality_12_month		
Married	Ref.	Ref.
Divorced	1.18 (0.89–1.57, $p = 0.25$)	1.21 (0.86–1.68, $p = 0.27$)
Single	1.24 (1.02–1.50, $p = 0.03$)	1.12 (0.90–1.40, $p = 0.32$)
Widowed	1.97 (1.66–2.33, $p < 0.001$)	1.38 (1.12–1.71, $p = 0.003$)

Abbreviations: CI, confidence interval; ICU, intensive care unit; OR, odds ratio.

After adjusting for confounding factors, multivariate analyses showed no statistically significant differences were observed in mortality risk at early follow-up between the married and widowed subgroup (3-month: OR: 1.19, 95% CI: 0.95–1.48, $p = 0.13$; 6-month: OR: 1.22, 95% CI: 0.98–1.51, $p = 0.08$). However, as the follow-up period lengthened, at 9- and 12-month follow-up nodes, multivariate analyses presented that the widowed had an 1.30-fold and 1.38-fold increased risk for death than the married subgroup at the 9-month (95% CI: 1.05–1.61, $p = 0.02$) and 12-month follow-up node (95% CI: 1.12–1.71, $p = 0.003$), respectively.

TABLE 3 Subgroup analysis for the effect of marital status (married vs. widowed) on mortality in older patients with cerebrovascular admitted to the ICU.

Subgroup	No.	Unadjusted OR (95% CI, *p*-value)	*p* Value for interaction
Gender			0.46
Male			
Married	1181	Ref.	
Widowed	212	2.14 [1.59–2.88, $p < 0.001$]	
Female			
Married	644	Ref.	
Widowed	635	1.76 [1.40–2.21, $p < 0.001$]	
Age			0.35
65–79			
Married	1182	Ref.	
Widowed	253	1.69 [1.26–2.27, $p < 0.001$]	
≥80			
Married	643	Ref.	
Widowed	594	1.37 [1.09–1.71, $p = 0.006$]	

Abbreviations: CI, confidence interval; ICU, intensive care unit; OR, odds ratio.

3.4 | Subgroup analysis

Table 3 presents the results of the subgroup analysis. Univariate analyses showed that the widowed subgroup had a 2.14-fold and 1.76-fold increased mortality risk than the married subgroup at the 12-month followed-up node (male: 95% CI: 1.59–2.88, $p < 0.001$; female: 95% CI: 1.40–2.21, $p < 0.001$). The widowed also had a higher increased risk for death than the married in the different age subgroups (65–79 years old: OR 1.69, 95% CI: 1.26–2.27, $p < 0.001$; ≥80 years old: OR 1.37, 95% CI: 1.09–1.71, $p = 0.006$). Moreover, the interaction value of p was >0.05 both in sex ($p = 0.46$ for interaction) and age ($p = 0.35$ for interaction) subgroups.

4 | DISCUSSION

Herein, the correlation between marital status and the prognosis of patients with CeVD aged 65 years and over in the ICU was investigated. In this study, marital status was identified as an independent factor affecting the prognosis of older ICU patients with CeVD. This effect appears to be significant at long-term rather than at short-term follow-up. In addition, subgroup analysis revealed no differences in the effects of marital status on populations of different sexes and age groups.

The present study first determined that the married group had obvious survival advantages by the K–M survival analysis. To date, few studies have explored the effect of marital status on mortality in critically ill older patients with CeVD. Based on data from a nationally representative sample of older adults who experienced a stroke, one previous study (Dupre and Lopes[12]) reported that compared with married patients, widowed patients had a high risk of death (HR: 1.32; 95% CI: 1.16–1.51). A similar study found that compared with unmarried (mostly widowed) patients, married patients with acute ischemic stroke showed a significantly lower risk of all-cause mortality (HR: 0.70; 95% CI: 0.58–0.84), stroke recurrence (HR: 0.78; 95% CI: 0.66–0.91) and stroke disability (HR: 0.75; 95% CI: 0.65–0.88).[6] These results supported the findings in this study. Some reasons could explain why the prognosis of widowed patients was poor. In this study, the groups differed in some baseline characteristics, like age and mechanical ventilation percentage. The unmarried were older (80 vs. 76) and had a lower proportion of mechanical ventilation (32.4% vs. 35.6%) than the married. Furthermore, previous studies revealed that better health behaviors, such as adherence to medication on time and encouragement from their partner, were observed in married patients.[13] In summary, younger patients, more aggressive treatment, and more standardized post-discharge rehabilitation may all contribute to a better prognosis in married patients compared with widowed patients. Marital separation (including widows and divorces) led to a fourfold increase in the odds of serious suicidal thoughts in Black African stroke survivors, which might result in worse overall survival rates.[14] However, the survival advantage of the married in judging the prognosis is still considered controversial.[5,15] At an earlier date, one study (Andersen et al.[15]) found that marital state was not a predictor of early case fatality (3-day, 7-day, and 30-day) in first-ever ischemic stroke. Indeed, as stated by Andersen, they did not believe that their finding could be taken to indicate higher short-term mortality among married stroke patients, and it is the result of a selection phenomenon similar to that brought about by mortality displacement in environmental research.[16] Thus, partners play a role in improving the prognosis of critically ill older patients with CeVD.

Furthermore, the effect of marital status on mortality in critically ill older patients with CeVD at different time nodes was explored. There was no difference in overall mortality among the different marital statuses at the 3- and 6-month time points in the multivariable analysis. However, over time, the advantage of being married in improving the prognosis becomes apparent. Previous studies have defined 2–6 months after onset as the convalescent stage of a cerebral hemorrhage.[17] Patients might be more susceptible to repeated exacerbations during this period, which could mask the influence of marriage on mortality risk. Moreover, patients admitted to the ICU usually have poor nutritional status.[18] Although married patients might be given more nutritional support than unmarried patients, it is a lengthy process before returning to normal levels. Previous studies reported that a 50% mortality rate within 6 months following hospital discharge was related to malnutrition.[19] Thus, after 6 months of follow-up, patients exhibited stable disease, and differences in nutritional status between married and unmarried individuals became significant. It is important to emphasize that marriage begins to exert an influence on prognosis at an early stage of the disease.

The results of the subgroup analysis require further discussions. Marital status had the same effect on males and females in the widows group, which was consistent with the previous study.[20] Although one recent study reported a worse prognosis among widowed men, which is not consistent with the present study.[21] Some studies have shown that the impact of bereavement is less severe in older patients than in younger patients.[22,23] This may explain why there is no difference in prognosis between the widowed men and the widowed women in the older population.

This study supplements data on the effect of marital status on mortality in older patients with CeVD admitted to the ICU. It emphasizes the importance of marriage partners and long-term accompaniment. Some strategies were proposed from the following aspects to reduce the mortality of elderly patients with CeVD. Doctors can help establish patient alliances to facilitate communication between patients. The community can strengthen the health management of the special population. and provide regular life and emotional support. Moreover, healthy lifestyle, like smoking cessation, abstinence, a proper amount of exercise, and good sleep habits.[24,25] This study had some limitations. This is a retrospective study. Information was missing for some variables. The admission diagnosis and medication after discharge were not recorded, which may have influenced the results. Moreover, whether married patients have good marital relationships is unknown. Marital violence can be more harmful to health than being widowed. Although the association between marital status and prognosis of older patients with CeVD in the ICU was explored in this work study, their causal relationship is largely unknown, additional exploration is needed.

5 | CONCLUSIONS

5.1 | Implications of the study

Overall, marital status was associated with the long-term prognosis of older ICU patients with CeVD. The presence of a marital partner contributes to reduced mortality.

5.2 | Recommendations

Widowed individuals should receive greater societal attention regardless of sex and age.

AUTHOR CONTRIBUTIONS

Jun Xie: Conceptualization; writing—original draft. **Chong Li**: Methodology; software. **Min Shi**: Conceptualization; writing—review & editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data sets generated during the current study are available in the MIMIC-IV repository (https://mimic.mit.edu/).

TRANSPARENCY STATEMENT

The lead author Min Shi affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

ORCID

Jun Xie http://orcid.org/0000-0003-3909-9231
Chong Li https://orcid.org/0000-0002-9215-6779
Min Shi https://orcid.org/0000-0002-3214-1137

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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