Journal of the American Heart Association

ORIGINAL RESEARCH

Impact of Marital Status on Management and Outcomes of Patients With Acute Myocardial Infarction: Insights From the China Acute Myocardial Infarction Registry

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BACKGROUND: Acute myocardial infarction (AMI) is one of the leading causes of mortality worldwide, whereas social support is a known predictor of the prognosis after AMI. As a common factor influencing social support, the impact of marital status on care quality, in-hospital mortality, and long-term prognosis of patients with AMI remains largely unknown.

METHODS AND RESULTS: The present study analyzed data from the CAMI (China Acute Myocardial Infarction) registry involving 19 912 patients with AMI admitted at 108 hospitals in China between January 2013 and September 2014 and aimed to evaluate marital status–based differences in acute management, medical therapies, and short-term and long-term outcomes. The primary end point was 2-year all-cause death. The secondary end points included in-hospital death and 2-year major adverse cardiac and cerebrovascular events (a composite of all-cause death, myocardial infarction, or stroke). After multivariable adjustment, 1210 (6.1%) unmarried patients received less reperfusion treatment in patients with both ST-segment–elevation myocardial infarction and non–ST-segment–elevation myocardial infarction (adjusted odds ratio [OR], 0.520 [95% CI, 0.437–0.618]; $P<0.0001$; adjusted OR, 0.489 [95% CI, 0.364–0.656]; $P<0.0001$). Being unmarried was not associated with poorer in-hospital outcome but with long-term all-cause mortality and major adverse cardiac and cerebrovascular events in both ST-segment–elevation myocardial infarction (adjusted hazard ratio [HR], 1.225 [95% CI, 1.031–1.456]; $P=0.0209$; adjusted HR, 1.277 [95% CI, 1.089–1.498]; $P=0.0027$) and non–ST-segment–elevation myocardial infarction (adjusted HR, 1.302 [95% CI, 1.036–1.638]; $P=0.0239$; adjusted HR, 1.368 [95% CI, 1.105–1.694]; $P=0.0040$) populations.

CONCLUSIONS: The present study suggests that being unmarried is independently related to less reperfusion received, but could not explain the higher in-hospital mortality rate after covariate adjustment. Being unmarried is associated with a substantially increased risk of adverse events over at least the first 24 months after AMI.

REGISTRATION: URL: https://www.clinicaltrials.gov; Unique identifier: NCT01874691.

Key Words: marital status ■ medical care research ■ myocardial infarction ■ prognosis ■ socioeconomic position

Lacking solid social support is a well-established contributor to cardiovascular mortality.[1–4] Marriage is one of the closest and most important relationships for receiving social support. Outcomes for married patients are shown to be superior to unmarried ones in several coronary heart disease studies across subpopulations.[5–8] As an acute and severe manifestation of coronary heart disease, acute

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Supplemental Material is available at https://www.ahajournals.org/doi/suppl/10.1161/JAHA.122.025671

For Sources of Funding and Disclosures, see page 12.

JAHA is available at: www.ahajournals.org/journal/jaha

CLINICAL PERSPECTIVE

What Is New?

- Being unmarried was independently associated with less reperfusion treatment after acute myocardial infarction (AMI).
- Unmarried patients with AMI had a similar risk of in-hospital mortality.
- Being unmarried was associated with a poor long-term prognosis after AMI, and the adverse effect was more severe in patients who were never married and those aged 75 years or younger than those older.

What Are the Clinical Implications?

- Unmarried patients with AMI should be provided with positive treatment recommendations similar to those of married counterparts.
- After AMI, unmarried patients represent a vulnerable cohort and should be given targeted long-term psychosocial support interventions that may narrow the survival gap between married and unmarried patients identified in this study.

Nonstandard Abbreviations and Acronyms

DAPT	dual antiplatelet therapy
MACCE	major adverse cardiac and cerebrovascular event

myocardial infarction (AMI) represents a substantial global health threat and health care burden.[9,10] Limited small-scale studies demonstrate the association of marital status with the short-term or long-term outcome after AMI with the potential existence of sex disparity.[7,8,11] This association was proved to be independent, not from bias that individuals with acceptable physical and mental statuses tend to be selected into marriage. However, the prognosis of patients with AMI may be largely influenced by therapeutic strategies received, including both acute management during hospitalization and prescription for long-term secondary prevention. Marital status may affect medical decision-making, potentially contributing to the worse post-AMI outcomes in unmarried patients than in married patients. However, the confounding effect from probable discrepancies in therapeutics received was not considered in former studies, which might lead to a biased difference in outcomes between married and unmarried patients.

The presence and magnitude of the protective effect of marital status in different populations may vary considerably, attributed in part to cultural differences. Up to now, conclusions from the pertinent literature on the issue of marriage's impact on the prognosis of patients after AMI may not be generalizable to the Eastern Asian population, given the disparate cultural backgrounds. The CAMI (China Acute Myocardial Infarction) registry is a prospective, nationwide registry program for patients with AMI in China. The present study aimed to comprehensively explore the relationship between marital status and care quality, in-hospital mortality, and long-term outcomes of patients hospitalized for AMI in this large-scale registry. Interactions between sex, age, and risk stage were also explored.

METHODS

Study Design and Population

This study is a part of the CAMI registry study, a prospective, nationwide registry program in China designed to obtain real-world information about patients with AMI (NCT01874691 at https://www.clinicaltrials.gov/).[12] This study was approved by the institutional review board central committee at Fuwai Hospital and performed in accordance with the Declaration of Helsinki. All eligible patients have provided informed consent. One hundred eight hospitals from 31 provinces and municipalities throughout mainland China have participated in the registry (Data S1). The data that support the findings of this study are available from the corresponding author on reasonable request. Patients with a primary diagnosis of AMI including ST-segment–elevation myocardial infarction (STEMI) and non–ST-segment–elevation myocardial infarction (NSTEMI) admitted to participating hospitals within 7 days after the onset of ischemic symptoms were consecutively enrolled into the registry from January 2013 to September 2014. The final diagnosis of AMI had to meet the third universal definition for myocardial infarction, including types 1, 2, 3, 4b, and 4c.[13] Type 4a and type 5 AMI were not eligible for the CAMI registry. After excluding patients with undefined AMI type, indeterminate marital status, and those without any follow-up record, 19 912 consecutive patients were eventually enrolled. Patients were grouped based on self-reported marital status as either married or unmarried (including never married, divorced, and widowed).

Data Collection and Follow-Up

Comprehensive clinical data were collected using a standardized set of variables, predefined definitions, systematic data entry and transmission procedures, and rigorous data quality control. Enrollment, data collection, and follow-up were all performed in a timely manner by trained physicians at each participating site, whereas senior cardiologists were responsible for the data quality control. Data were collected, validated, and submitted via a web-based electronic data collection platform system. The database was periodically checked, and hospital sites were randomly audited for data accuracy based on medical records.

Clinical follow-up was performed at 1, 6, 12, 18, and 24 months. Follow-up was conducted by phone interviews and electronic medical record reviews to determine adverse outcomes. Medical records were accessed or requested to validate all self-reported events, which were defined using standard criteria.

Study Variables and Outcomes

We calculated the proportion of patients who received guideline-recommended acute treatment and secondary prevention.[9,10,14] Acute treatment measures for patients with AMI included dual antiplatelet therapy (DAPT) and loading-dose DAPT, angiotensin-converting enzyme inhibitors/angiotensin receptor blockers, β-blockers, statins, heparin during hospitalization, and reperfusion therapy. Medical therapies for secondary prevention included DAPT at discharge, angiotensin-converting enzyme inhibitors/angiotensin receptor blockers at discharge, β-blockers at discharge, and statins at discharge.

The primary end point was the covariate-adjusted 2-year rates of all-cause death. The secondary end points were the covariate-adjusted rate of in-hospital death and the covariate-adjusted 2-year rate of the major adverse cardiac and cerebrovascular events (MACCEs; a composite of all-cause death, myocardial infarction, or stroke).

Statistical Analysis

Patient characteristics, medical contact, and treatments were compared between unmarried and married groups. Continuous variables were expressed as mean±SD or median (interquartile range [IQR]) and compared with the Student *t* test or the Mann-Whiney *U* test, respectively. Categorical variables were reported as numbers and percentages and were compared using χ^2 or Fisher exact test as appropriate.

To examine the association between patients' marital status and care pattern, logistic regression models were used to adjust for potential confounders, including demographic variables (age, sex), socioeconomic variables (medical insurance, educational level, and state of residence), cardiovascular risk factors (body mass index, smoking, diabetes, hypertension, hyperlipidemia, chronic kidney disease, prior myocardial infarction, prior heart failure, and prior stroke), and characteristics on admission (onset-to-arrival time [≤3 hours, 3–6 hours, 6–12 hours, and >12 hours], means of transport, heart failure on admission, cardiogenic shock on admission, cardiac arrest on admission, heart rate on admission, and systolic blood pressure on admission). Logistic regression analyses were also used to evaluate the relationship between marital status and in-hospital mortality, after adjusting for aforementioned variables (except for heart rate and systolic blood pressure on admission) and therapeutic strategies separately in patients with STEMI and NSTEMI.

Time-to-first-event data were graphically presented using the Kaplan-Meier method and were compared using the log-rank test. The relationship between marital status and long-term outcomes, including all-cause death and MACCEs at 24 months, was determined via Cox proportional hazards regression. The first model was adjusted for demographic variables (age, sex) and socioeconomic variables (medical insurance, educational level, and state of residence). Model 2 included all variables in Model 1 and cardiovascular risk factors (body mass index, smoking, diabetes, chronic kidney disease, prior myocardial infarction, prior heart failure, and prior stroke) together with characteristics on admission (onset-to-arrival time [≤3 hours, 3–6 hours, 6–12 hours, and >12 hours], means of transport, heart failure on admission, cardiogenic shock on admission, and cardiac arrest on admission). Model 3 was additionally adjusted for loading-dose DAPT after admission, and Model 4 was adjusted for variables in Model 3 with the addition of reperfusion strategy separately in STEMI and NSTEMI cohorts. To evaluate whether the effect of marriage on all-cause death varied according to specific patient groups, subgroup analyses were performed using interaction testing with Cox regression Model 3.

Missing qualitative variables were imputed by the highest frequency count, whereas missing quantitative variables were imputed by the mean value in logistic regression models and Cox proportional hazards regression models. Statistical analyses were performed using SAS statistical software (version 9.4 for Windows; SAS Institute). A 2-tailed $P<0.05$ was considered statistically significant.

RESULTS

Baseline Characteristics

The present study included 19 912 eligible patients with AMI, among which 1210 (6.1%) patients were unmarried, whereas 18 702 (93.9%) were married. The comparisons of baseline characteristics between unmarried and married groups are presented in Table 1. Compared with the married group, unmarried patients

Table 1. Demographics and Clinical Characteristics of Patients With Acute Myocardial Infarction Stratified by Marital Status

Variables	Total, n=19912	Married, n=18702	Unmarried, n=1210	*P* value
Age, y	62.4 (53.7–71.7)	62.0 (53.3–70.7)	73.7 (64.5–79.9)	<0.0001
Men (%)	14921 (74.9%)	14308 (76.5%)	613 (50.7%)	<0.0001
STEMI (%)	14950 (75.1%)	14096 (75.4%)	854 (70.6%)	0.0002
Medical insurance				0.0001
Urban insurance (%)	10310/19862 (54.1%)	9743/17897 (54.4%)	567/1176 (48.2%)	
Rural insurance (%)	7410/19862 (38.9%)	6895/17897 (38.5%)	515/1176 (43.8%)	
Self-paid (%)	1353/19862 (7.1%)	1259/17897 (7.0%)	94/1176 (8.0%)	
College education (%)	1701/14838 (11.5%)	1638/13844 (6.3%)	63/994 (11.8%)	<0.0001
Living status*				<0.0001
Living alone (%)	571/19888 (2.9%)	241/18680 (1.3%)	330/1208 (27.3%)	
Living with parents or children (%)	3041/19888 (15.3%)	2231/18680 (11.9%)	810/1208 (68.7%)	
Living with spouse (%)	16193/19888 (86.7%)	16153/18680 (86.5%)	40/1208 (3.3%)	
Other status† (%)	83/19888 (0.4%)	55/18680 (0.3%)	28/1208 (2.3%)	
Risk factors and medical history				
Body mass index, kg/m^2	24.1±3.1	24.19±3.10	23.31±3.44	<0.0001
Body mass index ≥25 kg/m^2 (%)	6918 (34.7%)	6594 (35.3%)	324 (26.8%)	<0.0001
Current smoker (%)	8933/19806 (45.1%)	8541/18598 (45.9%)	392/1208 (32.5%)	<0.0001
Diabetes (%)	3736/19181 (19.5%)	3509/18021 (19.5%)	227/1160 (19.6%)	0.935
Hypertension (%)	9946/19580 (50.8%)	9305/18400 (50.6%)	641/1180 (54.3%)	0.01
Known dyslipidemia (%)	1378/17325 (8.0%)	1325/16 336 (8.1%)	53/989 (5.4%)	0.001
Prehospital statin (%)	1866/19501 (10.1%)	1776/17298 (10.3%)	90/1153 (7.8%)	0.007
Prior myocardial infarction (%)	1432/18825 (7.6%)	1344/17684 (7.6%)	88/1141 (7.7%)	0.890
Prior stroke (%)	1821/19328 (9.4%)	1663/18143 (9.2%)	158/1185 (13.3%)	<0.0001
Presentation				
Means of transport				0.002
Self or family (%)	12737/19823 (64.3%)	11938/18617 (64.1%)	799/1206 (66.3%)	
Ambulance (%)	1957/19823 (9.9%)	1825/18617 (9.8%)	132/1206 (10.9%)	
Transferred (%)	4917/19823 (24.8%)	4663/18617 (25.0%)	254/1206 (21.1%)	
In-hospital (%)	212/19823 (1.1%)	191/18617 (1.0%)	21/1206 (1.7%)	
Onset-to-arrival time				0.009
≤3 h (%)	4415/19749 (22.4%)	4187/18552 (22.6%)	228/1197 (19.0%)	
3–6 h (%)	4881/19749 (24.7%)	4598/18552 (24.8%)	283/1197 (23.6%)	
6–12 h (%)	3132/19749 (15.9%)	2921/18552 (15.7%)	211/1197 (17.6%)	
>12 h (%)	7321/19749 (37.1%)	6846/18552 (36.9%)	475/1197 (39.7%)	
Severe clinical conditions on admission				
Heart failure on admission (%)	3189/19706 (16.2%)	2842/18511 (15.4%)	347/1195 (29.0%)	<0.0001
Cardiogenic shock on admission (%)	652/19758 (3.3%)	585/18557(3.2%)	67/1201 (5.6%)	<0.0001
Cardiac arrest on admission (%)	192/19808 (1.0%)	178/18602 (1.0%)	14/1206 (1.2%)	0.4959
Killip class III or IV heart failure on admission (%)	1629/19791 (8.2%)	1454/18584 (7.8%)	175/ 1207 (14.5%)	<0.0001
Renal insufficiency (%)	530 (2.7%)	504 (2.7%)	26 (2.1%)	0.2379
GRACE score on admission				<0.0001
≤108 (%)	2440 (12.3%)	2351 (12.6%)	89 (7.4%)	
109–140 (%)	6996 (35.1%)	6768 (36.2%)	228 (18.8%)	
>140 (%)	10476 (52.6%)	9583 (51.2%)	893 (73.8%)	

GRACE indicates Global Registry of Acute Coronary Events; and STEMI, ST-segment–elevation myocardial infarction.

*Patients with overlapping living status was processed as follows: Those who lived alone and with parents (n=1), children (n=22), and spouses (n=41) were integrated into the living alone group; those who lived with a spouse while also with parents (n=33), children (n=1615) and people apart from the above (n=12) were integrated into living with spouse group; patients who lived with children and others (n=3) were integrated into living with parents or children group.

†Living with people apart from parents, children, or spouse.

with AMI were older (73.7 years [IQR, 64.5–79.9 years] versus 62.0 years [IQR, 53.3–70.7 years], *P*<0.0001), there were fewer men (50.7% versus 76.5%, *P*<0.0001), and STEMI was less frequently diagnosed (70.6% versus 75.4%, *P*<0.0001).

Medical expenditures created during hospitalization of unmarried patients with AMI were more likely paid by rural insurance or patients themselves other than by urban insurance (*P*=0.0001). However, they were more frequently highly educated (11.8% versus 6.3%, *P*<0.0001). For unmarried patients, 27.3% with AMI lived alone, which was much higher than those who were married (1.3%, *P*<0.0001). Unmarried patients had a higher prevalence of hypertension (54.3% versus 50.6%, *P*=0.01) and previous stroke (13.3% versus 9.2%, *P*<0.0001), whereas married patients were more likely to be current smokers (32.5% versus 45.9%, *P*<0.0001) and be overweight or obese (35.3% versus 26.8%, *P*<0.0001). Married patients also presented with more known dyslipidemia (8.1% versus 5.4%, *P*=0.001) and received more prehospital statin treatment (10.3% versus 7.8%, *P*=0.007).

On the means of transport, unmarried patients were more likely to come to the hospital by themselves, by family, or by ambulance and less likely by transferred from other hospitals or medical organizations (*P*=0.002). They also took a longer time from symptom onset to hospital arrival, with 39.7% taking over 12 hours compared with 36.9% of their married counterparts (*P*=0.009). In terms of clinical characteristics, unmarried patients presented with more serious clinical conditions on admission, including heart failure, cardiogenic shock, Killip class III/IV, and GRACE (Global Registry of Acute Coronary Events) score >140 than married patients (all *P*<0.0001).

Clinical Management

Significant disparities in clinical management between unmarried and married patients with AMI were noted (Table 2). Of unmarried patients with STEMI and NSTEMI, 53.2% and 23.0%, respectively, received reperfusion therapy, much less than their married counterparts (76.2% and 47.0%, respectively, both *P*<0.0001). Of unmarried patients, 98.7%, 68.5%, 66.7%, and 7.8% were prescribed with DAPT, loading-dose DAPT, β-blockers, and statins, respectively, during hospitalization, less than the married cohort (99.3%, 76.0%, 72.2%, and 10.3%, respectively, all *P*<0.05). In terms of medical therapies for secondary prevention, unmarried individuals received fewer β-blockers at discharge compared with those in who were married (61.4% versus 66.5%, *P*=0.0003), whereas no disparity was observed in prescriptions of DAPT, angiotensin-converting enzyme inhibitors/angiotensin receptor blockers, or statins at discharge.

The marital status-based difference in reperfusion strategy was still significant after adjustment for demographic variables, socioeconomic variables, cardiovascular risk factors, and characteristics on admission in patients with both STEMI and NSTEMI (adjusted odds ratio (OR), 0.520 [95% CI, 0.437–0.618]; *P*<0.0001; adjusted OR, 0.489 [95% CI, 0.364–0.656]; *P*<0.0001). Unmarried status was also significantly associated with not receiving statins and receiving heparin during hospitalization, but did not independently affect medical prescriptions at discharge including β-blockers (Table 3).

Table 2. Treatments for Patients With Acute Myocardial Infarction Stratified by Marital Status

Treatments	Total, n=19 912	Married, n=18 702	Unmarried, n=1210	*P* value
Reperfusion therapy				
Reperfusion for STEMI (%)	11 121/14 843 (74.9%)	10 670/13 995 (76.2%)	451/848 (53.2%)	<0.0001
Reperfusion for NSTEMI (%)	2218/4901 (45.3%)	2137/4549 (47.0%)	81/352 (23.0%)	<0.0001
Medication during hospitalization				
DAPT (%)	19 689/19 842 (99.2%)	18 500/18 637 (99.3%)	1189/1205 (98.7%)	0.0374
Loading-dose DAPT (%)	14 881/19 689 (75.6%)	14 067/18 500 (76.0%)	814/1189 (68.5%)	<0.0001
ACEI/ARB (%)	12 057/19 664 (61.3%)	11 330/18 466 (61.4%)	727/1198 (60.7%)	0.6437
β-Blocker (%)	14 138/19 685 (71.8%)	13 338/18 485 (72.2%)	800/1200 (66.7%)	<0.0001
Statin (%)	1866/18 451 (10.1%)	1776/17 298 (10.3%)	90/1153 (7.8%)	0.007
Heparin (%)	17 813/19 452 (91.6%)	16 714/18 262 (91.5%)	1099/1190 (92.4%)	0.3116
Medical therapies for secondary prevention				
DAPT at discharge (%)	18 145/19 294 (94.0%)	17 042/18 114 (94.1%)	1103/1180 (93.5%)	0.3994
ACEI/ARB at discharge (%)	10 750/19 294 (55.7%)	10 098/18 114 (55.7%)	652/1180 (55.3%)	0.7414
β-Blocker at discharge (%)	12 778/19 294 (66.2%)	12 054/18 114 (66.5%)	724/1180(61.4%)	0.0003
Statin at discharge (%)	17 486/19 294 (90.6%)	16 432/1 8114 (90.7%)	1054/1180 (89.3%)	0.1185

ACEI/ARB indicates angiotensin-converting enzyme inhibitor/angiotensin receptor blocker; DAPT, dual antiplatelet therapy; NSTEMI, non–ST-segment–elevation myocardial infarction; and STEMI, ST-segment–elevation myocardial infarction.

Table 3. Adjusted Odds Ratios for Medical Treatment in Unmarried Patients Compared With Married Patients

Treatment	Adjusted OR* (95% CI), unmarried vs married	*P* value
Medication during hospitalization		
Reperfusion for STEMI†	0.520 (0.437–0.618)	<0.0001
Reperfusion for NSTEMI‡	0.489 (0.364–0.656)	<0.0001
DAPT	0.830 (0.467–1.473)	0.5245
ACEI/ARB	1.024 (0.893–1.174)	0.7366
β-Blocker	0.935 (0.812–1.076)	0.3507
Statin	0.698 (0.543–0.897)	0.0050
Heparin	1.299 (1.019–1.656)	0.0348
Medical therapies for secondary prevention		
DAPT at discharge	1.223 (0.939–1.593)	0.1357
ACEI/ARB at discharge	1.072 (0.937–1.226)	0.3102
β-Blocker at discharge	0.966 (0.843–1.106)	0.6144
Statin at discharge	1.027 (0.830–1.272)	0.8032

Missing qualitative variables were imputed by the highest frequency count, and missing quantitative variables were imputed by the mean value. ACEI/ARB indicates angiotensin-converting enzyme inhibitor/angiotensin receptor blocker; DAPT, dual antiplatelet therapy; NSTEMI, non–ST-segment–elevation myocardial infarction; OR, odds ratio; and STEMI, ST-segment–elevation myocardial infarction.

*ORs were adjusted for demographic variables(age, sex), socioeconomic variables (medical insurance, educational level, and state of residence), cardiovascular risk factors (body mass index, smoking, diabetes, hypertension, hyperlipidemia, chronic kidney disease, prior myocardial infarction, prior heart failure, and prior stroke), and characteristics on admission (onset-to-arrival time [≤3 hours, 3–6 hours, 6–12 hours, and >12 hours], means of transport, heart failure on admission, cardiogenic shock on admission, cardiac arrest on admission, heart rate on admission, and systolic blood pressure on admission).

†Number of cases: 14843.

‡Number of cases: 4901.

In-Hospital and Long-Term Outcome

The crude rate of in-hospital mortality was much higher in unmarried patients than married patients (7.2% versus 3.4%, *P*<0.0001) (Table 4). However, after being adjusted, the marital status–based difference is not significant (Tables S1 through S3).

During 24 months of follow-up, there were 2087 (10.8%) all-cause deaths and 2633 (13.7%) MACCEs. The all-cause mortality and MACCEs rates at 24 months were higher in unmarried participants than those who were married (24.2% versus 10.0%, *P*<0.0001; 28.0% versus 12.8%, *P*<0.0001) (Table 4). Kaplan-Meier curve analysis demonstrated a significantly worse 24-month outcome for unmarried patients in overall, STEMI, and NSTEMI populations (Figure 1). In a Cox model that included all aforementioned confounders, unmarried patients had a 36.4% higher risk of 24-month mortality (Model 2 in Table 5: adjusted hazard ratio [HR], 1.364 [95% CI, 1.188–1.566]; *P*<0.0001) and a 42.4% higher risk of 24-month MACCEs than married patients (Model 2 in Table 5: adjusted HR, 1.424 [95% CI, 1.253–1.619]; *P*<0.0001).

To evaluate whether the residual difference in long-term outcome could be explained by disparities in medical decision-making between the 2 groups, we performed additional adjustments for loading-dose DAPT and reperfusion therapy separately in patients with STEMI and NSTEMI. After further adjustment, the association between marriage and long-term adverse events was attenuated but remained statistically significant. In the STEMI population, the unmarried group yielded an HR of 1.225 (95% CI, 1.031–1.456; *P*=0.0209) for all-cause death and an HR of 1.277 (95% CI, 1.089–1.498; *P*=0.0027) for MACCEs. In the patients with NSTEMI, the unmarried group had an HR of 1.302 (95% CI, 1.036–1.638; *P*=0.0239) for all-cause death and an HR of 1.368 (95% CI, 1.105–1.694; *P*=0.0040) for MACCEs.

Relation With Living Status

The influence of living status on the 24-month mortality of patients with AMI was also analyzed. After stratified by living status, the best outcome was recorded in married people who lived alone, followed by married people who lived with others, then unmarried people who lived alone, and the worst outcome was recorded in unmarried patients who cohabitated with others (Figure 2). Differences resulting from living status were then adjusted separately in the married and unmarried groups. After multivariable adjustment, unmarried patients who lived with others, including with parents/children or a spouse, showed no significant difference in prognosis compared with their counterparts who lived alone (Table 6). Conversely, in married patients, those who lived with their parents or children had a lower

Table 4. Adverse Events in Hospital and at 24 Months in Patients With Acute Myocardial Infarction Stratified by Marital Status

Treatments	Total, n=19912	Married, n=18702	Unmarried, n=1210	*P* value
Adverse events in hospital				
Death (%)	714/19912 (3.6%)	627/18702 (3.4%)	87/1210 (7.2%)	<0.0001
Adverse events at 24 months				
All-cause mortality (%)	2087/19244 (10.8%)	1800/18058 (10.0%)	287/1186 (24.2%)	<0.0001
MACCEs (%)	2633/19193 (13.7%)	2302/18010 (12.8%)	331/1183 (28.0%)	<0.0001

MACCEs indicates major adverse cardiac and cerebrovascular events.

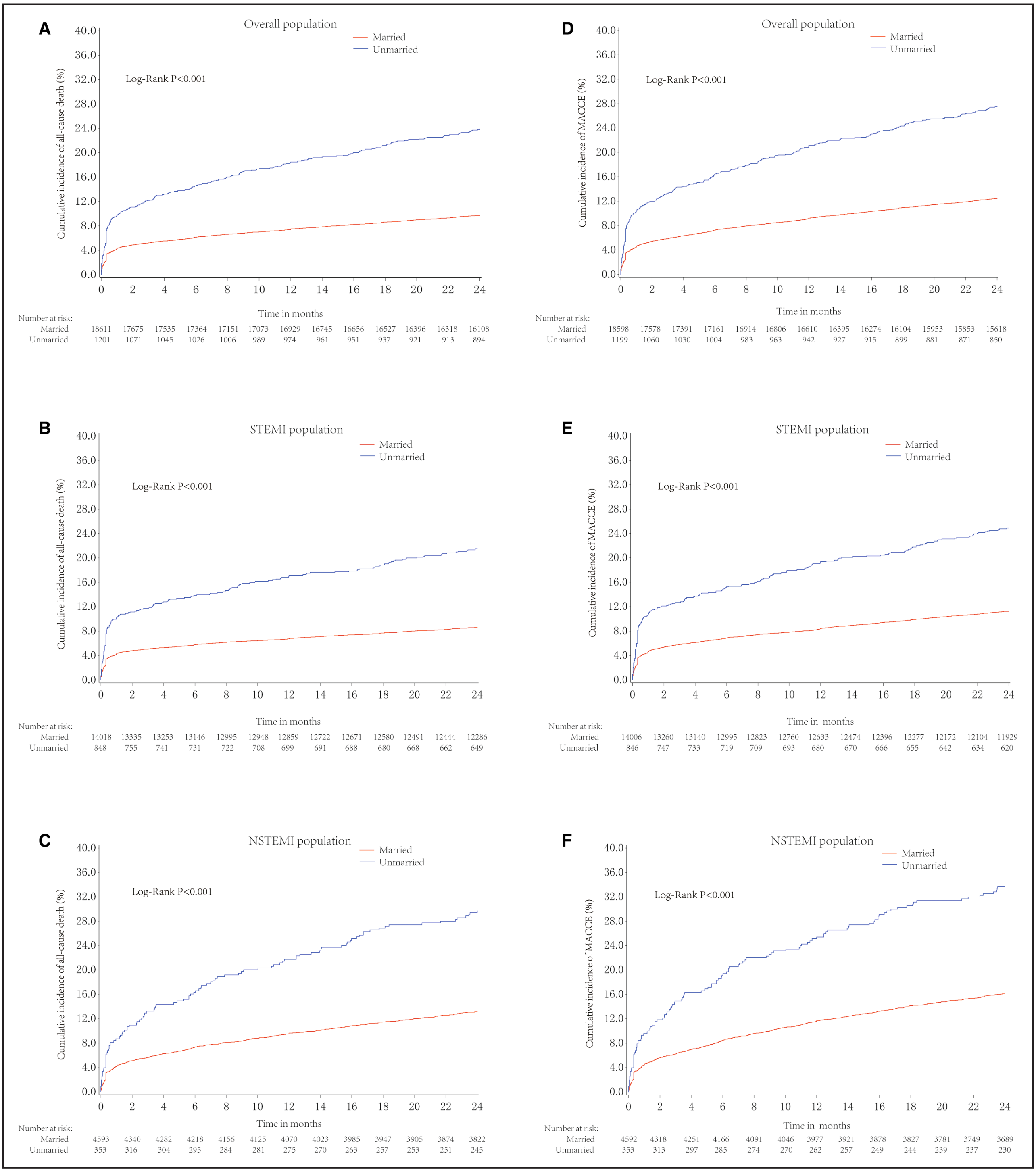

Figure 1. Kaplan-Meier curves for all-cause death and MAACEs.
A through **C**, Kaplan–Meier curves for all-cause death in overall, STEMI, and NSTEMI populations. **D** through **F**, Kaplan-Meier curves for MACCEs in overall, STEMI, and NSTEMI populations. MACCEs indicates major adverse cardiac and cerebrovascular events; NSTEMI, non–ST-segment–elevation myocardial infarction; and STEMI, ST-segment– elevation myocardial infarction.

risk of all-cause death than those who lived alone, with an adjusted HR of 1.650 (95% CI, 1.063–2.559; *P*=0.0255). No significant difference exists between living alone and living with a spouse or other people apart from the above.

Sensitivity and Subgroup Analyses

Sensitivity analyses were performed to examine whether sex, age, the GRACE risk score, or living status affected the association between marital status and long-term mortality. In the multivariable analysis

Table 5. Marital Status–Based Differences of Long-Term Outcome

Model	Total		Patients with STEMI		Patients with NSTEMI	
	Adjusted HR (95% CI), unmarried vs married	*P* value	Adjusted HR (95% CI), unmarried vs married	*P* value	Adjusted HR (95% CI), unmarried vs married	*P* value
Death						
Unadjusted	2.641 (2.331–2.991)	<0.0001	2.652 (2.269–3.099)	<0.0001	2.489 (2.023–3.063)	<0.0001
Model 1*	1.505 (1.311–1.726)	<0.0001	1.525 (1.283–1.812)	<0.0001	1.474 (1.174–1.851)	0.0008
Model 2†	1.364 (1.188–1.566)	<0.0001	1.369 (1.152–1.628)	0.0004	1.370 (1.089–1.724)	0.0072
Model 3‡	1.349 (1.175–1.549)	<0.0001	1.354 (1.139–1.611)	0.0006	1.355 (1.077–1.705)	0.0096
Model 4§	…		1.225 (1.031–1.456)	0.0209	1.302 (1.036–1.638)	0.0239
MACCEs						
Unadjusted	2.412 (2.149–2.707)	<0.0001	2.386 (2.066–2.754)	<0.0001	2.356 (1.943–2.858)	<0.0001
Model 1*	1.551 (1.365–1.762)	<0.0001	1.560 (1.330–1.831)	<0.0001	1.539 (1.244–1.902)	<0.0001
Model 2†	1.424 (1.253–1.619)	<0.0001	1.421 (1.211–1.668)	<0.0001	1.433 (1.157–1.776)	0.0010
Model 3‡	1.412 (1.242–1.605)	<0.0001	1.411 (1.202–1.657)	<0.0001	1.421 (1.147–1.761)	0.0013
Model 4§	…		1.277 (1.089–1.498)	0.0027	1.368 (1.105–1.694)	0.0040

Missing qualitative variables were imputed by the highest frequency count, and missing quantitative variables were imputed by the mean value. HR indicates hazard ratio; MACCEs, major adverse cardiac and cerebrovascular events; NSTEMI, non–ST-segment–elevation myocardial infarction; STEMI, ST-segment–elevation myocardial infarction.

*Model 1: Adjusted for demographic variables (age, sex) and socioeconomic variables (medical insurance, educational level, and state of residence).

†Model 2: Model 1 adjustments plus additionally adjusted for cardiovascular risk factors (body mass index, smoking, diabetes, chronic kidney disease, prior myocardial infarction, prior heart failure, and prior stroke), and characteristics on admission (onset-to-arrival time [≤3 hours, 3–6 hours, 6–12 hours, and >12 hours], means of transport, heart failure on admission, cardiogenic shock on admission, and cardiac arrest on admission).

‡Model 3: Model 2 adjustments plus additionally adjusted for loading-dose dual antiplatelet therapy after admission.

§Model 4: Model 3 adjustments plus additionally adjusted for reperfusion therapy (timely reperfusion, untimely reperfusion, and no reperfusion).

stratified by age, the adverse effect of unmarried status was more significant in patients aged 75 years or younger than those older (adjusted HR, 1.376 [95% CI, 1.088–1.740] versus adjusted HR, 1.235 [95% CI, 1.039–1.467]; *P* for interaction=0.0376) (Figure 3). The same difference was observed in the STEMI cohort (*P* for interaction=0.0255) but not in the NSTEMI cohort (*P* for interaction=0.7394) (Figure S1 and S2). There was no significant interaction between marital status and long-term death with respect to sex, GRACE score, and living status stratification in the general cohort, STEMI group, and NSTEMI group.

The unmarried group was then divided into widowed, divorced, and never married subgroups. Among these subgroups, widowed patients had the highest crude rates of in-hospital death, all-cause mortality, and MACCEs at 24 months (Figure 4, Table S3). After adjustment, however, never married was an independent

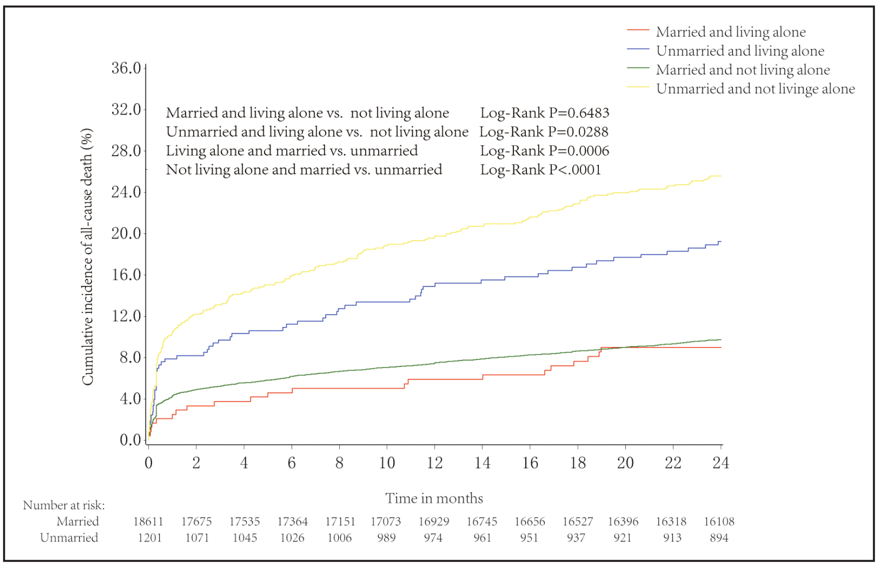

Figure 2. Kaplan-Meier curves for all-cause death in overall populations by marital and living status.

Table 6. Living Status–Based Differences of Long-Term Outcome Stratified by Marital Status

Living status	Unadjusted HR (95% CI)	*P* value	Adjusted HR (95% CI)*	*P* value	Unadjusted HR (95% CI)	*P* value	Adjusted HR (95% CI)*	*P* value
	Married group				Unmarried group			
Not living alone vs living alone	1.105 (0.719–1.699)	0.6488	1.299 (0.844–1.999)	0.2347	1.361 (1.031–1.797)	0.0298	1.014 (0.753–1.364)	0.9276
Living with parents/children vs living alone	2.289 (1.477–3.547)	0.0002	1.650 (1.063–2.559)	0.0255	1.411 (1.067–1.867)	0.0157	1.023 (0.758–1.381)	0.8814
Living with spouse vs living alone	0.952 (0.619–1.465)	0.8238	1.196 (0.776–1.844)	0.4162	0.488 (0.178–1.340)	0.1641	0.488 (0.176–1.353)	0.1682
Other status† vs living alone	0.855 (0.294–2.491)	0.7742	1.459 (0.500–4.259)	0.4895	1.289 (0.591–2.814)	0.5231	1.397 (0.632–3.091)	0.4089

Missing qualitative variables were imputed by the highest frequency count, and missing quantitative variables were imputed by the mean value. HR indicates hazard ratio.
*HRs were adjusted by Model 3 in Table 5.
†Living with people apart from parents, children, or spouse.

risk factor for in-hospital death compared with married and even with other unmarried subtypes (adjusted OR, 3.074 [95% CI, 1.249–7.570]; *P*=0.0146; adjusted OR, 0.339 [95% CI, 0.136–0.844]; *P*=0.0201; Table 7). It also represented a higher risk of all-cause death after discharge than married and other unmarried subtypes (adjusted HR, 2.774 [95% CI, 1.679–4.586]; *P*<0.0001; adjusted HR, 0.479 [95% CI, 0.289–0.795]; *P*=0.0044; Table 8). In addition, widowed or divorced patients also showed poorer long-term prognosis in comparison with married patients, but not for the short-term prognosis.

DISCUSSION

The main findings of our analysis are as follows: (1) Unmarried patients were less likely to receive reperfusion therapy than married counterparts after multivariable adjustment. (2) In accordance with other previous studies, the patients in the unmarried group had higher crude in-hospital mortality rates, long-term all-cause death, and MACCEs rates than those in the married group.[7,8,11] Nevertheless, after adjustment for clinical characteristics and in-hospital management, the difference in in-hospital mortality was no longer preserved, whereas marriage remained independently associated with a lower 24-month risk of all-cause death and MACCEs rates. (3) We found no significant interaction between marital status and long-term death with respect to sex. In contrast, we found a more significant adverse effect of being unmarried in patients aged 75 years or younger than those older.

The baseline characteristics of our cohort were similar to others.[6,11,15–17] Unmarried patients are generally older, there are fewer men, and they have more cardiovascular comorbidities than their married counterparts. In contrast with many stereotypes, their lifestyle can be even healthier and less likely to be current smokers or overweight. However, before the occurrence of AMI, they are probably provided with less primary prevention, as evidenced by lower rates of known hyperlipidemia and prehospital statin treatment. They are more likely to live alone, experience more delaying hospital admission after AMI onset, and present with more severe clinical conditions on admission than married patients.

Several previous reports claimed that not being in a marriage contributed to in-hospital mortality, independent of baseline indicators. However, in our study, multivariable analysis demonstrated that the increased crude mortality risk in unmarried patients was mainly attributed to the differences in baseline cardiovascular risk factors, clinical characteristics, and acute management. This conflicting result might reflect differences in the included populations and be partly because of

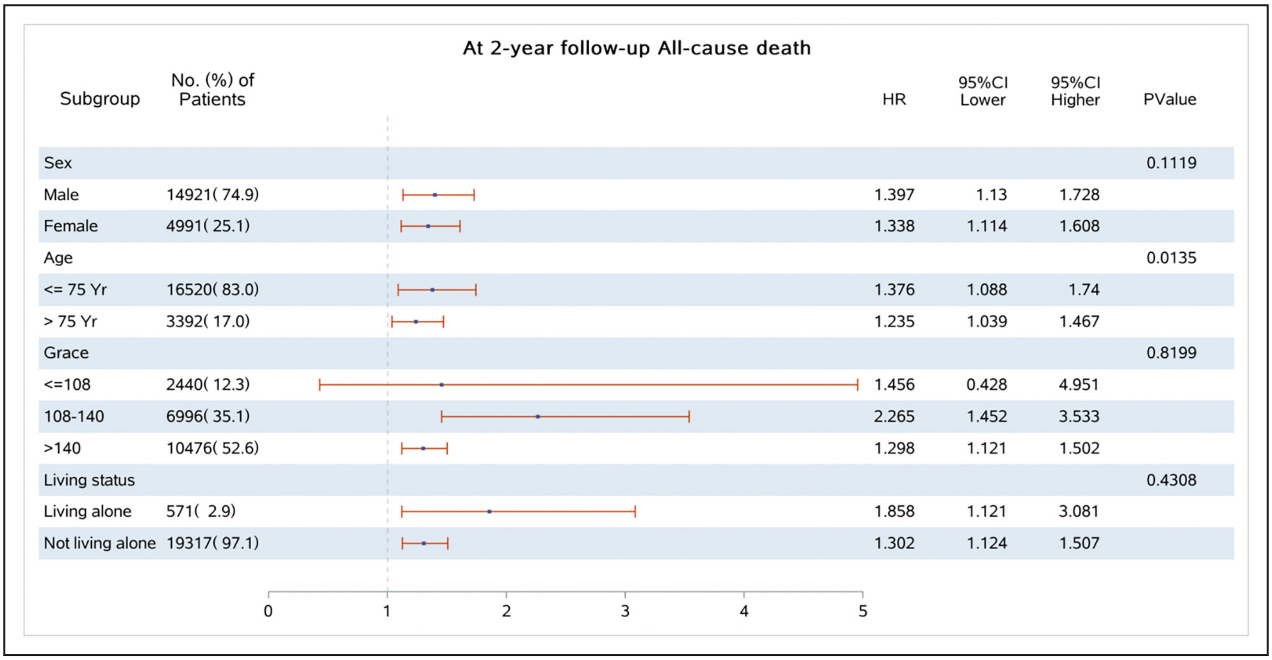

Figure 3. Comparative adjusted hazard ratios of all-cause death between unmarried and married groups for each subgroup in the overall population.
The dashed line, red bars, and blue dots, respectively, represent the cut-off value of HR as 1, 95% CI of HR, and HR value. GRACE indicates Global Registry of Acute Coronary Events; and HR, hazard ratio.

neglecting confounding effects from in-hospital managements in other previous studies. In our cohorts, unmarried patients were less likely to receive some evidence-based acute treatments, including reperfusion therapy, than married patients. This difference was still significant after multivariable adjustment and remarkably contributed to the increased in-hospital mortality in the unmarried group.

After AMI onset, married patients might be prompted by their spouses to seek medical attention for worrisome symptoms. Moreover, married patients might have easier and more prompt access to acute medical care, which could otherwise explain the delay from symptom onset to hospital arrival in unmarried patients.[18] Unmarried patients are less likely to arrive at the hospital for primary percutaneous coronary intervention (PCI) within the emergent time range, partly resulting in a lower proportion of reperfusion therapy. Moreover, unmarried patients are more likely to suffer from social isolation and depression. Therefore, physicians and patients themselves may be prone to choosing noninvasive management over married patients, potentially accounting for the discrepancies in acute treatment identified. Besides reperfusion therapy, guideline-recommended medications prescribed in

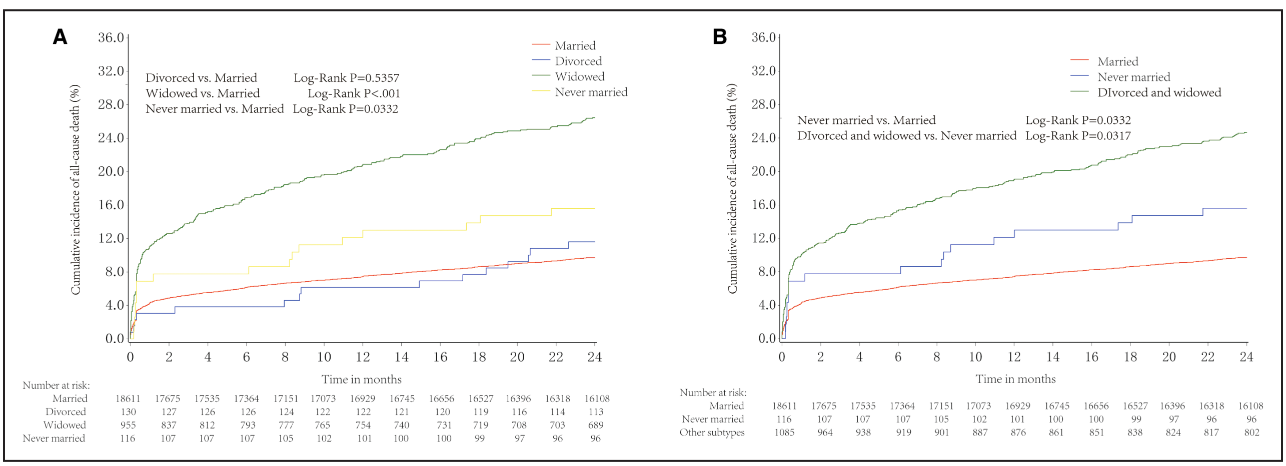

Figure 4. Kaplan-Meier curves for all-cause death in overall populations by marital subtype.
A, Before merging divorced and widowed into 1 group. **B**, After merging divorced and widowed into 1 group.

Table 7. Differences in In-Hospital Death Based on Marital Subtype

Marital subtype	Unadjusted OR (95% CI)	*P* value	Adjusted OR (95% CI) *	*P* value
Widowed vs married	2.435 (1.899–3.122)	<0.0001	1.022 (0.768–1.359)	0.8814
Divorced vs married	0.908 (0.335–2.464)	0.8497	1.262 (0.435–3.664)	0.6683
Never married vs married	2.135 (1.037–4.398)	0.0396	3.074 (1.249–7.570)	0.0146
Widowed or divorced vs never married	1.051 (0.495–2.233)	0.8971	0.339 (0.136–0.844)	0.0201

Missing qualitative variables were imputed by the highest frequency count, and missing quantitative variables were imputed by the mean value. OR indicates odds ratio.

*ORs were adjusted for demographic variables(age, sex), socioeconomic variables (medical insurance, educational level, and state of residence), cardiovascular risk factors (body mass index, smoking, diabetes, hypertension, hyperlipidemia, chronic kidney disease, prior myocardial infarction, prior heart failure, and prior stroke), and characteristics on admission (onset-to-arrival time [≤3 hours, 3–6 hours, 6–12 hours, and >12 hours], means of transport, heart failure on admission, cardiogenic shock on admission, cardiac arrest on admission).

the hospital and for secondary prevention did not show a wide gap from different marital statuses. Our outcomes showed that being unmarried was independently associated with less in-hospital heparin treatment, possibly because the married group underwent more PCI procedures with other anticoagulants and unmarried patients were more likely given heparin or low-molecular-weight heparin as the anticoagulant for acute coronary syndrome (ACS) without receiving PCI.

Although marital status does not independently contribute to the disparity in in-hospital mortality between married and unmarried groups, our study shows a clear and consistent protective effect of marriage in the long-term follow-up after AMI. After discharge, being married was associated with a lower 24-month risk for all-cause death and MACCEs in patients after both STEMI and NSTEMI. This protective effect is independent of baseline characteristics and in-hospital management strategy. Marriage is a known barrier to various forms of psychological distress.[19] Unmarried patients represent an at-risk population lacking social and emotional support and displaying a high risk of major depression.[20] Patients who lack emotional support do poorly after being diagnosed with cardiovascular diseases, mainly mediated by depression.[21,22] Moreover, spouses of married patients may supervise medication or promote medical advice seeking, which may also account for the protective effect.[23,24] Wu et al reported worse cardiac event-free survival in unmarried patients with heart failure than in married counterparts, and the worse adherence to medications mediates this disparity.[25]

Williams et al found that in a sample of 1368 coronary artery disease patients, those who were married without a confidant, unmarried but with a confidant, or married with a confidant had a significantly better survival rate than those unmarried patients without a confidant.[26] This study highlights that patients who have close social relationships may not suffer increased clinical events attributable to being unmarried. Therefore, we evaluated the influence of living status on unmarried patients, because living with others may also help maintain a healthy mental environment and motivate medical attention seeking. However, we found no benefit of living with others, whether with parents/children, a spouse, or someone else in the unmarried group, demonstrating that the adverse effect of not being in a marriage may not simply be attenuated by living with others. In the married group, those who lived with their parents or children had a lower risk of all-cause death than those who lived alone, maybe revealing the benefit of companionship independent of marital status.

Furthermore, the consensus has not been reached as to whether sex disparities about marriage exist and exert impacts on patients in the context of AMI. Interaction between sex and marital status on the risk of AMI was found in a case–control study, but was not with respect to long-term prognosis after PCI or coronary artery bypass grafting.[5,6,27] Marcus et al included 7233 post–ACS patients in their study,

Table 8. Differences in Long-Term Mortality Based on Marital Subtype

Marital subtype	Unadjusted HR (95% CI)	*P* value	Adjusted HR (95% CI)*	*P* value
Widowed vs married	2.989 (2.621–3.409)	<0.0001	1.297 (1.124–1.497)	0.0004
Divorced vs married	1.174 (0.706–1.951)	0.5370	1.702 (1.013–2.859)	0.0444
Never married vs married	1.647 (1.035–2.620)	0.0352	2.774 (1.679–4.586)	<0.0001
Widowed or divorced vs never married	1.671 (1.037–2.692)	0.0350	0.479 (0.289–0.795)	0.0044

Missing qualitative variables were imputed by the highest frequency count, and missing quantitative variables were imputed by the mean value. HR indicates hazard ratio.

*HRs were adjusted by Model 3 in Table 5.

and observed that married men showed the best prognosis, whereas nonmarried women showed the worst, but failed to find any interaction between sex and marital status during 5 years of follow-up.[11] In the present study, we also did not find the interaction between sex and marital status, indicating that marriage does not have differed post-AMI prognostic implications in different sex. On the contrary, we found an interaction between age categories and marital status. Lacking the protective effect from marriage exerted an augmented adverse effect on patients aged 75 years or younger than those older. The same difference was observed in the STEMI but not in the NSTEMI subgroup, probably reflecting the smaller sample size of patients with NSTEMI involved. This finding consists of a former census data study that found protective effects from the partnership were strong during mature adult life and the early stages of old age but tended to decline among the very old.[28] The exact reasons will need to be explored further, but it could probably reflect that for old patients, social support from their children, friends, or the community may play a more critical role in their recovery from AMI than their younger counterparts.

Because the unmarried group represents a heterogeneous population, including widowed, divorced, and never married, we also analyzed the separate impact of each subgroup on the short-term and long-term prognosis of patients with AMI. Unexpectedly, never married is an independent risk factor for in-hospital death, although other subtypes do not show the same impact. Moreover, never married patients have a higher risk of short-term and long-term mortality than not only married patients, but also their widowed and divorced counterparts, suggesting that among the high-risk group of unmarried patients with AMI, those who never married represent a cohort of the highest risk and should be given more medical attention.

Currently, research for AMI focuses mainly on biological investigations. The present study indicates that being married has a related health premium and identifies unmarried patients after AMI as a vulnerable subpopulation that may have a strong indication for targeted interventions, which could be a cost-effective method to close the survival gap identified in the current study between unmarried and married patients. Cognitive behavioral stress management training focuses on stress management, self-monitoring, cognitive restructuring, and skills building for developing better social relationships. As a potentially effective therapy, cognitive behavioral stress management training has been proved to reduce psychosocial and physiological risk factors in coronary heart disease patients and improve long-term clinical outcomes with a dose–response effect.[29–31] Therefore, it is supposed to be provided for unmarried patients after myocardial infarction, and should be performed as group-based training.[32]

The results of this study should be interpreted in consideration of several potential limitations. First, marital status was self-reported so that reporting bias may exist. Second, data on some important parameters that may help better analyze the influence of marital status are not available, such as time data for PCI and depression score, which may mediate the superiority of undermarriage in management and short-term and long-term outcomes. Third, the living status is overlapped in some patients, which may affect relevant results. Fourth, the unmarried group in our study is limited in sample size and thus may underestimate the influence of living status and the heterogeneity between diverse subtypes. Relevant findings warrant confirmation in larger samples.

CONCLUSIONS

Unmarried status is associated with a substantially increased risk of adverse events during the first 24 months after AMI, and independently contributes to fewer patients receiving reperfusion therapeutics, but could not explain the higher in-hospital mortality rate after covariate adjustment. As for unmarried patients with AMI, clinical staff should be alert to the poor outcomes observed in this vulnerable population and provide positive treatment recommendations similar to those of married counterparts.

ARTICLE INFORMATION

Received February 6, 2022; accepted September 12, 2022.

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Acknowledgments

The authors are grateful for the professional help from statistician K.-X. Liu (Medical Research and Biometrics Center, National Center for Cardiovascular Diseases of China).

Sources of Funding

This work was supported by the 12th Five-Year National Science and Technology Support Plan of the Scientific and Technological Department of China (number 2011BAI11B02), National Natural Science Foundation of China (number 81670337), and Foundation for Clinical and Translational Medical Research, Central Public Welfare Research of Chinese Academy of Medical Sciences (number 2019xk320061).

Disclosures

None.

Supplemental Material

Data S1
Tables S1–S3
Figures S1–S2

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SUPPLEMENTAL MATERIAL

Data S1.

Full List of Hospitals in the CAMI Registry

Hospital	Province/Municipality	City	PI
Fuwai Hospital	Beijing	Beijing	Yuan Wu
Beijing Friendship Hospital	Beijing	Beijing	Hongwei Li
Beijing Tongren Hospital	Beijing	Beijing	Changlin Lu
Beijing Daxing Hospital	Beijing	Daxing	Shujun Cao
Beijing Mentougou Hospital	Beijing	Mentougou	Dezhao Wang
Beijing Pinggu Hospital	Beijing	Pinggu	Guanglin Wei
Beijing Yanqing Hospital	Beijing	Yanqing	Jianbing Wang
Shanghai Jiaotong University Ruijin Hospital	Shanghai	Shanghai	Ruiyan Zhang
Shanghai 10th Hospital	Shanghai	Shanghai	Yawei Xu
Shanghai Fengxian Hospital	Shanghai	Fengxian	Zengyong Qiao
Tianjin Medical School General Hospital	Tianjin	Tianjin	Zheng Wan
Tianjin Baodi Hospital	Tianjin	Baodi	Yanjun Cao
Chongqing Medical School 2st Hospital	Chongqing	Chongqing	Yaohui Yin
Haerbin Medical School 1st Affiliated Hospital	Heilongjiang	Harbin	Weiming Li
Qiqihaer 1st Hospital	Heilongjiang	Qiqihar	Shuqing Wang
Tailai Hospital	Heilongjiang	Tailai	Gang Ma
Shuihua 1st Hospital	Heilongjiang	Shuihua	Yongchen Cai
Jilin University 1st Hospital	Jilin	Changchun	Yang Zheng
Tonghua Central Hospital	Jilin	Tonghua	Xuxia Zhang
Huinan County Hospital	Jilin	Huinan	Hongyan Guo
Shenyang Northern Hospital	Liaoning	Shenyang	Xiaozeng Wang
Fushun Central Hospital	Liaoning	Fushun	Ling Sun
Xiuyan County Hospital	Liaoning	Xiuyan	Jianhua Wu
Neimonggu Medical College 1st Affiliated Hospital	Inner Mongolia	Hohhot	Fengying Chen
Chifeng Hospital	Inner Mongolia	Chifeng	Ronghai Man
Aohan Hospital	Inner Mongolia	Aohan	Yanjie Li
Hebei Medcial School 2rd Affiliated Hospital	Hebei	Shijiazhuang	Xianghua Fu
Qinhuangdao 1st Hospital	Hebei	Qinhuangdao	Qingshen Wang
Qinhuangdao 2rd Hospital	Hebei	Changli	Liying Zhang
North-China Oil-administration General Hospital	Hebei	Renqiu	Xiaoli Gao
Changzhou Hospital	Hebei	Changzhou	Yali Hu
Hengshui Hardison Hospital	Hebei	Hengshui	Qun Zheng
Shanxi Cardiovascular Hospital	Shanxi	Taiyuan	Bao Li
Changzhi Hospital	Shanxi	Changzhi	Yuping zhang
Tunliu Hospital	Shanxi	Tunliu	Yaohong Dong
Henan Provincial Hospital	Henan	Zhengzhou	Chuanyu Gao
Linzhou Hospital	Henan	Linzhou	Zhoushun Qin
Changyuan Hospital	Henan	Changyuan	Guorui Hou
Xinxiang Central Hospital	Henan	Xinxiang	Lingling Liu
Yanjin Hospital	Henan	Yanjin	Shifeng Ren
Ye County hospital	Henan	Ye County	Dezhou wang
Pindingshan 2rd Hospital	Henan	Pindingshan	Xianting Luan
Anyang Prefecture Hospital	Henan	Anyang	Hui Liu
Puyang People's Hospital	Henan	Puyang	Liping Ma

Xihua Hospital	Henan	Xihua	Chuntong Wang
Xi'an Jiaotong University 1st Hospital	Shan'xi	Xi'an	Zuyi Yuan
Weinan Central Hospital	Shan'xi	Weinan	Junnong Li
Jiuquan Hospital	Gansu	Jiuquan	Yaofeng Yuan
Jinta Hospital	Gansu	Jinta	Huide Liu
Ningxia Medical College General	Ningxia	Yinchuan	Shaobin jia
Wuzhong Hospital	Ningxia	Wuzhong	Xianghong Luo
Qinghai University Affiliated Hospital	Qinghai	Xining	Yin Liu
Qinhai Cardiovascular Hospital	Qinghai	Xining	Pinfa Liu
Xining 1st Hospital	Qinghai	Xining	Xianning Zhao
Hainan Prefectural Hospital of Qinghai	Qinghai	Gonghe	Bao Ma
Xinjiang Medical College 1st Affiliated	Xinjiang	Urumchi	Yitong Ma
Changji Hospital	Xinjiang	Changji	Mao Wang
Fukang Hospital	Xinjiang	Fukang	Shiming Gao
Urumchi Friendship Hospital	Xinjiang	Urumchi	Hang Lu
Shandong Provincial Hospital	Shandong	Jinan	Lianqun Cui
Taian Central Hospital	Shandong	Taian	Huanyi Zhang
Xintai Hospital	Shandong	Xintai	Hongyan Zhang
Nanjing University Gulou Hospital	Jiangsu	Nanjin	Biao Xu
Jiangsu North Hospital	Jiangsu	Yangzhou	Shenghu He
Xuzhou 1st Central Hospital	Jiangsu	Xuzhou	Qiang Fu
Jiangyan Hospital	Jiangsu	Jiangyan	Shihai Shen
Anhui Provincial Hospital	Anhui	Hefei	Likun Ma
Fuyang Hospital	Anhui	Fuyang	Bin Ning
Taihe Hospital	Anhui	Taihe	Jili Fan
Zhejiang University 2rd Affiliated	Zhejiang	Hangzhou	Yong Sun
Taizhou Enze medical Center	Zhejiang	Taizhou	Lijiang tang
Taizhou Hospital	Zhejiang	Linhai	Danlei Xu
Fujian Medical College Union Hospital	Fujian	Fuzhou	Lianglong Chen
Xiamen Heart Center	Fujian	Xiamen	Yan Wang
Fuqing Hospital	Fujian	Fuqing	Ping chen
Longyan 1st Hospital	Fujian	Longyan	Kaihong Chen
Wuhan Tongji Hospital	Hubei	Wuhan	Daowen wang
Jinzhou 1st Hospital	Hubei	Jinzhou	Shuixian peng
Tianmen 1st Hospital	Hubei	Tianmen	Shuping Wan
Gong'an Hospital	Hubei	Gongan	Laxi Zhang
Central South University Xiangya 2nd	Hunan	Changsha	Shenhua Zhou
Xiangtan Central Hospital	Hunan	Xiangtan	Jianping Zeng
Xiangxiang Hospital	Hunan	Xiangxiang	Chonglun Zhou
Ya'an Hospital	Sichuan	Ya'an	Haibo zhang
Zigong 1st Hospital	Sichuan	Zigong	Dechao Zhong
Danleng County Hospital	Sichuan	Danleng	Yuquan Xiao
Guangxi Medical College 1st Affiliated	Guangxi	Nanning	Lang Li
Beihai Hospital	Guangxi	Beihai	Hai Zhu
Hepu Hospital	Guangxi	Hepu	Meisheng Lai
Nanchang Universuty 2ndAffiliated	Jiangxi	Nanchang	Xiaoshu Cheng
Pingxiang Hospital	Jiangxi	Pingxiang	Junming Ye
Shangli Hospital	Jiangxi	Shangli	Qishou Liu
Guizhou Cardiovascular Hospital	Guizhou	Guiyang	Tianhe Yang
Zhunyi 1st Hospital	Guizhou	Zhunyi	Zhengqiang Yuan
Honghuagang Hospital	Guizhou	Honghuagan	Chengyuan Zhao
Pan County Hospital	Guizhou	Pan	Xianwen Jiang
Guangdong Provincial Hospital	Guangdong	Guangzhou	Jiyan Chen
Guangzhou Traditional Chinese	Guangdong	Guangzhou	Wei Wu
Jiangmen Hospital	Guangdong	Jiangmen	Gaoxing Zhang

Heshan Hospital	Guangdong	Heshan	Haiyuan Mai
Kunming Medical College 1st Affiliated	Yunnan	Kunming	Tao Guo
Yunnan St. John's Hospital	Yunnan	Kunming	Yi Li
Chuxiong People's Hosptal	Yunnan	Chuxiong	Xiaoming Liu
Yao'an Hospital	Yunnan	Yao'an	Jinlong Xu
Tibet People's Hospital	Tibet	Lahsa	Gesang Luobu
Hainan Provincial Hospital	Hainan	Haikou	Bin Li
Sanya Hospital	Hainan	Sanya	Tiansong Wang
Wenchang Hospital	Hainan	Wenchang	Dong Wang

Table S1. Associated factors with in-Hospital death of STEMI patients.

Factors	Adjusted OR* (95% CI)	*P* Value
Unmarried (vs. Married)	0.998 (0.723,1.378)	0.9919
Age	1.025 (1.017,1.034)	<.0001
Male (vs. Female)	0.755 (0.614,0.929)	0.0080
Rural insurance (vs. Urban insurance)	1.460 (1.195,1.783)	0.0002
Self-paid (vs. Urban insurance)	1.003 (0.663,1.518)	0.9884
College education	0.967 (0.635,1.473)	0.8762
Living alone	0.831 (0.490,1.411)	0.4931
BMI＞25	0.723 (0.584,0.896)	0.0030
Current smoker	0.690 (0.551,0.864)	0.0012
Diabetes	1.197 (0.949,1.509)	0.1296
Chronic kidney disease	1.437 (0.674,3.062)	0.3476
Prior myocardial infarction	0.780 (0.522,1.164)	0.2235
Prior heart failure	1.104 (0.653,1.865)	0.7126
Prior stroke	1.246 (0.956,1.625)	0.1035
Onset-to-arrival time		
3-6h (vs. ≤3 h)	0.938 (0.700,1.257)	0.6679
6-12h (vs. ≤3 h)	1.236 (0.902,1.692)	0.1870
>12h (vs. ≤3 h)	1.160 (0.871,1.546)	0.3108
Means of transport		
Ambulance (vs. In-hospital)	0.740 (0.362,1.515)	0.4108
Self or family (vs. In-hospital)	0.482 (0.199,1.165)	0.1050
Transferred (vs. In-hospital)	0.554 (0.274,1.119)	0.0996
Heart failure on admission	2.100 (1.705,2.585)	<.0001
Cardiogenic shock on admission	5.796 (4.431,7.582)	<.0001
Cardiac arrest on admission	2.487 (1.457,4.245)	0.0008
Overdose DAPT	0.965 (0.780,1.194)	0.7425
No reperfusion	2.919 (2.269,3.753)	<.0001

Missing qualitative variables were imputed by the highest frequency count, and missing quantitative variables were imputed by the mean value.

Table S2. Associated factors with in-Hospital death of NSTEMI patients.

Factors	Adjusted OR* (95% CI)	P Value
Unmarried (vs. Married)	0.857 (0.499,1.471)	0.5749
Age	1.031 (1.015,1.048)	0.0002
Male (vs. Female)	0.795 (0.552,1.144)	0.2162
Rural insurance (vs. Urban insurance)	1.496 (1.050,2.133)	0.0259
Self-paid (vs. Urban insurance)	1.414 (0.709,2.821)	0.3249
College education	1.028 (0.458,2.304)	0.9470
Living alone	1.041 (0.429,2.524)	0.9297
BMI > 25	0.848 (0.581,1.239)	0.3947
Current smoker	0.658 (0.414,1.044)	0.0758
Diabetes	1.027 (0.700,1.508)	0.8901
Chronic kidney disease	0.796 (0.326,1.942)	0.6155
Prior myocardial infarction	1.117 (0.682,1.831)	0.6598
Prior heart failure	1.460 (0.854,2.496)	0.1667
Prior stroke	0.855 (0.515,1.421)	0.5462
Onset-to-arrival time		
3-6h (vs. ≤3 h)	1.323 (0.705,2.484)	0.3829
6-12h (vs. ≤3 h)	2.342 (1.256,4.365)	0.0074
>12h (vs. ≤3 h)	1.497 (0.872,2.569)	0.1432
Means of transport		
Ambulance (vs. In-hospital)	0.539 (0.227,1.283)	0.1623
Self or family (vs. In-hospital)	0.806 (0.320,2.035)	0.6486
Transferred (vs. In-hospital)	0.496 (0.217,1.130)	0.0951
Heart failure on admission	1.598 (1.102,2.316)	0.0134
Cardiogenic shock on admission	5.659 (3.186,10.051)	<.0001
Cardiac arrest on admission	3.341 (1.021,10.935)	0.0462
Overdose DAPT	0.746 (0.535,1.039)	0.0833
No reperfusion	3.536 (2.181,5.733)	<.0001

Missing qualitative variables were imputed by the highest frequency count, and missing quantitative variables were imputed by the mean value.

Table S3. Adverse events, in hospital and at 24 months in Acute Myocardial Infarction Patients Stratified by Marital subtype.

	Total (n=19912)	Married (n=18702)	Widowed (n=963)	Divorced (n=131)	Never married (n=116)	P Value
Adverse events in hospital						
Death (%)	714/19912 (3.6%)	627/18702 (3.4%)	75/963 (7.8%)	4/131 (3.1%)	8/116 (6.9%)	<0.0001
Adverse events at 24 months						
All-cause mortality	2087/19244 (10.8%)	1800/18058 (10.0%)	254/944 (26.9%)	15/128 (11.7%)	18/114 (15.8%)	<0.0001
MACCEs	2633/19193 (13.7%)	2302/18010 (12.8%)	291/941 (30.9%)	21/128 (16.4%)	19/114 (16.7%)	<0.0001

Figure S1. Comparative adjusted hazard ratios of all-cause death between unmarried and married groups for each subgroup in the STEMI population.

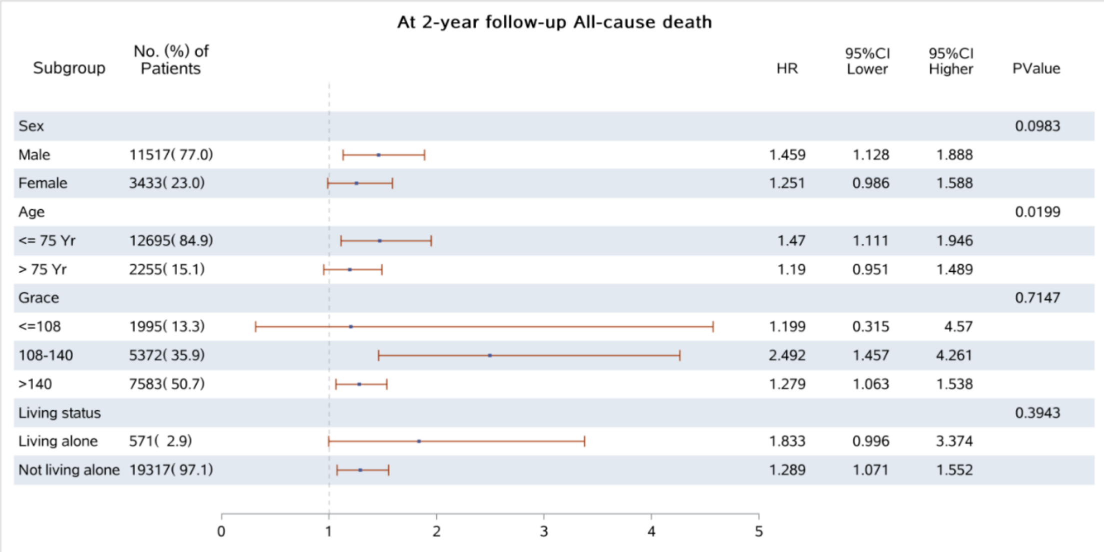

Figure S2. Comparative adjusted hazard ratios of all-cause death between unmarried and married groups for each subgroup in the NSTEMI population.