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ORIGINAL RESEARCH

Impact of Race on the In-Hospital Quality of Care Among Young Adults With Acute Myocardial Infarction

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BACKGROUND: The extent to which race influences in-hospital quality of care for young adults (≤55 years) with acute myocardial infarction (AMI) is largely unknown. We examined racial disparities in in-hospital quality of AMI care and their impact on 1-year cardiac readmission.

METHODS AND RESULTS: We used data from the VIRGO (Variation in Recovery: Role of Gender on Outcomes of Young AMI Patients) study enrolling young Black and White US adults with AMI (2008–2012). An in-hospital quality of care score (QCS) was computed (standard AMI quality indicators divided by the total a patient is eligible for). Multivariable logistic regression was performed to identify factors associated with the lowest QCS tertile, including interactions between race and social determinants of health. Among 2846 young adults with AMI (median 48 years [interquartile range 44–52], 67.4% women, 18.8% Black race), Black individuals, especially women, exhibited a higher prevalence of cardiac risk factors and social determinants of health and were more likely to experience a non–ST-segment–elevation myocardial infarction than White individuals. Black individuals were more likely in the lowest QCS tertile than White individuals (40.8% versus 34.7%; P=0.003). The association between Black race and low QCS (odds ratio [OR], 1.25; 95% CI, 1.02–1.54) was attenuated by adjustment for confounders. Employment was independently associated with better QCS, especially among Black participants (OR, 0.76; 95% CI, 0.62–0.92; $P\text{-}_{interaction}$=0.02). Black individuals experienced a higher rate of 1-year cardiac readmission (29.9% versus 20.0%; P<0.0001).

CONCLUSIONS: Black individuals with AMI received lower in-hospital quality of care and exhibited a higher rate of cardiac readmissions than White individuals. Black individuals had a lower quality of care if unemployed, highlighting the intersection of race and social determinants of health.

Key Words: acute myocardial infarction ■ health disparities ■ in-hospital quality of care ■ race ■ social determinants of health

Racial disparities in life expectancy in the United States are largely explained by cardiovascular disease.[1] Black individuals have a greater incidence of acute myocardial infarction (AMI) than White individuals, regardless of sex and age.[2] In addition, Black individuals with AMI also have higher rates of long-term mortality[3–7] and readmission,[8,9] with young Black women faring worse than young men and White women.[3,10–12]

The greater prevalence of traditional cardiovascular risk factors such as diabetes mellitus and hypertension among Black individuals with AMI only partially explains racial differences in cardiac outcomes.[7,13–15] Adverse social determinants of health (SDOH) in Black

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CLINICAL PERSPECTIVE

What Is New?

- Black individuals with acute myocardial infarction received lower in-hospital quality of care and exhibited a higher rate of cardiac readmission than White individuals did.
- Black individuals had a lower quality of care if unemployed, highlighting the intersection of race and social determinants of health.

What Are the Clinical Implications?

- Suboptimal in-hospital quality of acute myocardial infarction care is of immediate concern among young Black individuals, especially Black women.
- Beyond addressing traditional cardiovascular risk factors, social interventions such as facilitation of employment might mitigate racial disparities in the quality of acute myocardial infarction care and improve cardiovascular outcomes in young Black adults.

Nonstandard Abbreviations and Acronyms

QCS	quality of care score
SDOH	social determinants of health
VIRGO	Variation in Recovery: Role of Gender on Outcomes of Young AMI Patients

individuals are compounded by limited access to various resources including high-quality health care.[1] Therefore, race as a social construct likely affects access to high-quality care.[1,4,7,15] In prior studies that evaluated in-hospital quality of AMI care, higher quality of care received was associated with lower 30-day and 1-year mortality.[16–20] However, quality of AMI care in young Black individuals has not been explored in relation to AMI outcomes because most studies have focused on older adults, without reporting any race-disaggregated data.[16–20] Furthermore, the intersection between race and sex (biological variable) or gender (social construct) is rarely addressed, yet adverse SDOH may affect quality of AMI care and outcomes differently across races.

To address this gap in knowledge, our aims were to examine racial disparities within in-hospital quality of AMI care and whether they are associated with SDOH. In addition, we assessed the impact of low in-hospital quality of care on 1-year cardiac readmissions. We hypothesized that Black young adults, especially Black women, receive lower in-hospital quality of care and experience higher rates of cardiac readmissions relative to their White counterparts. In addition, we hypothesize that SDOH will be associated differentially by race with in-hospital quality of care.

METHODS

The authors declare that all supporting data are available within the article.

Participants and Study Design

We conducted an analysis of the VIRGO (Variation in Recovery: Role of Gender on Outcomes of Young AMI Patients) study. Details about the design of the VIRGO study have been previously described.[21] In brief, VIRGO was a prospective, multicenter, observational cohort study designed to investigate the demographic, clinical, psychosocial, biological, and behavioral factors associated with worse outcomes in young patients with AMI.[22] Between August 2008 and May 2012, patients aged 18 to 55 years were recruited into VIRGO from 103 US hospitals. Participants were recruited using a 2:1 female-to-male ratio to increase the proportion of young women in the sample. We included only young adults with AMI from the United States who self-reported as Black or White race, and excluded patients who self-reported as American Indian, Alaska Native, Asian, Pacific Islander, East Indian, or of another or unknown race (n=139).

In order to be eligible, participants were required to have increased cardiac biomarkers indicative of myocardial necrosis (with at least 1 cardiac biomarker above the 99th percentile of the upper reference limit) within 24 hours of admission. Evidence of acute myocardial ischemia was also required, including at least 1 of the following: symptoms of ischemia, ECG changes indicative of new ischemia, or imaging evidence of infarction. Participants were excluded from the study if they had elevated cardiac markers as a complication of elective coronary revascularization or physical trauma, were previously enrolled in VIRGO, did not speak English, were unable to provide informed consent or to be contacted for follow-up, or were currently a prisoner.[21] Institutional review board approval was obtained at each participating institution and individuals provided informed consent for their study participation.

Clinical Characteristics and SDOH

Baseline information, including patients' demographics, cardiac risk factors, comorbidities, and SDOH

were obtained both from medical records and from standardized in-person interviews administered by trained personnel during the index AMI admission. At baseline, race was self-reported by the patient, selecting among 2 racial categories defined as White/Caucasian or Black/African American.

Baseline cardiac risk factors and comorbidities included the following: obesity (ie, body mass index ≥30 kg/m^2), hypertension, diabetes mellitus, dyslipidemia, current smoking, family history of cardiovascular disease, physical activity, prior AMI, history of renal disease, history of depression (ie, before the index AMI), and alcohol use. Self-reported physical activity was measured with the Behavioral Risk Factor Surveillance Survey physical activity instrument, which has high reliability and validity among young adults.[23] Information was also collected on disease severity (ie, type of AMI: non–ST-segment–elevation myocardial infarction or ST-segment–elevation myocardial infarction [STEMI]).

SDOH, as a gendered social construct, was collected by self-report at baseline and included socioeconomic status, current employment, number of work hours per week, marital status, household primary earner status, burden of stress, support for household chores, and social support. Low socioeconomic status was defined combining education (ie, less than high school) or the 2 lowest categories of personal income (ie, ≤30 000 USD). Social support was measured using the ENRICHD Social Support Instrument, a reliable and valid measurement in individuals after AMI.[24,25] Low social support was defined as a score ≤3 on at least 2 items of the ENRICHD Social Support Instrument and a total ENRICHD Social Support Instrument score of ≤18.[26]

Quality of Care Indicators

Guided by American College of Cardiology/American Heart Association recommendations regarding the standard of AMI care, quality of care indicators for in-hospital AMI care were selected[27–31] including reperfusion benchmarks, in-hospital evaluations, and predischarge recommended counseling.

Based on prior published research, we calculated an opportunity-based in-hospital quality of care score (QCS), defined by dividing the total number of in-hospital quality indicators of care received (numerator) by the total number that the patient was eligible for (denominator). The in-hospital QCS ranges from 0 to 100%, with higher scores indicating better quality of care received. [16–20] The in-hospital QCS outcome was further stratified into tertiles of in-hospital quality of care: low, intermediate, and high quality of care as previously reported.[17]

Cardiac Readmission Adjudication

Cardiac readmissions were identified during the 1-year follow-up period. The research coordinator at each site collected readmission records within their hospital network, and participants also reported any readmissions during this period. Next, each of the self-reported events and hospital records were compared by the Yale Coordinating Center. Adjudication for each readmission was completed by 5 physicians and an advanced practice registered nurse at Yale University after receiving extensive training using a custom-developed REDCap external module.

Statistical Analysis

We compared baseline characteristics, cardiac risk factors and comorbidities, disease severity, SDOH, and quality of care indicators by race (Black versus White individuals) using a χ^2 Test of Homogeneity for dichotomous variables and Student *t* tests for continuous variables. We also compared 1-year cardiac readmission rates across QCS tertiles[17] between racial groups using the χ^2 Test of Homogeneity. The missingness was assumed to be missing-at-random (Tables S1 and S2); nevertheless, the modeling was performed both with and without the imputation of missing values and we reported the complete case analysis because the results were similar.

Univariate and multivariable analyses were performed using logistic regression models. Unadjusted univariate models were used to study the association between race, sex, age, cardiac risk factors, comorbidities, disease severity, and SDOH and the likelihood of receiving in-hospital QCS in the lowest tertile. Covariates for the multivariable models were selected using a combination of clinical judgment and statistical parameters from the univariate analysis (Table S3).

The independent association between several covariates and the likelihood of receiving in-hospital QCS in the lowest tertile was assessed in a multivariable analysis using 3 models, adding domains sequentially based on the statistical significance at the univariate analysis stage. Model 1 included age, race, and sex. Model 2 included age, race, sex, hypertension, diabetes mellitus, dyslipidemia, current smoking, and physical activity, prior AMI, history of renal disease, history of depression, and AMI severity. Model 3 included any additional SDOH that were statistically significant in the univariate analysis. Results from the multivariable analysis are presented as odds ratio (OR) of in-hospital QCS in the lowest tertile compared with other tertiles associated with each covariate and its 95% CI. We also tested the 2-way interactions between race and any SDOH that were associated with low QCS using the Wald's χ^2

test. All statistical analyses were conducted using SAS version 9.4 (SAS Institute), with 2-tailed tests for statistical significance and P=0.05.

RESULTS

Baseline Characteristics

Among a total of 2846 patients included in the analysis, the median age was 48 years (interquartile range, 44–52), 67.4% were female, and 18.8% were Black individuals. Compared with White participants, Black participants were more likely to be younger, female, with a higher burden of cardiovascular risk factors (eg, obesity, hypertension, and diabetes mellitus), and were less physically active (Table 1). Moreover, Black adults were more likely to have had a prior AMI, a history of renal disease, and to have had a non–ST-segment–elevation myocardial infarction. Black adults were also more socially vulnerable; they had a lower socioeconomic status, were less likely to be currently employed, married or living with a partner, and less likely to be the primary earner of the household. They were also less likely to receive support for household chores and received lower levels of social support than their White counterparts. Of note, Black women displayed the worst burden of cardiovascular risk factors and comorbidities, and of adverse SDOH compared with their White and male counterparts (Table S4).

Race and In-Hospital Quality of Care

The lowest QCS tertile included individuals who received an in-hospital QCS lower than 63.0%, representing 35.9% of individuals in the study. The intermediate QCS tertile included individuals who received an in-hospital QCS between 65.0% and 80.0%, representing 37.2% of individuals. Lastly, the highest QCS tertile included individuals who received an in-hospital QCS >80.0%, representing 27.0% of individuals.

Black individuals were more likely to receive an in-hospital care in the lowest QCS tertile (40.8% versus 34.7%, P=0.003) (Table 2). When examining the proportions of Black individuals and White individuals receiving individual quality of care indicators, Black individuals were less likely at discharge to receive cardiac rehabilitation counseling (33.9% versus 49.3%; P<0.0001) and dual antiplatelet therapy (62.6% versus 67.2%; P=0.04).

When examining in-hospital care by race and sex, Black men were more likely to be in the lowest QCS tertile than either Black women, White women, or White men (41.8%, 40.6%, 36.7%, 31.1%, respectively, Table S4).

When examining baseline characteristics stratified by in-hospital QCS tertile (Table S5), our results demonstrate that individuals in the lowest QCS tertile were more likely to suffer from a non–ST-segment–elevation myocardial infarction and to present with cardiac risk factors and comorbidities, including hypertension and a history of renal disease. They were also less likely to be currently employed than individuals in the intermediate and high QCS tertiles.

Table 1. Baseline Characteristics of Young Adults with AMI Stratified by Race

	White (N=2312)	Black (N=534)	*P* Value
Sociodemographics			
Age, y, mean±SD	47.4 ± 6.0	46.1 ± 6.9	<0.0001
Sex			
Female	1491 (64.5)	426 (79.8)	<0.0001
Male	821 (35.5)	108 (20.2)	
Cardiac risk factors			
Obesity	1193 (51.7)	333 (62.4)	<0.0001
Hypertension	1446 (62.5)	439 (82.2)	<0.0001
Diabetes mellitus	774 (33.5)	234 (43.8)	<0.0001
Dyslipidemia	2009 (86.9)	451 (84.5)	0.14
Current smoking	663 (28.7)	166 (31.1)	0.27
Family history of CVD	1597 (69.3)	316 (59.3)	<0.0001
Physically active	1559 (67.4)	283 (53.0)	<0.0001
Comorbidities/medical history			
Prior AMI	462 (20.0)	152 (28.5)	<0.0001
History of renal disease	250 (10.9)	74 (13.9)	0.04
Alcohol abuse	825 (35.7)	159 (29.8)	0.01
History of depression	1021 (44.2)	164 (30.7)	<0.0001
Disease severity			
AMI type			
STEMI	1206 (52.2)	212 (39.7)	<0.0001
NSTEMI	1106 (47.8)	322 (60.3)	
Social determinants of health			
Low SES	896 (39.9)	317 (62.3)	<0.0001
Current employment	1474 (63.8)	267 (50.0)	<0.0001
Number of work hours per wk, mean±SD	42.0 ± 13.6	40.1 ± 14.6	0.03
Married or living with a partner	1389 (60.1)	186 (34.8)	<0.0001
Primary earner	1753 (75.9)	358 (67.0)	<0.0001
High burden of stress	1167 (50.9)	236 (45.2)	0.02
Support for household chores	1502 (65.6)	313 (60.2)	0.02
Low social support†, mean±SD	28.3 ± 5.7	27.4 ± 5.9	0.0007

AMI indicates acute myocardial infarction; CVD, cardiovascular disease; NSTEMI, non–ST-segment–elevation myocardial infarction; SES, socioeconomic status; and STEMI, ST-segment–elevation myocardial infarction.

†The variable low social support is represented by the ENRICHD Social Support Instrument score, with lower scores indicating lower social support received.

Table 2. In-hospital Quality of Care Indicators for Young Adults with AMI Stratified by Race

	White (N=2312)	Black (N=534)	*P* Value
In-hospital QCS tertiles			
≤63%	706 (34.7)	194 (40.8)	0.003
64–80%	751 (36.9)	181 (38.1)	
>80%	577 (28.4)	100 (21.1)	
In-hospital quality indicators			
Young adults with STEMI			
Any reperfusion therapy	1030 (86.3)	178 (84.8)	0.56
Door-to-balloon exceed benchmark	414 (46.2)	65 (43.1)	0.48
Door-to-needle exceed benchmark	54 (50.5)	7 (70.0)	0.24
Young adults with NSTEMI			
Any reperfusion therapy	786 (74.9)	254 (82.7)	0.07
All young adults with AMI			
Stress test in conservatively treated individuals	14 (0.6)	2 (0.4)	0.52
Echocardiogram predischarge	1551 (67.3)	393 (73.9)	0.003
Cardiac rehabilitation counseling	1139 (49.3)	181 (33.9)	<0.0001
Smoking cessation counseling	1547 (66.9)	346 (64.8)	0.35
Diet counseling	2120 (91.7)	487 (91.2)	0.71
Aspirin at discharge	2164 (93.6)	495 (92.7)	0.45
P2Y12 receptor antagonist at discharge	1620 (70.1)	351 (65.7)	0.05
DAPT at discharge	1554 (67.2)	334 62.6)	0.04
Statins at discharge	2127 (92.0)	495 (92.7)	0.59
Beta-blockers at discharge	2117 (91.6)	476 (89.1)	0.08

AMI indicates acute myocardial infarction; DAPT, dual antiplatelet therapy; NSTEMI, non–ST-segment–elevation myocardial infarction; QCS, quality of care score; and STEMI, ST-segment–elevation myocardial infarction.

Factors Associated With Low In-Hospital QCS

Results from univariate analyses revealed that Black participants had a 30% greater odds of being in the lowest QCS tertile than White participants (Table S3). Female sex was also associated with greater odds of being in the lowest QCS tertile. In addition, comorbidities and cardiac risk factors including hypertension, diabetes mellitus, and current smoking, were associated with lower quality of AMI care. Among the SDOH examined, current employment was the only factor significantly associated with quality of care; it displayed a strong protective relationship with receiving better in-hospital quality of care.

The ORs of receiving in-hospital care in the lowest QCS tertile in the 3 adjusted multivariate models are displayed in Table 3. In model 1 with sex, race, and age as covariates, Black race (OR, 1.25; 95% CI, 1.02–1.54), and female sex (OR, 1.23; 95% CI, 1.03–1.47) were each associated with greater odds of receiving the lowest in-hospital QCS tertile. However, adjustments for cardiac risk factors, comorbidities, disease severity, and employment attenuated the effects of race (OR, 0.97; 95% CI, 0.77–1.22). Of all the SDOH tested for interaction with race, only employment moderated the effect of race on quality of care ($P_{\text{-interaction}}$=0.02). Specifically, Black unemployed individuals were more likely to receive a low in-hospital QCS, while employed Black individuals and White individuals, regardless of their employment status, were less likely to receive a low in-hospital QCS.

Individuals who experienced a cardiac readmission were more likely to be in the lowest in-hospital QCS tertile (41.0% versus 34.4%; *P*=0.01). Black individuals experienced higher rates of 1-year cardiac readmissions than their White counterparts (29.9% versus 20.0%; *P*<0.0001).

DISCUSSION

We have demonstrated significant racial disparities within the in-hospital quality of care among young adults with AMI. Young Black individuals received the lowest quality of care, especially Black women, and experienced a higher rate of 1-year cardiac readmission. Nevertheless, the association of Black race with the likelihood of receiving poor in-hospital quality of care was attenuated after adjustment for individual

Table 3. Multivariate Model Showing Factors Associated With Having an In-hospital Quality of Care Score in the Lowest Tertile Among Young Adults with AMI

	Model 1	Model 2	Model 3
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Sociodemographics			
Black race	1.25 (1.02–1.54)	0.99 (0.78–1.25)	0.97 (0.77–1.22)
Age, y	1.00 (0.98–1.01)	0.99 (0.97–1.00)	0.99 (0.97–1.00)
Female sex	1.23 (1.03–1.47)	0.97 (0.79–1.19)	0.94 (0.77–1.16)
Cardiac risk factors			
Hypertension		1.17 (0.95–1.45)	1.16 (0.94–1.43)
Diabetes mellitus		1.04 (0.85–1.26)	1.01 (0.83–1.24)
Dyslipidemia		0.72 (0.55–0.94)	0.71 (0.54–0.93)
Current smoking		1.22 (1.00–1.49)	1.28 (1.04–1.56)
Physically active		0.92 (0.76–1.11)	0.95 (0.78–1.14)
Comorbidities/medical history			
Prior AMI		1.15 (0.92–1.44)	1.11 (0.89–1.40)
History of renal disease		1.31 (0.99–1.73)	1.26 (0.95–1.67)
History of depression		1.10 (0.91–1.33)	1.06 (0.88–1.29)
Disease severity			
STEMI (vs NSTEMI as reference)		0.16 (0.13–0.19)	0.16 (0.13–0.19)
Social determinants of health			
Current employment			0.76 (0.62–0.92)†

AMI indicates acute myocardial infarction; NSTEMI, non–ST-segment–elevation myocardial infarction; OR, odds ratio; and STEMI, ST-segment–elevation myocardial infarction.

†$P_{interaction}$=0.02 for race*employment.

clinical characteristics and SDOH, namely, employment, highlighting that the intersection between race and clinical and/or social risk factor profiles largely explains the association between race and in-hospital quality of AMI care. Notably, being employed had a significant protective effect against receiving lower-quality in-hospital AMI care, predominantly among Black individuals.

Black adults with AMI received fewer recommended high-quality interventions in their in-hospital care. Cardiac rehabilitation counseling and secondary prevention strategies, including dual antiplatelet therapy at discharge, are the most evident omissions in the care of young Black adults with AMI. Contrary to prior work, we did not find any disparity in terms of reperfusion therapy,[10,14,32–35] although regardless of race, the high proportion of patients exceeding benchmarks of reperfusion is of immediate concern in this cohort of young patients.

Our findings also provide insights on the reasons behind suboptimal AMI care received by young Black adults. In line with previous findings, Black individuals with AMI, particularly young Black women, exhibit a more adverse cardiac risk factor profile and are more socially vulnerable than White individuals, likely contributing to their adverse cardiovascular outcomes.[4,5,7,13–15] These findings suggest that race is a social construct and adverse SDOH intersect with race to moderate observed racial disparities, rather than a construct based on genetics or biological characteristics.[1] The high burden of cardiovascular risk factors in Black individuals, especially Black women, compounded by a cluster of vulnerable SDOH, appeared to play a major role in determining quality of care.

Specifically, we found that employment played a significant role in affecting the in-hospital quality of AMI care received by Black individuals. In a multipayer healthcare system such as in the United States, the significance of employment status is particularly tied to one's ability to purchase private health insurance coverage. In fact, a 20-year National Health Interview Survey Analysis revealed that Black individuals are more likely to be uninsured and to forego or delay medical care because of cost than White individuals.[36] Uninsurance rates have fallen since the implementation of the Affordable Care Act expansion in 2014, yet significant disparities remain; the US Census Bureau reports that in 2019, 9.6% of Black individuals were uninsured compared with 5.2% of non-Hispanic White individuals.[37] Therefore, addressing employment status may in turn provide individuals with private health insurance and improve access to high-quality health care. In addition to enabling access to private health insurance coverage, prior work has demonstrated

significant associations between employment status and cardiovascular health outcomes.[38] Findings from the Atherosclerosis Risk in Communities Study enrolling 16 000 adults from 4 US communities revealed that women employed outside of the home had a decreased risk of coronary heart disease and stroke compared with homemakers.[39] Moreover, unemployment status, cumulative number of job losses, and cumulative time unemployed were each independently associated with increased risk of AMI of similar magnitude to that of other traditional cardiovascular risk factors among adults in the United States.[40] Beyond access to health insurance, the underlying mechanism of the association between employment and cardiovascular outcomes needs to be further explored.

Nevertheless, these findings have meaningful public health implications. The intersection between SDOH and AMI care disparities with race is likely rooted in structural racism that results in uneven access to good-paying jobs, higher incomes, health insurance, and quality medical care. Structural racism, favoring White Americans and devaluing minorities, in particular, Black individuals,[41] has been identified as an impediment to healthcare equity. Promoting optimal health in marginalized groups and reducing health disparities require restructuring systems to improve conditions that affect health in workplaces, neighborhoods, and schools.[42] Addressing current employment in future interventions may represent a strategy to reduce healthcare quality gaps and improve cardiovascular health outcomes among at-risk groups such as young Black adults with AMI. Moreover, despite the Affordable Care Act having increased access to health insurance for historically underserved groups, scalable interventions to target prevention and treatment efforts at the healthcare system level must be implemented even when insurance is available. Improving access to person-focused primary care, diversifying the healthcare workforce, and addressing structural competence among healthcare providers have been proposed as strategies to reduce racial health disparities.[42] Future research should focus on advancing knowledge about the impact of structural racism on health outcomes as well as effective interventions to mitigate these adverse effects.

Additionally, this study reflects a widespread gap within in-hospital quality of care for young adults with AMI that can significantly impact this population's health outcomes: >30% of individuals, regardless of race, missed at least one third of quality of care indicators, and thus were more likely to experience 1-year cardiac readmissions. Therefore, increased awareness about in-hospital quality of care indicators may benefit all sex–race subgroups of young adults with AMI. In the interest of improving young adults' in-hospital quality of AMI care, particular attention should be paid to the quality of care indicators with the lowest attainment rates: door-to-balloon and door-to-needle time benchmarks for individuals with STEMI, and cardiac rehabilitation counseling.

LIMITATIONS

These findings should be interpreted in light of potential limitations. First, this study analyzed individuals who were exclusively treated in the United States; thus its external validity may be limited for populations receiving care in other countries. Second, the study possesses a modest sample of Black young adults. Nonetheless, by using the largest prospective cohort to date of young adults with AMI conducted in the United States, we have provided a comprehensive overview of the associations of SDOH and race with in-hospital quality of AMI care and 1-year cardiac readmissions for Black and White young adults. Finally, our study findings are dependent on the accuracy and completeness of the patient's self-reporting questionnaire, and of the patient interview. Although the fact that our complete case analysis yielded results similar to that with imputations is reassuring.

CONCLUSIONS

Black young adults with AMI, particularly Black women, received lower in-hospital quality of care than White adults and exhibited higher rates of 1-year cardiac readmissions. Black adults exhibited a higher burden of cardiovascular risk factors and a vulnerable social phenotype that attenuated the observed racial disparity within in-hospital quality of AMI care. Employment status played a significant role in moderating in-hospital quality of AMI care among Black individuals who had a lower quality of care if unemployed. Our findings highlight the intersection of race and SDOH and suggest that social interventions such as facilitation of employment or providing unemployment insurance might mitigate racial disparities in the quality of care of young adults with AMI, and improve cardiovascular outcomes in Black young adults.

ARTICLE INFORMATION

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Disclosure

None.

Supplementary Material

Table S1-S5

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SUPPLEMENTAL MATERIAL

Table S1. Missing Values for the Baseline Variables used in the Analysis*

	Overall Missing	White Missing	Black Missing
Socio-demographics			
Age	0 (0)	0 (0)	0 (0)
Sex			
Female	0 (0)	0 (0)	0 (0)
Male			
Cardiac risk factors			
Obesity	2 (0.1)	2 (0.1)	0 (0)
Hypertension	0 (0)	0 (0)	0 (0)
Diabetes	0 (0)	0 (0)	0 (0)
Dyslipidemia	0 (0)	0 (0)	0 (0)
Current smoking	0 (0)	0 (0)	0 (0)
Family history of CVD	10 (0.4)	9 (0.4)	1 (0.2)
Physically active	0 (0)	0 (0)	0 (0)
Comorbidities/Medical history			
Prior AMI	0 (0)	0 (0)	0 (0)
History of renal disease	10 (0.4)	7 (0.3)	3 (0.6)
Alcohol abuse	0 (0)	0 (0)	0 (0)
History of depression	1 (0.04)	1 (0.04)	0 (0)
Disease severity			
AMI type			
STEMI	0 (0)	0 (0)	0 (0)
NSTEMI			
Social determinants of health			
Low SES	93 (3.3)	68 (2.9)	25 (4.7)
Current employment	0 (0)	0 (0)	0 (0)
Number of work hours per week	23 (1.3)	21 (1.4)	2 (0.7)
Married or living with a partner	0 (0)	0 (0)	0 (0)
Primary earner	3 (0.1)	3 (0.1)	0 (0)
High burden of stress	33 (1.2)	21 (0.9)	12 (2.2)
Support for household chores	35 (1.2)	21 (0.9)	14 (2.6)
Low social support	57 (2.0)	39 (1.7)	18 (3.4)

*Data are presented as number of participants with the missing value (% of the overall, white individuals and black individuals).

†CVD= Cardiovascular disease; AMI=Acute myocardial infarction; STEMI=ST-Elevation myocardial infarction; NSTEMI=Non-ST elevation myocardial infarction; SES=Socioeconomic status.

Table S2. Missing Values for the Quality of Care Indicators*

	Overall Missing	White Missing	Black Missing
In-hospital QCS tertiles			
≤63%	337 (11.8)	278 (12.0)	59 (11.0)
64-80%			
>80%			
In-hospital quality indicators			
Young adults with STEMI			
Any reperfusion therapy	14 (1.0)	12 (1.0)	2 (0.9)
Door-to-balloon exceed benchmark	117 (10.7)	94 (10.2)	23 (13.8)
Door-to-needle exceed benchmark	3 (2.5)	2 (1.9)	1 (9.1)
Young adults with NSTEMI			
Any reperfusion therapy	70 (5.0)	55 (5.0)	15 (4.7)
All young adults with AMI			
Stress test in conservatively treated individuals	0 (0)	0 (0)	0 (0)
Echocardiogram pre-discharge	9 (0.3)	7 (0.3)	2 (0.4)
Cardiac rehabilitation counseling	0 (0)	0 (0)	0 (0)
Smoking cessation counseling	0 (0)	0 (0)	0 (0)
Diet counseling	0 (0)	0 (0)	0 (0)
Aspirin at discharge	0 (0)	0 (0)	0 (0)
P2Y12 receptor antagonist at discharge	0 (0)	0 (0)	0 (0)
DAPT at discharge	0 (0)	0 (0)	0 (0)
Statins at discharge	0 (0)	0 (0)	0 (0)
Beta-blockers at discharge	0 (0)	0 (0)	0 (0)

*Data are presented as number of participants with the missing value (% of the overall, white individuals and black individuals).
QCS=Quality of Care Score; STEMI=ST-Elevation myocardial infarction; NSTEMI=Non-ST elevation myocardial infarction; AMI=Acute myocardial infarction; DAPT=Dual antiplatelet therapy.

Table S3. Odds Ratios for Having an In-hospital Quality of Care Score in the Lowest Tertile among Young Adults with AMI.

Characteristic	Univariate Analysis	
	Odds Ratio (95% Confidence Interval)	**P-value**
Socio-demographics		
Female Sex (vs. Male as reference)	1.27 (1.06, 1.51)	0.01
Age	1.00 (0.98, 1.01)	0.42
Black (vs. White as reference)	1.30 (1.06, 1.60)	0.01
Cardiac risk factors		
Obesity	0.98 (0.83, 1.16)	0.83
Hypertension	1.36 (1.14, 1.62)	0.0006
Diabetes	1.22 (1.03, 1.44)	0.02
Dyslipidemia	0.77 (0.61, 0.97)	0.03
Current smoking	1.37 (1.15, 1.64)	0.0005
Family history of CVD	0.89 (0.75, 1.06)	0.19
At least 1 CVD risk factor	1.17 (0.58, 2.34)	0.66
Physically active	0.81 (0.69, 0.96)	0.02
Comorbidities/Medical history		
Prior AMI	1.30 (1.07, 1.58)	0.01
History of renal disease	1.45 (1.13, 1.86)	0.004
Alcohol abuse	0.87 (0.73, 1.04)	0.12
History of depression	1.21 (1.03, 1.43)	0.02
Disease severity		
STEMI (vs. NSTEMI as reference)	0.15 (0.12, 0.18)	<0.0001
Social determinants of health		
Low SES	1.08 (0.91, 1.27)	0.38
Current employment	0.68 (0.57, 0.80)	<0.0001
Number of work hours	1.01 (1.00, 1.01)	0.23
Married or living with a partner	1.02 (0.86, 1.20)	0.84
Primary earner status	1.01 (0.84, 1.21)	0.95
High burden of stress	1.06 (0.90, 1.24)	0.52
Household chores support	1.17 (0.98, 1.39)	0.08
Low social support	0.97 (0.79, 1.18)	0.74

*CVD=Cardiovascular disease; STEMI=ST-Elevation myocardial infarction; NSTEMI=Non-ST elevation myocardial infarction; AMI=Acute myocardial infarction; SES=Socioeconomic status.

Table S4. Baseline Clinical Characteristics, Social Determinants of Health, and In-hospital QCS for Young Adults with AMI Stratified by Race and Sex.

	Women White (N=1491)	Women Black (N=426)	Men White (N=821)	Men Black (N=108)
In-hospital QCS tertiles				
≤63%	482 (36.7)	156 (40.6)*	224 (31.1)	38 (41.8)
64-80%	474 (36.1)	150 (39.1)*	277 (38.4)	31 (34.1)
>80%	357 (27.2)	78 (20.3)*	220 (30.5)	22 (24.2)
Socio-demographics				
Age - years, Mean±SD	47.5±6.0	46.0±7.1*	47.3±5.9	46.3±6.0
Cardiac risk factors				
Obesity	792 (53.2)	280 (65.7)*	401 (48.8)	53 (49.1)
Hypertension	931 (62.4)	354 (83.1)*	515 (62.7)	85 (78.7)*
Diabetes	562 (37.7)	204 (47.9)*	212 (25.8)	30 (27.8)
Dyslipidemia	1248 (83.7)	356 (83.6)	761 (92.7)	95 (88.0)
Current smoking	417 (28.0)	137 (32.2)	246 (30.0)	29 (26.9)
Family history of CVD	1036 (69.7)	257 (60.5)*	561 (68.7)	59 (54.6)*
Physically active	982 (65.9)	216 (50.7)*	577 (70.3)	67 (62.0)
Comorbidities/ Medical history				
Prior AMI	274 (18.4)	123 (28.9)*	188 (22.9)	29 (26.9)
History of renal disease	188 (12.6)	56 (13.2)	62 (7.6)	18 (16.8)*
Alcohol abuse	435 (29.2)	108 (25.4)	390 (47.5)	51 (47.2)
History of depression	800 (53.7)	152 (35.7)*	221 (27.0)	12 (11.1)*
Disease severity				
AMI Type				
STEMI	728 (48.8)	157 (36.9)*	478 (58.2)	55 (50.9)
NSTEMI	763 (51.2)	269 (63.2)*	343 (41.8)	53 (49.1)
Social determinants of health				
Low SES	646 (44.5)	270 (66.3)*	250 (31.6)	47 (46.1)*
Current employment	871 (58.4)	200 (47.0)*	603 (73.5)	67 (62.0)*
Number of work hours per week, Mean±SD	39.0±12.4	38.7±15.0	46.4±14.0	44.3±12.3
Married or living with a partner	866 (58.1)	134 (31.5)*	523 (63.7)	52 (48.2)*
Primary earner	1130 (75.8)	289 (67.8)*	623 (76.2)	69 (63.9)*

High burden of stress	847 (57.2)	203 (48.9)*	320 (39.5)	33 (30.8)
Support for household chores	943 (63.7)	245 (59.2)	559 (69.0)	68 (64.2)
Low social support, Mean±SD	28.2±5.7	27.2±5.9*	28.5±5.8	28.1±5.9

*Denotes variables for which the difference between White and Black women or men, respectively, is statistically significant (P-value<0.05).

†Data are presented as number of participants (%) unless otherwise specified.

‡The variable low social support is represented by the ESSI social support score, with lower scores indicating lower social support received.

§QCS=Quality of Care Score; AMI=Acute myocardial infarction; SD=standard deviation; CVD= Cardiovascular disease; STEMI=ST-Elevation myocardial infarction; NSTEMI=Non-ST elevation myocardial infarction; SES=Socioeconomic status.

Table S5. Baseline Demographics, Clinical Characteristics and Social Determinants of Health for Young Adults with AMI Stratified by QCS Category.

	Low QCS ≤63% (n=900)	**Intermediate QCS 64-80% (n=932)**	**High QCS >80% (n=677)**
Socio-demographics			
Age — years, Mean±SD	47.1±6.4	47.4±5.9	47.2±6.0
Sex			
Female	638 (70.9)	624 (67.0)	435 (64.3)
Male	262 (29.1)	308 (33.0)	242 (35.7)
Cardiac risk factors			
Obesity	483 (53.7)	500 (53.7)	371 (54.8)
Hypertension	637 (70.8)	616 (66.1)	414 (61.2)
Diabetes	344 (38.2)	336 (36.1)	207 (30.6)
Dyslipidemia	760 (84.4)	803 (86.2)	616 (91.0)
Current smoking	296 (32.9)	291 (31.2)	133 (19.6)
Family history of CVD	589 (65.7)	628 (67.6)	466 (69.0)
Physically active	551 (61.2)	598 (64.2)	465 (68.7)
Comorbidities/Medical history			
Prior AMI	222 (24.7)	205 (22.0)	119 (17.6)
History of renal disease	125 (13.9)	91 (9.8)	70 (10.4)
Alcohol abuse	293 (32.6)	346 (37.1)	228 (33.7)
History of depression	402 (44.7)	366 (39.3)	278 (41.1)
Disease severity			
AMI Type			
STEMI	153 (17.0)	576 (61.8)	357 (52.7)
NSTEMI	747 (83.0)	356 (38.2)	320 (47.3)
Social determinants of health			
Low SES	399 (45.8)	410 (45.5)	277 (42.0)
Current employment	490 (54.4)	567 (60.8)	460 (67.9)
Number of work hours per week, Mean±SD	42.3±14.7	41.2±13.7	41.7±13.6
Married or living with a partner	501 (55.7)	513 (55.0)	376 (55.5)
Primary earner	669 (74.4)	690 (74.2)	504 (74.4)
High burden of stress	453 (50.9)	452 (49.1)	337 (50.1)
Support for household chores	588 (66.4)	583 (63.1)	421 (62.6)
Low social support, Mean±SD	28.1±5.9	28.1±5.8	28.2±5.6

*Data are presented as number of participants (%) unless otherwise specified.

†The variable low social support is represented by the ESSI social support score, with lower scores indicating lower social support received.

‡ QCS=Quality of Care Score; AMI=Acute myocardial infarction; SD=standard deviation; CVD= Cardiovascular disease; STEMI=ST-Elevation myocardial infarction; NSTEMI=Non-ST elevation myocardial infarction; SES=Socioeconomic status.