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Association Between Psychosocial Risk Factors and Readmissions After Acute Myocardial Infarction: Role of COVID-19 Pandemic

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Abstract: Psychosocial risk factors (PSRFs) are known to be associated with worse cardiovascular (CV) outcomes. However, there are limited data on the impact of PSRFs on readmissions after acute myocardial infarction (AMI) before and during the COVID-19 (Coronavirus Disease 2019) pandemic. Therefore, we aimed to examine this association and whether the effects of PSRFs were amplified during the COVID-19 pandemic. We queried the 2019 and 2020 Nationwide Readmissions Database for adult (age ≥18 years) index admissions with AMI as the primary diagnosis. They were then divided into 2 cohorts based on the presence or absence of ≥1 PSRF and compared across

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non-COVID-19 (2019) and COVID-19 (2020) time periods. The primary outcome was 30-day all-cause readmissions. Secondary outcomes included cause-specific readmissions (cardiac, noncardiac, AMI, heart failure). Multivariable hierarchical logistic regression was conducted to evaluate differences in outcomes. The study included 380,820 patients with index AMI, of which 214,384 (56%) had ≥1 PSRFs. Patients with PSRFs were younger, more likely to be female, and had a higher prevalence of CV risk factors. Of 30-day all-cause readmissions were higher in patients with PSRFs in both eras. Moreover, noncardiac and heart failure readmissions were also higher in patients with PSRFs admitted with AMI in 2019 and 2020. This study of a nationally representative population magnifies the association of PSRF with more unplanned readmissions after AMI in both pre-COVID-19 and COVID-19 times. (Curr Probl Cardiol 2023;48:101881.)

Introduction

Acute myocardial infarction (AMI) is one of the leading causes of death in the United States (US). The Atherosclerosis Risk in Communities (ARIC) study revealed approximately 605,000 new cases and 200,000 recurring cases of AMI annually.[1] Approximately 35% of the people with a coronary event would die in a year, and 14% would die due to a subsequent AMI.

Psychosocial risk factors (PSRFs) and financial stressors can trigger acute cardiovascular (CV) events. Psychiatric conditions such as depression, post-traumatic stress disorder (PTSD), anxiety, and stress are shown to be associated with adverse CV events and mortality in patients with coronary artery disease (CAD).[2] Socioeconomic status, represented by total family income, has been shown to correlate with the incidence and worse outcomes of CAD, partly due to lack of access to health insurance and routine preventative healthcare.[3]

During the COVID-19 (Coronavirus Disease 2019) pandemic, healthcare professionals worldwide noted a significant decrease in AMI admissions; however, those admissions were associated with higher mortality, complications, and worse short-term outcomes.[4-7] There is growing evidence in the literature towards the association between COVID-19 and a

higher risk of major adverse CV events (MACE), specifically CAD, irrespective of age, race, baseline CV risk factors, and severity of the COVID-19 infection, as nonhospitalized subjects remained at a higher risk as well. This suggests incorporating COVID-19 status in risk stratification tools by clinicians.[8] Social isolation, distancing, and quarantine imposed to curb the spread of the COVID-19 pandemic have further compounded impacts on mental health and well-being at both individual and population levels.[9] The World Health Organization (WHO) has stressed the impact of the COVID-19 pandemic on the physical, psychological, and social aspects of health.[10]

Growing evidence shows the association of PSRFs with AMI; however, its impact on readmissions after AMI in a global pandemic like COVID-19 has not been well studied. Hence, we aimed to examine the association of PSRFs with 30-day readmissions for adult patients admitted with AMI and compare the differences between patients before and during the pandemic in a nationally representative cohort.

Methods

Data Source

The Nationwide Readmissions Database (NRD) 2019 and 2020 were used for this study. The Agency for Healthcare Research and Quality (AHRQ) developed the dataset for the Healthcare Cost and Utilization Project (HCUP). It is a publicly available, all-payer, de-identified administrative dataset constructed using pooling discharges from 30 State Inpatient Databases, representing ~ 62% of the US resident population and ~60% of all US hospitalizations. Approximately 18 million unweighted discharges and 35 million weighted discharges for national estimates are available annually. Patient linkage information in NRD can be used to track the same individual across the hospitals within a state in one calendar year. The study was deemed exempt from Institutional Board Review since the NRD contains deidentified publicly available dataset for retrospective analysis. The nature of the dataset also precluded the need for informed consent.

Study Population

Hospitalizations for index AMI as primary diagnosis in adults aged ≥18 years in 2019 and 2020 were identified using the *International Classification of Diseases, Tenth Revision, Clinical Modification*

(ICD-10-CM) (Table S1). Index admission was the first hospitalization for AMI in the calendar year. Patients were excluded if index AMI hospitalization was in December of respective years (n = 53,563) owing to lack of 30-day follow-up data. Since we wanted to study the impact of the US COVID-19 pandemic, which started in late March 2020, we excluded patients with index AMI in January-March 2019 and 2020 (n = 171,357). In addition, patients were excluded if they had COVID-19-positive status in index AMI admission (n = 1776), left against medical advice or had unknown discharge disposition (n = 6150), or died (n = 20,026) during the index hospitalization. The final cohort included 380,820 index AMI admissions (Fig 1). Weighted samples were used for all analyses.

Exposure of interest was the presence of PSRFs. The factors were categorized into 5 domains based on previous work[11] and chosen since they could be extracted from the NRD: limited cognitive understanding, substance use disorder, psychiatric disease, uninsured status, and low socioeconomic status (Table S1). Patients were classified as having PSRF if they had at least 1 positive factor from any domain.

Patient and Hospital Characteristics

Baseline patient demographics (age, sex, median household income, primary expected payer), PSRFs, type of AMI, comorbidities, hospital characteristics, and discharge disposition were extracted. ICD-10-CM/PCS (*Procedure Coding System*) codes were used to define these variables (Table S1).

Outcomes Measured

Primary outcomes of interest were 30-day all-cause readmissions. Only the first readmission was counted for patients with multiple readmissions within 30 days. Transfer to another hospital or inpatient rehab was not counted as readmission. Secondary outcomes included 30-day cause-specific readmissions (cardiac, noncardiac, heart failure [HF], AMI) using HCUP CCSR (Clinical Classifications Software Refined) codes (CIR001-CIR039 for cardiac causes; rest were designated noncardiac, CIR009 for AMI, CIR019 for HF).

Statistical Analysis

Patient demographics, comorbidities, hospital characteristics, and discharge disposition were compared between patients with vs without PSRF using the Pearson $\chi 2$ test for categorical variables and the

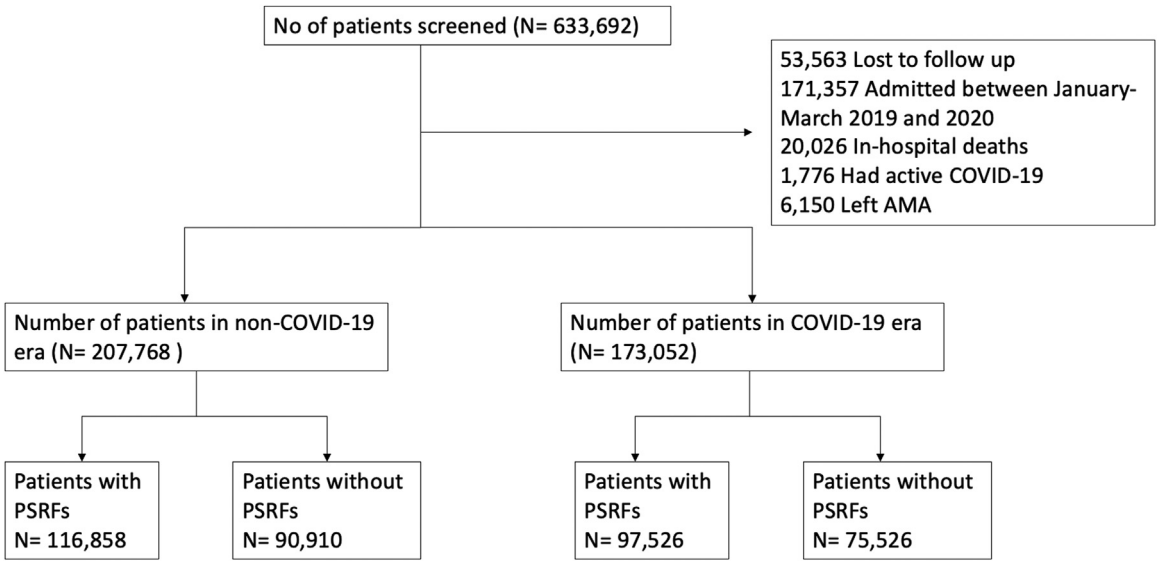

FIG 1. Study flow chart. Flow chart depicting final study population after applying inclusion and exclusion criteria. AMA, against medical advice; COVID-19, Coronavirus Disease-2019; PSRFs, psychosocial risk factors.

Kruskal-Wallis test for continuous variables. They were further compared separately for 2019 and 2020. Multivariable hierarchical logistic regression was conducted to evaluate differences in primary and secondary outcomes after adjusting for variables listed in Table 1.

Categorical variables were presented as frequency (percentage) and continuous variables as mean (standard deviation, SD) or median (interquartile range, IQR) as appropriate. Odds ratios and 95% confidence intervals (CIs) were used to report the results of regression analyses. Statistical analyses were performed using Stata, version 17 (Statistical Software: Release 17. College Station, TX: StataCorp LLC). All P-values were two-sided with a significance threshold of <0.05.

Results

Using NRD, 633,692 AMI admissions were screened between 2019 and 2020. Of these, 380,820 patients met the study selection criteria (Fig 1). 207,768 patients (54.6%) were admitted in 2019 (pre-COVID-19 era), while 173,052 (45.4%) were admitted in 2020 (COVID-19 era). At least 1 PSRF was prevalent in 56.3% of the study population, with similar prevalence in 2019 (56.2%) and 2020 (56.4%).

Baseline Patient and Hospital Characteristics

There were significant differences in baseline characteristics in patients with PSRF compared to those without, both in COVID-19 and pre-COVID-19 eras (Table 1). Patients with vs without PSRF were younger (64.8 vs 69.5 years in 2019; 64.3 vs 69.1 years in 2020; $P < 0.001$), more likely to be female (38.5% vs 35.6% in 2019; 37.4% vs 34.0% in 2020, $P < 0.001$). Traditional CV risk factors, including diabetes, hypertension, dyslipidemia, and chronic kidney diseases, were lower in patients with PSRF (Table S2), with similar distribution noted on stratification by year (Table 1)**.** Of all AMIs, 67.9% and 68.6% had non-ST elevation MI in 2019 and 2020, respectively, while ST-elevation MI was present in 26.6% and 28.8%, respectively. Most of the patients were admitted to urban teaching hospitals during both years.

Outcomes

Comparison of Outcomes in Patients With vs Without Psychosocial Risk Factors in the Overall Cohort. In the study cohort, 30-day all-cause readmissions were higher in patients with PSRFs (unadjusted odds ratio,

TABLE 1. Baseline characteristics of AMI patients across non-COVID-19 and COVID-19 eras stratified by presence of PSRFs

Characteristics	AMI in 2019 (non-COVID-19 era)				AMI in 2020 (COVID-19 era)			
	Overall (n = 207,768)	No PSRFs (n = 90,910; 43.8%)	≥1 PSRFs (n = 116,858; 56.2%)	*P*-value	Overall (n = 173,052)	No PSRFs (n = 75,526; 43.6%)	≥1 PSRFs (n = 97,526; 56.4%)	*P*-value
Demographics								
Age, mean (SD), years	66.8 (13.3)	69.5 (12.5)	64.8 (13.5)	<0.001	66.4 (13.2)	69.1 (12.4)	64.3 (13.4)	<0.001
Women	77,371 (37.2)	32,333 (35.6)	45,038 (38.5)	<0.001	62,158 (35.9)	25,646 (34)	36,512 (37.4)	<0.001
Psychosocial risk factors								
Limited cognition	10,378 (5.0)	-	10,378 (8.9)	-	8013 (4.6)	-	8013 (8.2)	-
Substance abuse	57,096 (27.5)	-	57,096 (48.9)	-	49,143 (28.4)	-	49,143 (50.4)	-
Psychiatric disorders	26,215 (12.6)	-	26,215 (22.4)	-	23,127 (13.4)	-	23,127 (23.7)	-
Uninsured	8491 (4.1)	-	8491 (7.3)		7034 (4.1)	-	7034 (7.2)	
Median household income, 0-25th percentile	58,871 (28.3)	-	58,871 (50.4)	-	47,885 (27.7)	-	47,885 (49.1)	-
Comorbidities								
Dyslipidemia	144,490 (69.5)	65,668 (72.2)	78,822 (67.5)	<0.001	123,676 (71.5)	55,716 (73.8)	67,960 (69.7)	<0.001
Hypertension	169,997 (81.8)	74,851 (82.3)	95,146 (81.4)	<0.001	142,084 (82.1)	62,474 (82.7)	79,610 (81.6)	<0.001
Diabetes Mellitus	82,599 (39.8)	37,703 (41.5)	44,896 (38.4)	<0.001	68,404 (39.5)	30,825 (40.8)	37,579 (38.5)	<0.001
Obesity	44,675 (21.5)	19,596 (21.6)	25,079 (21.5)	0.60	41,309 (23.9)	17,680 (23.4)	23,629 (24.2)	<0.001
Heart Failure	86,102 (41.4)	37,274 (41.0)	48,828 (41.8)	<0.001	72,096 (41.7)	31,166 (41.3)	40,930 (42.0)	0.003
Known CAD	134,742 (64.9)	59,239 (65.2)	75,503 (64.6)	0.01	113,475 (65.6)	49,465 (65.5)	64,010 (65.6)	0.54
Prior AMI	33,095 (15.9)	14,424 (15.9)	18,671 (16.0)	0.49	28,034 (16.2)	11,880 (15.7)	16,154 (16.6)	<0.001
Prior PCI	34,336 (16.5)	15,586 (17.1)	18,750 (16.0)	<0.001	27,407 (15.8)	12,280 (16.3)	15,127 (15.5)	<0.001
Prior CABG	19,602 (9.4)	9657 (10.6)	9945 (8.5)	<0.001	14,684 (8.5)	7070 (9.4)	7614 (7.8)	<0.001
Prior TIA/ stroke	16,412 (7.9)	6849 (7.5)	9563 (8.2)	<0.001	13,235 (7.6)	5,607 (7.4)	7628 (7.8)	<0.01
Atrial fibrillation	38,118 (18.3)	18,959 (20.9)	19,159 (16.4)	<0.001	27,012 (15.6)	13,067 (17.3)	13,945 (14.3)	<0.001
Prior PPM	5856 (2.8)	3031 (3.3)	2825 (2.4)	<0.001	4358 (2.5)	2215 (2.9)	2143 (2.2)	<0.001
Prior ICD	3787 (1.8)	1716 (1.9)	2071 (1.8)	0.051	2907 (1.7)	1276 (1.7)	1631 (1.7)	0.78

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TABLE 1. (*continued*)

Characteristics	AMI in 2019 (non-COVID-19 era)				AMI in 2020 (COVID-19 era)			
	Overall (n = 207,768)	No PSRFs (n = 90,910; 43.8%)	≥1 PSRFs (n = 116,858; 56.2%)	*P*-value	Overall (n = 173,052)	No PSRFs (n = 75,526; 43.6%)	≥1 PSRFs (n = 97,526; 56.4%)	*P*-value
Peripheral vascular disease	23,622 (11.4)	10,324 (11.4)	13,298 (11.4)	0.87	19,094 (11.0)	8276 (11.0)	10,818 (11.1)	0.38
Anemia	7830 (3.8)	3389 (3.7)	4441 (3.8)	0.39	6564 (3.8)	2790 (3.7)	3774 (3.9)	0.06
Chronic kidney disease	48,985 (23.6)	24,016 (26.4)	24,969 (21.4)	<0.001	39,126 (22.6)	19,168 (25.4)	19,958 (20.5)	<0.001
Chronic lung disease	43,852 (21.1)	14,623 (16.1)	29,229 (25.0)	<0.001	35,153 (20.3)	11,524 (15.3)	23,629 (24.2)	<0.001
Chronic liver disease	7233 (3.5)	2907 (3.2)	4326 (3.7)	<0.001	6615 (3.8)	2676 (3.5)	3939 (4.0)	<0.001
Coagulopathy	12,566 (6.0)	5990 (6.6)	6576 (5.6)	<0.001	10,718 (6.2)	5137 (6.8)	5581 (5.7)	<0.001
Hypothyroidism	26,369 (12.7)	12,897 (14.2)	13,472 (11.5)	<0.001	21,973 (12.7)	10,397 (13.8)	11,576 (11.9)	<0.001
Pulmonary circulation disorders	12,486 (6.0)	5713 (6.3)	6773 (5.8)	<0.001	10,422 (6.0)	4824 (6.4)	5598 (5.7)	<0.001
Cancer	6408 (3.1)	3242 (3.6)	3166 (2.7)	<0.001	5250 (3.0)	2612 (3.5)	2638 (2.7)	<0.001
No. of Elixhauser comorbidities, median (IQR)	4 (3)	4 (3)	4 (4)	<0.001	4 (3)	4 (3)	4 (4)	<0.001
AMI type								
Non-STEMI	140,979 (67.9)	62,445 (68.7)	78,534 (67.2)	<0.001	118,766 (68.6)	52,392 (69.4)	66,374 (68.1)	<0.001
STEMI	55,314 (26.6)	23,685 (26.1)	31,629 (27.1)	<0.001	49,787 (28.8)	21,291 (28.2)	28,496 (29.1)	<0.001
Unspecified	11,475 (5.5)	4780 (5.3)	6695 (5.7)	<0.001	4499 (2.6)	1843 (2.4)	2656 (2.7)	<0.001
Elective admission	5852 (2.8)	2354 (2.6)	3498 (3.0)	<0.001	4367 (2.5)	1798 (2.4)	2569 (2.6)	0.001
Hospital characteristics								
Bed size								
Small	31,287 (15.1)	14,551 (16.0)	16,736 (14.3)	<0.001	26,442 (15.3)	12,245 (16.2)	14,197 (14.6)	<0.001
Medium	59,723 (28.7)	26,173 (28.8)	33,550 (28.7)		49,676 (28.7)	21,690 (28.7)	27,986 (28.7)	
Large	116,758 (56.2)	50,186 (55.2)	66,572 (57.0)		96,934 (56.0)	41,591 (55.1)	55,343 (56.7)	
Location								
Rural	1160 (0.6)	286 (0.3)	874 (0.7)	<0.001	1061 (0.6)	339 (0.4)	722 (0.7)	<0.001
Urban	206,608 (99.4)	90,624 (99.7)	115,984 (99.3)			75,187 (99.6)	96,804 (99.3)	

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TABLE 1. (*continued*)

Characteristics	AMI in 2019 (non-COVID-19 era)				AMI in 2020 (COVID-19 era)			
	Overall (n = 207,768)	No PSRFs (n = 90,910; 43.8%)	≥1 PSRFs (n = 116,858; 56.2%)	*P*-value	Overall (n = 173,052)	No PSRFs (n = 75,526; 43.6%)	≥1 PSRFs (n = 97,526; 56.4%)	*P*-value
Teaching status								
Nonteaching	53,376 (25.7)	21,491 (23.6)	31,885 (27.3)	<0.001	45,695 (26.4)	18,531 (24.5)	27,164 (27.9)	<0.001
Teaching	154,392 (74.3)	69,419 (76.4)	84,973 (72.7)		127,357 (73.6)	56,995 (75.5)	70,362 (72.1)	
Disposition								
Routine	150,043 (72.2)	64,999 (71.5)	85,044 (72.8)	<0.001	127,918 (73.9)	55,415 (73.4)	72,503 (74.3)	<0.001
Short-term hospital	6242 (3.0)	3118 (3.4)	3124 (2.7)		4513 (2.6)	2274 (3.0)	2239 (2.3)	
Skilled nursing facility	21,293 (10.2)	8870 (9.8)	12,423 (10.6)		12,492 (7.2)	5033 (6.7)	7459 (7.6)	
Home health care	30,118 (14.5)	13,894 (15.3)	16,224 (13.9)		28,064 (16.2)	12,776 (16.9)	15,288 (15.7)	

Data is presented as frequency (percentage); unless otherwise specified.

AKI: acute kidney injury, AMI: acute myocardial infarction, CABG: coronary artery bypass graft, CAD: coronary artery disease, COVID-19: coronavirus disease-2019, ICD: implantable cardioverter- defibrillator, IQR: inter-quartile range, MI: myocardial infarction, MV: mitral valve, PCI: percutaneous coronary intervention, PPM: permanent pacemaker, PSRFs: psychosocial risk factors, SD: standard deviation, STEMI: ST-elevation myocardial infarction, TIA: transient ischemic attack.

uOR, 1.04 [95% CI, 1.02-1.07]; adjusted odds ratio, aOR, 1.12 [95% CI, 1.09-1.15]) (Table 2). Further, patients with PSRFs had a higher frequency of 30-day noncardiac readmissions (≥1 PSRF, 5.4% vs no PSRF, 4.9%). However, after adjusting for covariates, cardiac, noncardiac, and HF readmissions were significantly higher in patients with ≥1 PSRF, but 30-day AMI readmissions were not significant across the 2 groups. Further subgroup analyses for each individual year are reported in Tables S3 and S4.

Comparison Effect of Year in Patients With ≥1 Psychosocial Risk Factors: Pre-COVID-19 vs During COVID-19. Among patients with at least ≥1 PSRF, there was no difference in 30-day all-cause readmissions in the COVID-19 era compared to the pre-COVID-19 era (Table 3). Noncardiac readmissions were more frequently observed in 2019 compared to 2020 (5.6% vs 5.3%, $P = 0.004$), but there was no statistical significance after adjustment. Of the other secondary outcomes, 30-day AMI readmissions (aOR, 0.92, [95 % CI 0.86-0.99]) were slightly lower during COVID-19 pandemic compared to the pre-COVID-19 year, but other cause-specific readmissions were not different.

Discussion

Our study involving 380,820 AMI patients using an extensive all-payer nationally representative readmission database compared PSRFs and their impact in the COVID-19 vs pre-COVID-19 era. We report the following novel findings. First, patients with AMI with PSRFs had an increased 30-day cardiac readmission rate in the COVID-19 era compared to the pre-COVID-19 era. Second, patients with ≥1 PSRF had an increased rate of cardiac, noncardiac, and HF readmissions in both the pre-COVID-19 and COVID-19 eras.

Previous studies have shown that PSRFs are associated with increased cardiovascular mortality and AMI. The INTERHEART study, performed across 52 countries, is one of the most extensive studies to date to show the relationship between psychosocial stressors and increased risk of AMI.[12,13] According to this case-control study, 43.8% of the cases with AMI in North America had the presence of at least one or more stressors in their life as opposed to the 35.3% in the control group (OR: 1.6 [95% CI 1.05-2.59], $P < 0.005$). Furthermore, a higher prevalence of depression was noted in patients with AMI vs the control group (24% vs 17.6%, OR: 1.55 [95% CI 1.42-1.69]). These findings were consistent across multiple continents

TABLE 2.. Primary and secondary outcomes in overall cohort (non-COVID-19 and COVID-19 combined)

30-day outcomes	Overall (380,820)	No PSRF (n = 166,436; 43.7%)	≥1 PSRFs (n = 214,384; 56.3%)	Unadjusted OR (CI)*	*P*-value	Adjusted OR (CI)*	*P*-value
Primary outcomes							
All-cause readmissions	47,236 (12.4%)	20,200 (12.1%)	27,036 (12.6%)	1.04 (1.02-1.07)	<0.001	1.12 (1.09-1.15)	<0.001
Secondary outcomes							
Cardiac readmissions	27,180 (7.1%)	11,908 (7.1%)	15,272 (7.1%)	1.00 (0.98-1.02)	0.71	1.04 (1.00-1.08)	0.02
Noncardiac readmissions	20,056 (5.3%)	8292 (4.9%)	11,764 (5.4%)	1.11 (1.08-1.14)	<0.001	1.21 (1.16-1.25)	<0.001
Heart failure readmissions	7341 (1.9%)	3161 (1.8%)	4180 (1.9%)	1.03 (0.98-1.08)	0.26	1.16 (1.09-1.23)	<0.001
AMI readmissions	6884 (1.8%)	3043 (1.8%)	3841 (1.8%)	0.98 (0.93-1.03)	0.40	0.98 (0.92-1.04)	0.42

AMI: myocardial infarction, CI: confidence interval, OR: odds ratio, PSRFs: psychosocial risk factors.
*No PSRF used as reference.

TABLE 3.. Primary and secondary outcomes in AMI with ≥1 PSRFs comparing non-COVID-19 and COVID-19 eras

30-day outcomes	Overall (214,384)	≥1 PSRF in 2019 (n = 116,858; 54.5 %)	≥1 PSRF in 2020 (n = 97,526; 45.5%)	Unadjusted OR (CI)*	*P*-value	Adjusted OR (CI)*	*P*-value
Primary outcomes							
All-cause readmissions	27,036 (12.6%)	14,966 (12.8%)	12,070 (12.3%)	0.96 (0.94-0.99)	0.003	0.98 (0.95-1.01)	0.24
Secondary outcomes							
Cardiac readmissions	15,272 (7.1%)	8403 (7.1%)	6869 (7.0%)	0.98 (0.95-1.01)	0.19	0.98 (0.94-1.02)	0.44
Noncardiac readmissions	11,764 (5.5%)	6563 (5.6%)	5201 (5.3%)	0.95 (0.91-0.98)	0.004	0.98 (0.93-1.02)	0.34
Heart failure readmissions	4180 (1.9%)	2287 (1.9%)	1893 (1.9%)	0.99 (0.93-1.05)	0.79	1.03 (0.96-1.11)	0.33
AMI readmissions	3841 (1.8%)	2145 (1.8%)	1696 (1.7%)	0.95 (0.89-1.01)	0.093	0.92 (0.86-0.99)	0.04

AMI: myocardial infarction, CI: confidence interval, OR: odds ratio, PSRFs: psychosocial risk factors.
*Year 2019 used as reference.

and ethnic groups. Similarly, several other studies have established a correlation between PSRFs and CAD.[14-17] According to a recent large single-center cross-sectional study involving about 355 patients with AMI, a significant increase in mortality of 17.7% in the COVID-19 era compared to the pre-COVID-19 era.[4] Similar results have also been shown in other studies. Although these studies did not directly assess the impact of PSRF in the COVID-19 era, it is crucial to understand the impact of COVID-19 on CV outcomes associated with increased risk of 30-day readmissions of HF, AMI, and pneumonia in patients with psychiatric disorders.[18] Our study results showed an increased rate of all-cause and cause-specific (cardiac, noncardiac, HF) readmissions in pre-COVID-19 and the COVID-19 era among patients with PSRFs. Interestingly, we also found increased 30-day cardiac readmission rates in patients with $\geq$1 PSRF in the COVID-19 era compared to the pre-COVID-19 era. These findings could be due to multiple factors, including limitations in access to care, limitations in interventional procedures, and the COVID-19 disease itself.[19]

PSRFs are significantly prevalent among patients with CAD.[20] However, they lack a standardized definition or assessment tool for cardiovascular outcomes. In our study, the most common PSRF is lower household income (49.8%) and substance abuse (49.6%), which is followed by psychiatric disorders (23.0%) (Table S3). The pathways associated with worse CV outcomes in this population are complicated since it is often coupled with unhealthy behaviors, increasing the risk of cardiovascular disease (CVD) and early mortality.[20-23] Previous studies have illustrated a correlation between increased PSRF and a lower median household income which is also reflected in our study population.[24-26] During COVID-19, an increased prevalence of psychiatric disorders (23.7% vs 22.4%, $P < 0.001$) and substance use (50.4% vs 28.9%, $P < 0.001$) was present in patients hospitalized for AMI.

Given that ethnic minorities and patients who present with more severe disease states are more likely to have PSRFs, they may have a significant impact on the current healthcare inequities. In addition, less social support and larger PSRFs are linked to higher mortality and a worse prognosis, making PSRF a critical prognostic indicator in CV medicine. Even though there is not yet a universal definition for PSRFs, they are a vital tool that should be added to the clinician's evaluation to assist in predicting and possibly preventing worse outcomes.

Limitations

Our analysis has a few limitations inherent to the administrative nature of the dataset. First, the NRD relies on accurate ICD coding, and coding-related inaccuracies could affect the results. Second, the dataset does not contain information on race/ethnicity, and thus, the interplay of PSRF and racial heterogeneities could not be assessed. Third, since PSRFs are a composite of various factors, no one definition applies to all of them. Thus, we could not attach a value to the association of individual factors with study outcomes. Additionally, we could not analyze all PSRFs because of the limitations of the administrative database. Fourth, NRD only captures inpatient data, thus introducing ascertainment bias. For example, there could be potential for underreporting complications recognized in outpatient or emergency services. Lastly, out-of-hospital vital status is not captured. As a result, readmission frequency could be impacted by competing risks of death.

Conclusion

Our nationally representative database-based analysis found a high prevalence of PSRFs (56%) in AMI admissions. During the pre-COVID-19 and COVID-19 eras, 30-day all-cause readmissions were higher in patients with PSRFs. Patients with PSRFs admitted with AMI during the COVID-19 pandemic had significantly higher MI readmissions. These findings reiterate the magnitude of PSRFs as highly prevalent and nontraditional contributors to worsening cardiovascular disease outcomes. These findings are of public health concern and warrant early identification and mitigation of PSRFs at the primary care level, incorporating them as predictors of worse outcomes during clinical decision-making.

Clinical Perspectives

Clinical Competencies

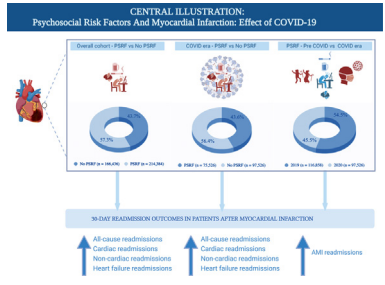
Medical Knowledge 1: Our study reiterates the importance of controlling nontraditional risk factors, such as psychosocial risk factors in myocardial infarction patients, as it was associated with worse outcomes of all-cause readmissions, irrespective of the COVID-19 pandemic.

Medical Knowledge 2: COVID-19 pandemic exacerbated the effects of psychosocial risk factors in patients with myocardial infarction leading to higher myocardial infarction readmission rates and vascular complication rates.

Patient Care: Early identification and mitigation of psychosocial risk factors in patients with myocardial infarction can decrease readmissions, especially during a pandemic.

Translational Outlook

Further research with multinational collaborations is necessary to evaluate psychosocial and other nontraditional risk factors on myocardial infarction outcomes during the COVID-19 pandemic.



Central illustration

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Dr. Desai reports working under contract with the Centers for Medicare and Medicaid Services to develop and maintain performance measures used for public reporting and pay for performance programs. He reports research grants and/or consulting for Amgen, Astra Zeneca, Bayer, Boehringer Ingelheim, Bristol Myers Squibb, Cytokinetics, Merck, Novartis, SCPharmaceuticals, and Vifor.

All other authors have nothing to disclose.

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Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.cpcardiol.2023.101881.

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