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Authors

Lin, Sara
Shermeyer, Andrew
Nikpay, Sayeh
et al.

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Initial Treatment of Uninsured Patients with ST-Elevation Myocardial Infarction by Facility PCI Capabilities

Sara Lin[1], **Andrew Shermeyer, MPA**[2], **Sayeh Nikpay, PhD, MPH**[2], **Renee Y. Hsia, MD, MSc**[3,4], **Michael J. Ward, MD, PhD, MBA**[5,6,7]

1. Vanderbilt University School of Medicine, Nashville, TN

2. Division of Health Policy and Management, University of Minnesota School of Public Health, Minneapolis, MN.

3. Department of Emergency Medicine, University of California at San Francisco, San Francisco, CA.

4. Philip R. Lee Institute for Health Policy Studies, University of California at San Francisco, San Francisco, CA.

5. Department of Emergency Medicine, Vanderbilt University Medical Center, Nashville, TN.

6. Department of Biomedical Informatics, Vanderbilt University Medical Center, Nashville, TN.

7. Geriatric Research, Education, and Clinical Center (GRECC), VA Tennessee Valley Healthcare System, Nashville, TN

Abstract

Background—Timely reperfusion is necessary to reduce morbidity and mortality in patients with ST-elevation myocardial infarction (STEMI). Initial care by facilities with percutaneous coronary intervention (PCI) capabilities reduces time to reperfusion. We sought to examine whether insurance status was associated with initial care at EDs with PCI capabilities amongst adult patients with STEMI.

Corresponding Author: Michael Ward, MD, PhD, Associate Professor Department of Emergency Medicine and Biomedical Informatics, Vanderbilt University Medical Center, 2525 West End Ave, Ste 1430, Nashville, TN, 37232, michael.j.ward@vumc.org.

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Methods—We conducted a retrospective cross-sectional study using Department of Healthcare Access and Information (HCAI), a non-public statewide database reporting ED visits and hospitalizations in California. We included adults initially arriving at EDs with STEMI by diagnostic code (International Classification of Diseases v9 or 10) from 2011–2019. Multivariable logistic regression modeling included initial care by PCI capable facility as the primary outcome, and insurance status (none vs. any) as the primary exposure. Covariates included patient, facility, and temporal factors and we conducted multiple robustness checks.

Results—We analyzed 135,358 eligible visits with STEMI included. In our multivariable model, the odds of uninsured patients being initially treated at a PCI-capable facility were significantly lower than insured patients (adjusted odds ratio [aOR] 0.62, 95%CI 0.54–0.72, p<0.001) and was unchanged in sensitivity analyses.

Conclusions—Uninsured patients with STEMI had significantly lower odds of first receiving care at facilities with PCI capabilities. Our results suggest potential disparities in accessing high-quality and time-sensitive treatment for uninsured patients with STEMI.

INTRODUCTION

Nearly 250,000 ST-Elevation Myocardial Infarctions (STEMI) present to the US EDs annually and the preferred reperfusion strategy is percutaneous coronary intervention (PCI).[1] Timely reperfusion is necessary to reduce patients' morbidity and mortality from STEMI.[2] Delays beyond the door-to-balloon benchmark of 90 minutes are a commonly recognized problem since they were first identified and associated with prolonged ischemia and increased 12-month and 5-year mortality in US-based interfacility transfers.[3,4,5,6,7] Similar delays and diminished outcomes are an international challenge.[8,9] Rapid treatment and subsequently clinical outcomes are achievable when patients initially receive care at facilities with PCI capabilities instead of requiring interfacility transfer, as the duration of myocardial ischemia is reduced.[2,3,10] However, only 36% of US hospitals have PCI capabilities.[11] As a result, one study found that 25% of patients were transferred for primary PCI.[3]

In the setting of worse clinical outcomes for patients who are transferred and have delayed care, insurance status may play an important role in the timeliness and location of care. It is unknown to what extent the differences in outcomes can be explained by the characteristics of the initially treating facility and likelihood to transfer. Prior work in a national sample of ED visits, found that lack of insurance among patients with STEMI was independently associated with 60% higher odds of being transferred.[12] Recent data from the state of California, however, found that uninsured patients with STEMI were no more likely (and in fact, less likely) to be transferred than their insured counterparts.[13] This could be due to the robust state-level regionalization in PCI care found in California.[14] However, a key unanswered question—and the subject of this present study—is to determine whether transfer is indicated among uninsured patients with STEMI. Specifically, whether uninsured patients with STEMI are more likely to receive initial treatment at PCI-capable hospitals.

METHODS

Study Design and Setting

We conducted a retrospective cross-sectional study of all patients with STEMI treated at California EDs between 2011 and 2019 using the Healthcare Access and Information (HCAI) dataset, previously named California Office of Statewide Health Planning and Development (OSHPD). Using de-identified data, HCAI tracks patient, facility, and utilization data from 8,000 California non-federal healthcare facilities. Emergency Department Data (EDD), Patient Discharge Data (PDD), Annual Utilization Data, and Inpatient Mortality Indictors (IMI) were our primary sources of data within HCAI. The EDD includes individual patient encounters in California EDs, while the PDD records all inpatient discharges from California licensed hospitals. Encounters were included that were designated as "General Acute Care Hospital" by HCAI Annual Utilization Dataset. This multi-year retrospective cross-sectional study was approved by The Vanderbilt University Medical Center Institutional Review Board with a waiver of informed consent as it was minimal risk.

Data Collection

Patient encounters were retrospectively identified in the HCAI database. Unique patient and facility identifiers were used to link patient encounters between the EDD and PDD datasets to ensure that each episode of care was counted once. All adult patients (18 years of age or older) with STEMI were identified using International Classification of Disease (ICD), Ninth Revision, Clinical Modification Codes: 410.00, 410.01, 410.10, 410.11, 410.20, 410.21, 410.30, 410.31, 410.40, 410.41, 410.50, 410.51, 410.60, 410.61, 410.80, 410.81, 410.90, 410.91 and ICD, Tenth Revision, Clinical Modification Codes: I21.01, I21.02, I21.09, I21.11, I21.19, I21.21, I21.29, I21.3.[12,15–17] As we were most interested in the first ED episode that provided treatment, episodes were excluded if they had a missing disposition status or if the admission source was another hospital, which was most likely to represent an interfacility transfer. This allowed for capture of the patient's first episode of care and excluded those episodes resulting from a transfer. Visits with unknown or missing insurance status in EDD or PDD were also excluded as this was the primary exposure. While multiple ED visits for the same episode were excluded, patients could have multiple STEMIs separated by time allowing for multiple entries per patient.

Exposures and Outcomes

The patient's health insurance status at the time of arrival to the ED was the primary exposure. Insurance status was collected at the initial ED encounter and/or admission to the hospital. De-identified patient insurance status was collected from HCAI as "Expected source of payment" (EDD) or "Payer category" (PDD) and was categorized as one of five mutually exclusive groups: Medicare, Medicaid, Commercial health insurance, Other (including workers' compensation, county indigent programs, other indigent programs, other government programs, and other payers), and Self-Pay, which was coded as uninsured. Our first level analysis examined any insurance (including Medicare, Medicaid, commercial, other) vs. no insurance and the association with initial treatment at PCI capable facilities.

The dependent variable of our primary analysis was whether the individual was first treated at a PCI capable facility, which was treated as a binary variable, and is defined below.

Measurements

Annual total PCI counts collected in the HCAI Annual Utilization file were used to determine whether a facility could perform PCI. PCI volume was identified using 135 ICD-9 and 10 procedure codes (Supplemental Table 1). Primary PCI volume was previously demonstrated to be associated with patient outcomes,[18–20] and is used to determine PCI capability status by the Joint Commission. Specifically, the Joint Commission facility volume threshold is at least 36 primary PCI annually for Primary Heart Attack Certification.[20] While PCI may be elective, not the equivalent of primary PCI, and occur more frequently than primary PCI, the HCAI database excludes ambulatory PCI. Inclusion in this dataset likely represents acute primary PCI and is an appropriate surrogate for primary PCI. Thus, we used 36 annual PCI as our threshold for categorizing a facility as having PCI capabilities.[20] This does not imply that facilities defined as capable by our methods will have the ability to perform PCI 24/7, but rather that they do perform PCIs at this volume threshold. There was no missing data handled as only complete cases were included as none of the observations had a missing value for a variable used in our models. All observations that contained a missing value for a variable used in the model were excluded, which represented 155 encounters or 0.11% of final study sample. It was important to make sure that each iteration of our main analysis (i.e. no controls to patient and facility controls) contained the same number of observations.

Our data included several potential cofounders that we included as covariates including patient-level demographic variables, facility characteristics, and temporal factors. Patient-level factors included patient age, sex, race, ethnicity, rurality, poverty index, and co-morbidity index and were abstracted from EDD and PDD. Facility characteristics included facility ownership (nonprofit vs. for profit), annual ED volume, annual transfer volume for patients leaving the hospital, facility rurality, and payer mix (measured by percentage of commercially insured patients), which were in the Annual Utilization dataset. Specifically, the percentage of commercially insured patients was calculated for all California EDs and then divided to form commercial payment share quartile. The first quartile of facilities had the lowest share of commercially insured patients, while the fourth had the highest. Temporal factors included month and year of initial episode of care as well as day of the week (weekday vs. weekend) found in the EDD and PDD datasets. Patient and facility rurality were defined using Rural-Urban Commuting Area (RUCA) codes and grouped in two categories as urban or rural (RUCA ≥ 4 as rural).[21,22] We used the US Census Bureau's Small Income and Poverty Estimates (SAIPE) Program to determine the percentage of people in the county living below the federal poverty level.[23] We used an R package that uses ICD-9 and 10 codes to calculate the Elixhauser Comorbidity Index.[24]

Analysis

We performed descriptive analyses to summarize patient, facility, and temporal factors and initial treatment at California EDs by PCI capability. Comparisons of the populations initially treated by facilities with and without capabilities were conducted with t-tests, and chi squared, as appropriate.

For our primary outcome, we performed multivariable logistic regression using STATA, adjusting for the covariates described above, including patient, facility, and temporal factors that may confound the relationship between the primary exposure (insurance status) and the primary outcome (presentation to a PCI facility). We clustered standard errors at the hospital level to account for correlation in the error term within hospitals given patient and facility factors were analyzed. All analyses were conducted using STATA version 17 software.[25] We hypothesized that uninsured patients with STEMI would be more likely to receive initial treatment at EDs without PCI capabilities.

Sensitivity Analyses—Five planned sensitivity analyses were conducted to determine whether the results were due to our sample collection or variable selection. The first separated the samples into ICD-9 and ICD-10, as the diagnostic code version changed in 2015. Second, while PCI volume of 36 annually was used to determine a facility's PCI capabilities, the threshold of PCI volume and its impact on our primary outcome was uncertain. Thus, we examined three PCI volume thresholds: *low volume*: 11–35[19,20] primary PCIs per year, *medium volume*: 36–60[19] primary PCIs per year, and *high volume*: >60[19] primary PCIs per year. While PCI volume represents an indicator of a facility's PCI capabilities, it does not account for partial capabilities (e.g., daytime availability only), so a facility with sufficient daytime volume may appear as "PCI Capable" facility when they may not be able to provide PCI for a patient with STEMI presenting in the evening. The third sensitivity analysis limited our sample to 2013 when a state-wide survey assessed California facility PCI capabilities as the following: no, partial, or full PCI capabilities.[26] The fourth sensitivity analysis included a full set of insurance categories (Medicare, Medicaid, commercial) instead of any vs. none. Finally, the fifth sensitivity analysis redefined the uninsured population to include populations that were underinsured, such as those enrolled in county indigent programs. County level programs, such as Healthy San Francisco may include safety-net care but do not provide access as full insurance would.[27]

RESULTS

Characteristics of Study Subjects

Between 2011 and 2019, there were 171,472 visits for STEMI in California hospitals. After exclusions, 135,358 visits were included in the multivariate analysis with 7,322 (5.4%) uninsured patient visits and the full cohort can be seen in Figure 1. Among the 128,036 STEMI visits for patients with insurance, 62,963 had Medicare (46.5%), 42,016 had commercial insurance (31.0%), 17,583 had Medicaid (12.99%), and 5,469 with Other (4.0%). There were 13,717 patients (identified with a unique record locator number) with more than one encounter in our dataset. With expansion of Medicaid in California in 2014, the number of uninsured patients declined by approximately 50% and continued to drop throughout our study period (Supplemental Table 2). Using the primary exposure of no insurance versus any insurance, those without insurance were younger (54 vs. 65, $p<0.001$), more likely to be male (81.5% vs. 69.0%, $p<0.001$), and were more likely to be non-white

(51.8% vs. 40.7%, p<0.001). Uninsured patients were more likely to receive initial treatment at facilities with reduced average annual ED volumes (52,644 vs. 55,251, n p<0.001). They were less likely to initially receive treatment at facilities with non-profit status (65.6% vs. 70.1%, p<0.001), and at facilities with a larger commercially insured patient population (4th quartile commercial payment share) (20.4% vs. 25.8%, p<0.001). There was no significant association with rurality of facility for initial treatment of uninsured patients (6.3% vs. 6.5%, p=0.56). The full demographics of this population can be seen in Table 1.

As seen in Table 2 describing the STEMI population by facility characteristics, 86,068 (64%) first received treatment at facilities with PCI capabilities as defined by annual PCI volume. Those who initially received treatment at facilities with PCI capabilities were more likely to be male (71.1% vs. 67.3%, p<0.001) and white (60.3% vs. 55.8%, p<0.001), and less likely to be uninsured (4.6% vs. 6.9%, p<0.001) and residing in rural areas (6.1% vs. 17.3%, p<0.001).

Primary Analysis Results

In the primary multivariable logistic regression model, lack of health insurance was associated with significantly lower odds of receiving initial treatment at a facility with PCI capabilities (adjusted odds ratio [aOR] for uninsured patients versus those with any health insurance: 0.62, 95% CI: 0.54–0.72) (Table 3, Figure 2). Other risk factors associated with lower odds of initial treatment at a facility with PCI capabilities included female sex, Black race, and Hispanic ethnicity. Patients with STEMI who received initial treatment at a rural facility significantly decreased the odds of treatment at a facility with capabilities (aOR 0.04, 95% CI: 0.01–0.24).

Sensitivity Analyses—The five sensitivity checks of volume thresholds, ICD-9 vs. ICD-10, use of the 2013 PCI facility indicator, full insurance categories, and inclusion of underinsured populations were all associated with significantly reduced odds of initial treatment at a facility with PCI capabilities (Supplemental Table 3). Notably, when using alternative volume thresholds (instead of 36 primary PCIs per year) to determine facility PCI capability we found the uninsured patients had significantly higher odds of receiving initial treatment at low-volume facilities, yet significantly lower odds of initial care at medium or high-volume facilities (Table 4).

DISCUSSION

This is the first study, to our knowledge, that identifies that when compared with insured patients, uninsured patients with STEMI had significantly lower odds of receiving initial treatment at facilities with PCI capabilities. These findings were supported by multiple robustness checks. This work builds on prior research that lack of insurance was independently associated with increased odds of interfacility transfer for patients with emergency conditions.[28–31] While uninsured patients with STEMI were initially demonstrated to be more likely to be transferred,[12] recent findings that control for the PCI capabilities of the transferring facilities found that the odds of transfer were similar to their insured counterparts.[13] Prior research found that transferred patients were not transferred to the highest quality receiving hospitals (i.e., lower risk-adjusted mortality) in the setting of acute myocardial infarction,[32] and emergency general surgery.[33] The present study reported here is the first to date, to our knowledge, that addresses the PCI capabilities of the initial facility for uninsured patients with STEMI. Taken together, uninsured patients may not have access to the appropriate facilities that can treat such a cardiac emergency.

Receiving initial treatment at facilities without capabilities is an important barrier to optimal care for patients with STEMI as this contributes to delays in timely reperfusion, increased myocardial ischemia, and higher morbidity and mortality.[2–7] Existing disparities in accessing high-quality, time-sensitive treatment for uninsured individuals with STEMI may further diminish clinical outcomes. Despite California's STEMI regionalization efforts to increase access to care, work done by Hsia et al. found that patients in minoritized communities, who are more likely to be uninsured, derived smaller benefits (as measured by access to PCI facilities and receipt of PCI) from regionalization.[34] This work also builds on a larger body of research on limited access of the uninsured to high quality care, the subject of Healthy People 2030.[35] Lack of insurance is a key barrier to accessing high quality care,[36,37] which may also extend to cardiac emergencies. The present findings suggest that while regionalization may mitigate disparities in transfers from PCI capable facilities, there may be PCI center gaps or "PCI deserts" limiting uninsured patient access.

Future studies should examine the role of social determinants of health that contribute to the initial treatment of uninsured patients with STEMI at facilities with PCI capabilities (economic stability, educational access and quality, health care access and quality, neighborhood environment, and social and community context). Also, examining whether uninsured populations are geographically localized further from PCI-capable facilities. Use of insurance status remains a good surrogate for other social determinates of health that may be difficult to capture in large datasets.[38] Further, these findings should be examined in other settings, particularly those without Medicaid expansion and the regionalization efforts of California. Finally, understanding why uninsured patients are more likely to access less capable facilities, the quality of these facilities, and strategies to mitigate these disparities are important future directions.

LIMITATIONS

While our findings were supported by multiple robustness checks, the following limitations should be considered when interpreting these study results. The number of ED STEMI visits (135,358) included in our study may have allowed the comparisons between insured uninsured populations in Table 1 to reach statistical significance because of large sample size and may not be substantially clinically significant. Additionally, we used administrative data from a non-public statewide database. The accuracy of insurance status, our primary exposure, in the dataset may be difficult to determine in such datasets. However, we excluded patients with missing insurance status and prior research found misclassification within the insured population rather than between the insured and uninsured groups.[39] We are also unable to determine if insurance status changed throughout an admission. For example, some patients may have been enrolled in emergency Medicaid or county indigent programs and were subsequently not included in the uninsured population of our study. Another limitation of administrative data was the use of ICD-9 and ICD-10 diagnostic codes to define STEMI. While these diagnostic have been used extensively,[15–17] they may not accurately capture STEMI diagnoses. These diagnostic codes were updated in the middle of the study period to increase the specificity of a STEMI diagnostic code. Robustness checks confirmed that this change did not impact study conclusions.

The HCAI dataset also lacked the corresponding variables for mode of arrival including emergency medical services (EMS) rather than private vehicle arrival and admission source to the ED. We could not examine whether patients had agency in determining where they were initially treated or if this was directed by EMS. While HCAI enabled identification of another hospital as a presumptive transfer, there was no variable identifying that a patient was transferred. Additionally, the dataset did not include the patients' home zip code. As a result, specificity in determination of patient rurality was limited by county and the subsequent use of county-level measures from the Census Bureau for the measurement of patient poverty. We were unable to observe the variability in poverty within a county.

Potential lack of generalizability is an additional concern. We only studied California EDs which may limit generalizability due to variation in geography and policies in place (e.g., early expansion of Medicaid and STEMI regionalization). Only 5.4% of patients were uninsured in our study population which limits generalizability to other settings with a larger proportion of uninsured individuals. However, the size of California and diversity of the state are strengths that enhance the generalizability of our findings to similar settings. Finally, we used PCI volume as a surrogate for primary PCI capabilities. While facilities are financially motivated to bill for their services, this may not capture whether PCI capabilities were available at the time of patient arrival. As one of the multiple robustness checks performed, data from 2013 surveyed facility PCI capabilities providing an opportunity to examine whether partial capabilities were associated with the primary outcome.[26] This analysis similarly did not impact study findings. Future work collecting PCI capabilities at the time of individual arrival and care may help to address this specific limitation.

CONCLUSIONS

Uninsured patients with STEMI had significantly lower odds of receiving initial treatment at facilities with PCI capabilities. When uninsured patients did initially receive treatment at facilities with PCI capabilities, these facilities performed fewer annual PCI, suggesting potential disparities in accessing high-quality time-sensitive treatment for uninsured individuals with STEMI. Future work should investigate the contributions of social determinants of health on access to high quality emergency cardiovascular care for the uninsured population and how this impacts patient outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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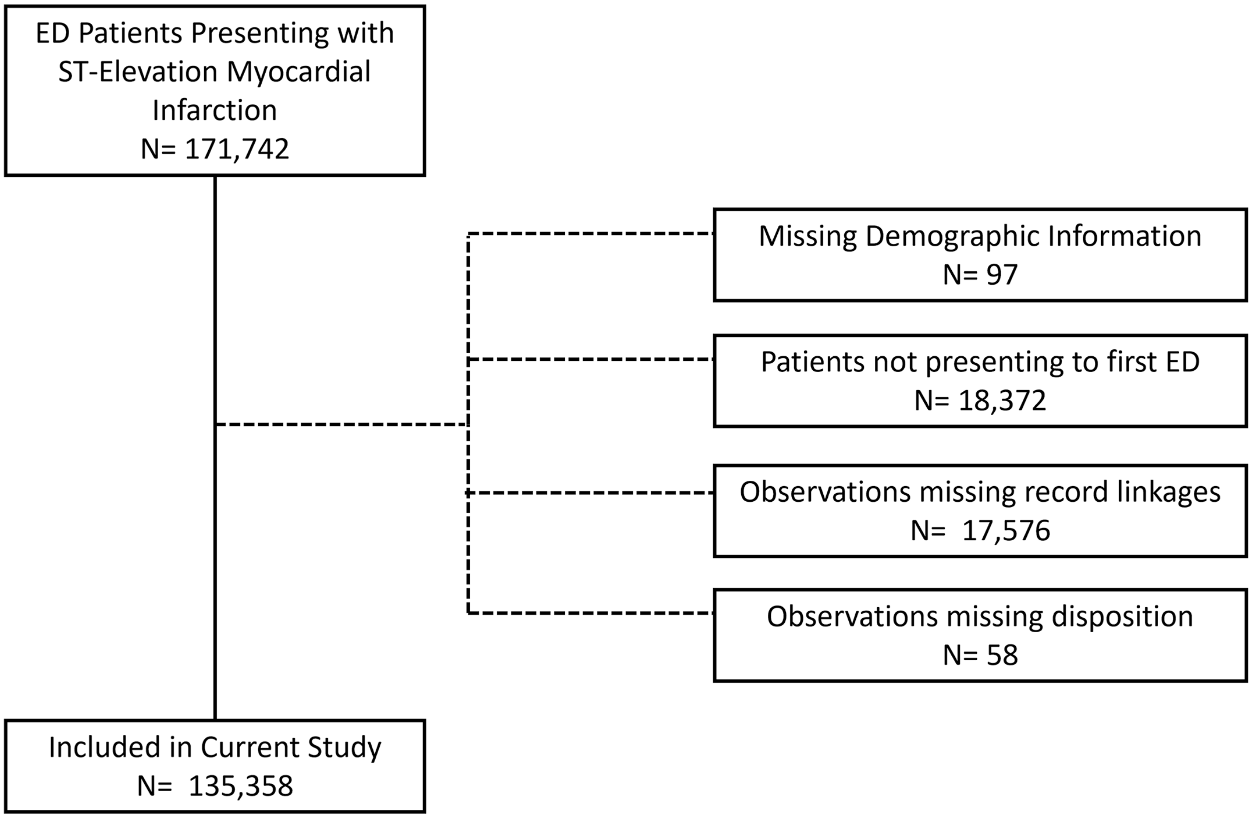

Figure 1.
Cohort Definition

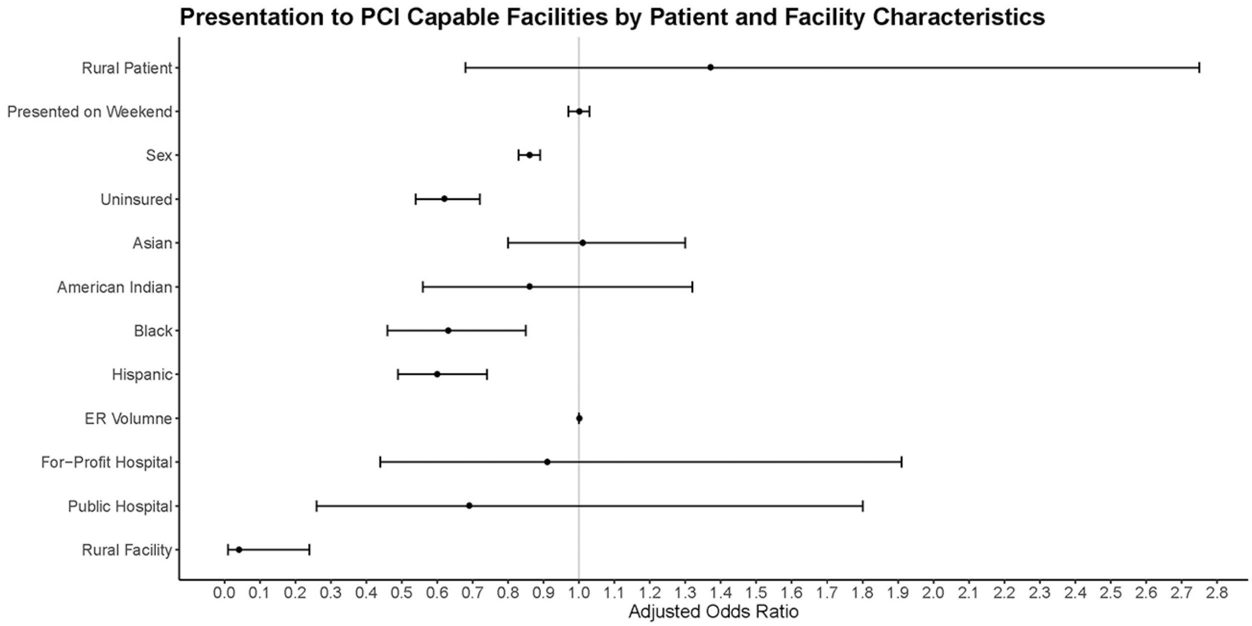

Figure 2.

Initial Treatment at PCI Capable Facilities by Patient and Facility Characteristics

Table 1:

Sample Characteristics for patients with ST-elevation myocardial infarction by insurance status

	Insured (N=128036)	Uninsured (N=7322)	p-value
Age, Mean (SD)	65 (14)	54 (10)	<0.001
Male, N (%)	88403 (69.0%)	5966 (81.5%)	<0.001
Elixhauser Comorbidity Index, Mean (SD)	0.653 (0.519)	0.569 (0.513)	<0.001
Patient Race, N (%)			<0.001
American Indian/Alaskan Native	446 (0.35%)	25 (0.34%)	
Asian/Pacific Islander	11648 (9.1%)	615 (8.4%)	
Black	7236 (5.7%)	524 (7.2%)	
White, non-Hispanic	75930 (59.3%)	3526 (48.2%)	
Other	5765 (4.5%)	370 (5.0%)	
Hispanic	27011 (21.1%)	2262 (30.9%)	
Weekend Arrival, N (%)	36251 (28.3%)	2168 (29.6%)	<0.001
Mean Residents in Poverty by County, N (SD)	543097 (636083)	629052 (692686)	<0.001
Rural Patient, N (%)	13076 (10.2%)	696 (9.5%)	0.05
Rural Facility, N (%)	8264 (6.5%)	460 (6.3%)	0.56
ER Volume Mean (SD)	55251 (26907)	52644 (26202)	<0.001
Transfer (Out) Volume	30691 (24.0%)	2150 (29.4%)	<0.001
Commercial Payment Share Quartile, N (%)			<0.001
1st	12177 (9.5%)	1049 (14.3%)	
2nd	38284 (29.9%)	2283 (31.2%)	
3rd	44566 (34.8%)	2496 (34.1%)	
4th	33009 (25.8%)	1494 (20.4%)	
Ownership, N (%)			<0.001
Non-Profit	89779 (70.1%)	4804 (65.6%)	
Public	16672 (13.0%)	1189 (16.2%)	
For-Profit	21585 (17.1%)	1329 (18.2%)	

Table 2.

Sample Characteristics by Facility PCI Capability

	Initial treatment at Facilities with PCI Capability (N=86068)	Initial treatment at Facilities without PCI Capability (N=49290)	p-value
Age, Mean (SD)	65 (14)	65 (14)	<0.001
Male, N (%)	61185 (71.1%)	33184 (67.3%)	<0.001
Elixhauser Comorbidity Index, Mean (SD)	0.650 (0.518)	0.645 (0.520)	0.09
Patient Race, N (%)			<0.001
American Indian/Alaskan Native	213 (0.25%)	258 (0.52%)	
Asian/Pacific Islander	7986 (9.3%)	4277 (8.7%)	
Black	4483 (5.2%)	3277 (6.7%)	
White non-Hispanic	51938 (60.4%)	27518 (55.8%)	
Other	4485 (5.2%)	1650 (3.3%)	
Hispanic Ethnicity, N (%)	16963 (19.7%)	12310 (25.0%)	
Uninsured, N (%)	3918 (4.6%)	3404 (6.9%)	<0.001
Weekend Arrival, N (%)	24558 (28.5%)	13861 (28.1%)	0.11
Mean Residents in Poverty by County, N (SD)	539510 (616672)	562130 (677456)	<0.001
Rural Patient, N (%)	5268 (6.1%)	8504 (17.3%)	<0.001
Rural Facility, N (%)	356 (0.4%)	8368 (17.0%)	<0.001
ED Volume Mean (SD)	62585 (24733)	42057 (25445)	<0.001
Transfer (Out) Volume	6600 (7.7%)	26241 (53.2%)	<0.001
Commercial Payment Share Quartile, N (%)			<0.001
1st	2782 (3.2%)	10444 (21.2%)	
2nd	25056 (29.1%)	15511 (31.5%)	
3rd	36282 (42.2%)	10780 (21.9%)	
4th	21948 (25.5%)	12555 (25.5%)	
Ownership, N (%)			<0.001
Non-Profit	63156 (73.4%)	31427 (63.8%)	
Public	9572 (11.1%)	8289 (16.8%)	
For-Profit	13340 (15.5%)	9574 (19.4%)	

Table 3:

Main Model Results

Variable	Adjusted OR (95% CI)	p-value
Uninsured	0.62 (0.54–0.72)	<0.001
Age	1.00 (1.00–1.00)	0.13
Male Sex	0.86 (0.83–0.89)	<0.001
Year of Arrival		
2011	1.03 (0.85–1.27)	0.71
2012	1.06 (0.84–1.33)	0.63
2013	1.00 (0.76–1.31)	0.99
2014	0.85 (0.65–1.12)	0.26
2015	0.77 (0.56–1.05)	0.10
2016	0.74 (0.52–1.06)	0.10
2017	0.65 (0.45–0.92)	0.02
2018	0.78 (0.53–1.15)	0.21
2019	0.72 (0.48–1.08)	0.11
Elixhauser Comorbidity Index	1.03 (0.97–1.09)	0.35
Patient Race		
White non-Hispanic	[Reference]	
American Indian/Alaskan Native	0.86 (0.56–1.31)	0.48
Asian/Pacific Islander	1.01 (0.79–1.29)	0.91
Black	0.63 (0.46–0.85)	0.003
Other	1.25 (1.03–1.53)	0.03
Hispanic	0.60 (0.49–0.74)	<0.001
Weekend Arrival	1.00 (0.97–1.03)	0.92
Poverty	1.00 (1.00–1.00)	0.18
Rural Patient	1.37 (0.68–2.75)	0.38
Rural Facility	0.04 (0.01–0.24)	0.001
ER Volume Mean	1.00 (1.00–1.00)	<0.001
Commercial Payment Share Quartile		
First	[Reference]	
Second	3.83 (1.64–8.93)	0.002
Third	7.51 (3.10–18.24)	<0.001
Fourth	2.67 (0.96–7.38)	0.06
Ownership		
Non-Profit	[Reference]	
Public	0.70 (0.26–1.83)	0.46
For-Profit	0.91 (0.44–1.91)	0.81

Table 4:

Annual PCI Volume at the Initial Facility

	Low (11–35) Annual PCI Volume (N = 135,538)		Medium (36–60) Annual PCI Volume (N = 135,538)		High (>60) Annual PCI Volume (N = 135,538)	
	Adjusted Odds Ratio (95% CI)	**p - value**	**Adjusted Odds Ratio (95% CI)**	**p - value**	**Adjusted Odds Ratio (95% CI)**	**p - value**
Uninsured	1.60 (1.39–1.85)	<0.001	0.80 (0.70–0.93)	0.003	0.74 (0.64–0.87)	<0.001
Age	1.00 (1.00–1.00)	0.13	1.00 (1.00–1.00)	0.64	1.00 (1.00–1.00)	0.28
Male Sex (ref=Female)	1.17 (1.12–1.21)	<0.001	0.93 (0.89–0.97)	0.002	0.92 (0.89–0.96)	<0.001
Year of Arrival (ref=2010)						
2011	0.96 (0.79–1.17)	0.71	1.05 (0.75–1.46)	0.76	1.00 (0.76–1.31)	0.99
2012	0.94 (0.75–1.19)	0.63	1.02 (0.76–1.38)	0.89	1.03 (0.79–1.33)	0.85
2013	1.00 (0.77–1.31)	0.99	1.30 (0.87–1.94)	0.19	0.80 (0.58–1.15)	0.22
2014	1.17 (0.89–1.53	0.26	1.20 (0.81–1.76)	0.36	0.74 (0.53–1.04)	0.08
2015	1.31 (0.95–1.79)	0.09	1.71 (1.11–2.64)	0.02	0.47 (0.30–0.74)	0.001
2016	1.34 (0.94–1.91)	0.1	1.41 (0.91–2.20)	0.13	0.55 (0.35–0.87)	0.01
2017	1.55 (1.08–2.21)	0.02	1.59 (1.00–2.56)	0.05	0.43 (0.27–0.68)	<0.001
2018	1.28 (0.87–1.88)	0.21	2.29 (1.41–3.70)	0.001	0.36 (0.22–0.60)	<0.001
2019	1.39 (0.93–2.07)	0.11	2.15 (1.29–3.59)	0.003	0.36 (0.22–0.60)	<0.001
Elixhauser Comorbidity Index	0.97 (0.92–1.03)	0.35	1.02 (0.97–1.08)	0.46	1.00 (0.96–1.06)	0.77
Patient Race (Ref = White)						
American Indian/Alaskan Native	1.16 (0.76–1.78)	0.48	1.67 (0.94–2.97)	0.08	0.50 (0.30–0.83)	0.01
Asian/Pacific Islander	0.99 (0.77–1.26)	0.91	1.62 (1.26–2.09)	<0.001	0.63 (0.49–0.82)	0.001
Black	1.59 (1.17–2.16)	0.003	1.00 (0.76–1.32)	0.98	0.67 (0.48–0.93)	0.02
Other	0.80 (0.65–0.97)	0.03	1.37 (1.10–1.73)	0.01	0.93 (0.75–1.16)	0.51
Hispanic Ethnicity	1.67 (1.36–2.06)	<0.001	0.97 (0.79–1.19)	0.76	0.63 (0.51–0.78)	<0.001
Weekend Arrival	1.00 (0.97–1.03)	0.92	0.97 (0.94–1.00)	0.05	1.03 (0.99–1.05)	0.07
Poverty	1.00 (1.00–1.00)	0.18	1.00 (1.00–1.00)	0.77	1.00 (1.00–1.00)	0.28
Rural Patient	0.73 (0.36–1.46)	0.38	0.78 (0.52–1.17)	0.23	1.48 (0.82–2.69)	0.19
Rural Facility	27.32 (4.19–178.20)	<0.001	0.14 (0.02–0.77)	0.02	Excluded for collinearity	
ER Volume Mean	1.00 (1.00–1.00)	<0.001	1.00 (1.00–1.00)	0.01	1.00 (1.00–1.00)	<0.001
Commercial Payment Share Quartile (ref = 1st)						

	Low (11–35) Annual PCI Volume (N = 135,538)		**Medium (36–60) Annual PCI Volume (N = 135,538)**		**High (>60) Annual PCI Volume (N = 135,538)**	
	Adjusted Odds Ratio (95% CI)	**p - value**	**Adjusted Odds Ratio (95% CI)**	**p - value**	**Adjusted Odds Ratio (95% CI)**	**p - value**
2nd	0.26 (0.11–0.61)	0.002	1.44 (0.73–2.85)	0.29	11.47 (1.85–71.36)	0.01
3rd	0.13 (0.05–0.32)	<0.001	1.38 (0.66–2.90)	0.39	21.66 (3.27–143.27)	0.001
4th	0.37 (0.14–1.04)	0.06	1.44 (0.62–3.36)	0.39	8.29 (1.17–58.95)	0.04
Ownership (ref=Non-Profit)						
Public	1.44 (0.54–3.79)	0.46	0.81 (0.32–2.04)	0.66	0.89 (0.25–3.16)	0.86
For Profit	1.10 (0.52–2.29)	0.81	1.02 (0.52–1.99)	0.96	0.81 (0.36–1.80)	0.59