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Sex, race, and insurance status differences in hospital treatment and outcomes following out-of-hospital cardiac arrest

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ABSTRACT

Background: Sex, race, and insurance status are associated with treatment and outcomes in several cardiovascular diseases. These disparities, however, have not been well-studied in out-of-hospital cardiac arrest (OHCA).
Objective: Our objective was to evaluate the association of patient sex, race, and insurance status with hospital treatments and outcomes following OHCA.
Methods: We studied adult patients in the 2011–2015 California Office of Statewide Health Planning and Development (OSHPD) Patient Discharge Database with a "present on admission" diagnosis of cardiac arrest (ICD-9-CM 427.5). Insurance status was classified as private, Medicare, and Medi-Cal/government/self-pay. Our primary outcome was good neurologic recovery at hospital discharge, which was determined by discharge disposition. Secondary outcomes were survival to hospital discharge, treatment at a 24/7 percutaneous coronary intervention (PCI) center, "do not resuscitate" orders within 24 h of admission, and cardiac catheterization during hospitalization. Data were analyzed with hierarchical multiple logistic regression models.
Results: We studied 38,163 patients in the OSHPD database. Female sex, non-white race, and Medicare insurance status were independently associated with worse neurologic recovery [OR 0.94 (0.89–0.98), 0.93 (0.88–0.98), and 0.85 (0.79–0.91), respectively], lower rates of treatment at a 24/7 PCI center [OR 0.89 (0.85–0.93), 0.88 (0.85–0.93), and 0.87 (0.82–0.94), respectively], and lower rates of cardiac catheterization [OR 0.61 (0.57–0.65), 0.90 (0.84–0.97), and 0.44 (0.40–0.48), respectively]. Female sex, white race, and Medicare insurance were associated with DNR orders within 24 h of admission [OR 1.16 (1.10–1.23), 1.14 (1.07–1.21), and 1.25 (1.15–1.36), respectively].
Conclusions: Sex, race, and insurance status were independently associated with post-arrest care interventions, patient outcomes and treatment at a 24/7 PCI center. More studies are needed to fully understand the causes and implications of these disparities.

Introduction

Out-of-hospital cardiac arrest (OHCA) is the leading cause of death from cardiovascular disease in the United States. Less than 10% of the approximately 350,000 adults who suffer OHCA each year in the United States survive to hospital discharge [1], and survival with good neurologic function is even more rare. Survival with good neurologic function following OHCA depends on immediate bystander recognition of OHCA, rapid prehospital care and effective post-cardiac arrest care. Current guidelines for post-arrest care recommend regionalized care at cardiac resuscitation centers with 24/7 percutaneous coronary intervention (PCI) capability; targeted temperature management for all arrest rhythms; cardiac catheterization for patients with suspected cardiac etiology and deferring prognostication for at least 72 h post-arrest

[2]. Early "do not resuscitate" (DNR) orders within 24 h of admission have been associated with fewer procedures and worse outcomes for post-OHCA patients [3].

Outcome and treatment disparities with respect to age [4,5], sex [4,5], race [5,6] and insurance status [5,7–10] have been suggested for OHCA and acute myocardial infarction. However, these studies do not fully describe disparities in United States patient populations with OHCA. Furthermore, they do not address important prognostic events including in-hospital cardiac catheterization and early DNR orders. In this study, we used the California Office of Statewide Health Planning and Development (OSHPD) Patient Discharge Database to identify demographic and insurance factors associated with in-hospital treatments and outcomes among adults with OHCA. We hypothesized that female sex, non-white race and lack of private insurance would be associated

with lower rates of good neurological recovery, survival to hospital discharge, treatment at a 24/7 PCI center, and cardiac catheterization; and higher rates of receiving a DNR order within 24 h.

Methods

We analyzed a retrospective cohort of adult patients in the OSHPD Patient Discharge Database. This study was approved by the California Committee for the Protection of Human Subjects and was exempt from review by our Institutional Review Board.

Population and setting

California has a population of nearly 40 million people [11]. The OSHPD Patient Discharge Database is a comprehensive data collection system for inpatient encounters in California. Per California Health and Safety Code Section 128736, all acute care hospitals in California (excluding Veterans Affairs and military facilities) must submit data for every inpatient encounter to OSHPD. These data do not represent a sample, but rather surveillance with 100% coverage. Each patient in the OSHPD Patient Discharge Database is assigned a record linkage number, which is a unique alphanumeric value based on the Social Security Number that allows multiple encounters from the same patient to be identified. In this study, we included all adult patients (≥ 18 years) in the OSHPD Patient Discharge Database with a "present on admission" diagnosis of cardiac arrest (International Classification of Diseases, Ninth Revision, Clinical Modification [ICD-9-CM] 427.5) admitted from the emergency department to an acute care hospital from 1/1/2010 to 9/30/2015. We excluded patients with a length of stay over 60 days. We also excluded patients who were missing predictor variable(s) or outcome(s).

Experimental protocol

Patient-level data obtained from OSHPD included record linkage numbers, age, sex, race, ethnicity, insurance status, diagnosis codes (up to 25), present on admission codes, procedure codes (up to 21), survival to hospital discharge, discharge disposition, and receipt of a DNR order within 24 h of admission. Insurance status categories were collapsed into private, Medicare, and Medi-Cal/other government/self-pay. Race was collapsed into white and non-white because each non-white race group contained a small number of patients. Ventricular fibrillation or ventricular tachycardia (VF/VT) rhythms and cardiac catheterization procedures were identified using ICD-9-CM codes in any position. Multiple records for the same patient were identified using record linkage numbers. When multiple records resulted from the patient being transferred from one hospital to another, the records were consolidated into a single record. The initial hospital providing care was considered the treating hospital if the length of stay was greater than one day. If the length of stay at the initial hospital was one day or less, the hospital accepting the patient transfer was considered the treating hospital. When multiple records for the same patients were from unique encounters, only the record from the first encounter was included in the analysis.

Data obtained from the OSHPD Hospital Annual Utilization Data for each year included intensive care unit census days, general acute care bed days, teaching hospital status, and level 1 or 2 trauma center status. Presence of 24/7 PCI capability was obtained from the American Heart Association via the Cardiovascular Research Foundation website [12].

Key outcome measures

Our primary outcome was good neurologic recovery at hospital discharge. In the OSHPD data, good neurologic recovery was defined as discharge to home, residential care facility, prison, jail, or another hospital for non-acute/non-skilled care. Patients who left against

medical advice were also considered to have good neurologic recovery. Patients with all other dispositions, including death, were considered not to have good neurologic recovery [13–15]. Secondary outcomes were survival to hospital discharge, receipt of a DNR order within 24 h of admission, treatment at a 24/7 PCI center, and cardiac catheterization.

Data analysis

Summary statistics were calculated for each variable. Continuous data reported as the median with interquartile ranges. Univariable analyses were performed to evaluate the relationship between sex, non-white race, and insurance status; and the primary and secondary outcomes.

In the analyses for good neurologic recovery, survival to discharge, cardiac catheterization and DNR order within 24 h, hierarchical models with hospitals modeled with random intercepts were used to account for correlation among patients treated at the same hospital [16,17]. Multiple logistic regression models were specified with the following independent variables: age, sex, race, ethnicity, insurance type, ventricular arrest rhythm, hospital size, intensive care unit bed days, 24/7 PCI capability, level 1–2 trauma center designation, and teaching status [18–20]. In the analysis for treatment at a 24/7 PCI center as the dependent variable, a multiple logistic regression model was specified with the following independent variables: age, sex, race, ethnicity, insurance type, and ventricular arrest rhythm. Independent variables were selected *a priori* based on existing literature [18–20] and clinical judgment for all models. All analyses were performed using Stata 14.2 (StataCorp, College Station, TX).

Results

Of 43,909 OSHPD records with a "present on admission" diagnosis of cardiac arrest, 38,163 met our inclusion criteria and had complete data (Fig. 1). Patients missing outcome data (good neurologic recovery, n = 221; survival, n = 12) were excluded from the respective models. The median age of study subjects was 67 years (55–70), and the majority of patients were male (22,178/38,163, 58%; Table 1). Overall, approximately one-quarter of patients had good neurologic recovery at hospital discharge (9,241/37,942, 24%).

Sex and outcomes

In multivariable analysis of the OSHPD data, female sex was associated with worse neurologic recovery (OR 0.94, 95% CI 0.89–0.98), worse survival (OR 0.94, 95% CI 0.90–0.99), decreased odds of cardiac catheterization (OR 0.61, 95% CI 0.57–0.65), decreased odds of treatment at a 24/7 PCI center (OR 0.89, 95% CI 0.85–0.93), and increased odds of receiving a DNR order within one day of admission (OR 1.16, 95% CI 1.10–1.23) (Table 2).

Race and outcomes

White race was associated with better neurologic recovery (OR 1.08, 95% CI 1.02–1.14), increased odds of receiving a DNR order within one day of admission (OR 1.14, 95% CI 1.07–1.21), increased odds of treatment at a 24/7 PCI center (OR 1.13, 95% CI 1.07–1.18), and increased odds of cardiac catheterization (OR 1.11, 95% CI 1.03–1.19) (Table 2).

Insurance and outcomes

Medicare insurance was associated with worse neurologic recovery (OR 0.85, 95% CI 0.79–0.91). Non-private insurance was associated with worse survival (OR 0.65, 95% CI 0.61–0.69 for government insurance and OR 0.78, 95% CI 0.73–0.83 for Medicare), increased odds