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Clinical paper

Racial/ethnic and gender disparities of the impact of the COVID-19 pandemic in out-of-hospital cardiac arrest (OHCA) in Texas

Summer Chavez, Ryan Huebing, Hei Kit Chan, Kevin Schulz, Micah Panczyk, Normandy Villa, Renee Johnson, Robert Greenberg, Veer Vithalani, Rabab Al-Araji, Bentley Bobrow

Abstract

Introduction: Prior research shows a greater disease burden, lower BCPR rates, and worse outcomes in Black and Hispanic patients after OHCA. Female OHCA patients have lower rates of BCPR compared to men and other survival outcomes vary. The influence of the COVID-19 pandemic on OHCA incidence and outcomes in different health disparity populations is unknown.

Methods: We used data from the Texas Cardiac Arrest Registry to Enhance Survival (CARES). We determined the association of both prehospital characteristics and survival outcomes with the pandemic period in each study group through Pearson’s \( \chi^2 \) test or Fisher’s exact tests. We created mixed multivariable logistic regression models to compare odds of cardiac arrest care and outcomes between 2019 and 2020 for the study groups.

Results: Black OHCA patients (aOR = 0.73; 95% CI: 0.65 – 0.82) had significantly lower odds of BCPR compared to White OHCA patients, were less likely to achieve ROSC (aOR = 0.86; 95% CI: 0.74 – 0.99) or have a good CPC score (aOR = 0.47; 95% CI: 0.29 – 0.75). Compared to White patients with OHCA, Hispanic persons were less likely to have a field TOR (aOR = 0.86; 95% CI: 0.75 – 0.99) or receive BCPR (aOR = 0.78; 95% CI: 0.69 – 0.87). Female OHCA patients had higher odds of surviving to hospital admission compared to males (aOR = 1.29; 95% CI: 1.15 – 1.44).

Conclusion: Many OHCA outcomes worsened for Black and Hispanic patients. While some aspects of care worsened for women, their odds of survival improved compared to males.

Keywords: Cardiac arrest, Out-of-hospital cardiac arrest, Prehospital care, COVID-19, Disparities, Healthcare disparities, Minority health, Vulnerable populations

Introduction

In the United States (US), nearly 1,000 people daily suffer from non-traumatic out-of-hospital cardiac arrest (OHCA), with 90% of cases fatal, making this a significant public health issue. Although the overall US death rate has decreased over the last few decades, this has been offset by recent increases in racial and ethnic disparities. Even before the coronavirus disease 2019 (COVID-19) pandemic, there was 21% a higher cardiac disease death rate in Black persons than in White persons. During the early phases of the pandemic in the US, health disparity populations experienced a disproportional increase in deaths from heart disease and strokes. In addition to disparities in the prevalence of cardiac arrest, focus must also be placed on the inequities that exist in cardiac arrest care and outcomes.

Timely bystander cardiopulmonary resuscitation (BCPR) and automated external defibrillator use (AED) are two interventions demonstrating the greatest impact on OHCA outcomes. Overall, approximately half of OHCA patients receive BCPR while estimates of public AED use vary from 9-12%. Compared to White patients, Black and Hispanic patients are less likely to have a witnessed arrest, be in a shockable rhythm, or receive bystander CPR. Females are less likely to receive BCPR with other outcomes.
We defined patient cardiac arrest characteristics as age, gender, race/ethnicity (Non-Hispanic White, Non-Hispanic Black, Hispanic, Other), witnessed arrest, location type (home/residence, public), and initial rhythm type (shockable, non-shockable). The disparity groups of interest were race/ethnicity and gender. Prehospital outcomes were BCPR, PAD, sustained ROSC, and prehospital termination of resuscitation (TOR). The hospital survival outcomes were survival to hospital admission, survival to hospital discharge, good neurologic outcomes (CPC score 1 or 2), and Utstein bystander survival rate (OHCA patients surviving to hospital discharge with a witnessed arrest by bystander, initial rhythm that was shockable and received BCPR and/or AED interventions).24

Statistical analysis
We examined patient characteristics, prehospital outcomes and hospital survival outcomes through descriptive statistics stratified by year. For age, we determined the medians and interquartile ranges between the two years. We evaluated the age difference between the two groups using two-sample Wilcoxon rank sum (Mann-Whitney) test. For examining association of other categorical variables with the two groups, we used Pearson’s $\chi^2$ test and Fisher’s exact tests (for variables with expected frequencies < 5). Sub-setting the data by race/ethnic group and gender, we determined the association of both prehospital characteristics and survival outcomes with the pandemic period in each disparity group through Pearson’s $\chi^2$ test or Fisher’s exact tests.

We created mixed multivariable logistic regression models to compare odds of cardiac arrest care and outcomes between 2019 and 2020. We analyzed the dependent variable of interest (bystander CPR, bystander AED, sustained ROSC, TOR, survival to admission, survival to discharge, good CPC score, Utstein bystander survival) for the pre-pandemic and pandemic periods with race, ethnicity and gender as covariates adjusting for other arrest characteristics (i.e. location type, shockable rhythm, witnessed arrest), modeling EMS agency as the random intercept. We constructed mixed multivariable logistic regression models to study the association of disparity groups (gender and race/ethnicity) with our outcomes of interest (bystander CPR, bystander AED, sustained ROSC, TOR, survival to admission, survival to discharge, good CPC score, Utstein bystander survival), adjusting for the pandemic and other arrest characteristics (i.e. location type, shockable rhythm, witnessed arrest) and modeling EMS agency as the random intercept. We obtained adjusted odds ratios of the pandemic year and the disparity groups on both prehospital arrest care and hospital survival outcomes of interest with 95% confidence intervals. All analyses were conducted with STATA 16.1.

Results
The total sample included 8,037 instances of OHCA. (Fig. 1) In 2019, there were 3,619 (45.0%) cases which increased in 2020 (4,418; 55.0%). The distribution of gender and race/ethnicity remained consistent both years. (Table 1) When comparing prehospital characteristics and survival outcomes between 2019 and 2020 in White OHCA patients, we found an association with pandemic year, worsening from 2019 to 2020: BCPR (48.7% in 2019 vs 44.8% in 2020; $P<0.01$), bystander AED (15.9% in 2019 vs 8.1% in 2020; $P<0.01$), sustained ROSC (28.8% in 2019 vs 22.4% in 2020; $P<0.01$), field TOR (39.0% in 2019 vs 50.2%; $P<0.01$) and survival to hospital admission (27.2% in 2019 vs 21.7% in 2020; $P<0.01$). Similarly, there were worse outcomes for Black OHCA patients including sustained ROSC (27.0% in 2019 vs 19.0% in 2020; $P<0.01$), field TOR (32.6% in 2019 vs 38.4% in 2020; $P<0.01$), survival to hospital admission (27.6% in 2019 vs 20.6% in 2020; $P<0.01$), and survival to hospital discharge (10.2% in 2019 vs 7.2% in 2020; $P=0.02$) were associated with the pandemic year. For Hispanic patients, we found BCPR (42.6% in 2019 vs 37.8% in 2020; $P=0.03$), sustained ROSC (30.5% in 2019 vs 22.0% in
2020; P < 0.01), TOR (39.8% in 2019 vs 50.0% in 2020; P < 0.01), survival to admission (26.2% in 2019 vs 21.1% in 2020; P < 0.01), and survival to discharge (8.3% in 2019 vs 5.9% in 2020; P = 0.03) were associated with pandemic year and worsened. For patients of Other race/ethnicity, we also found BCPR (55.7% in 2019 vs 43.1% in 2020; P = 0.01), sustained ROSC (30.7% in 2019 vs 20.4% in 2020; P < 0.01), survival to hospital admission (29.3% in 2019 vs 15.3% in 2020; P < 0.01), and survival to hospital discharge (11.0% in 2019 vs 5.1% in 2020; P = 0.03) were significantly associated with the pandemic year and worsened.

We examined the same set of outcomes by gender, finding significant associations with the pandemic year in male OHCA patients for nearly all outcomes: BCPR (46.7% in 2019 vs 42.1% in 2020; P < 0.01), bystander AED (15.0% in 2019 vs 7.1% in 2020; P < 0.01), sustained ROSC (27.3% in 2019 vs 20.4% in 2020; P < 0.01), TOR (36.5% in 2019 vs 45.7% in 2020; P < 0.01), survival to hospital admission (27.1% in 2019 vs 20.5% in 2020; P < 0.01), survival to hospital discharge (10.9% in 2019 vs 7.6% in 2020; P < 0.01), and Utstein bystander survival (39.1% in 2019 vs 27.8% in 2020; P = 0.01). Female OHCA patients had much fewer worsened outcomes with significant associations to the pandemic years: sustained ROSC (31.7% in 2019 vs 22.5% in 2020; P < 0.01), and survival to hospital admission (27.2% in 2019 vs 21.8% in 2020; P < 0.01). All health disparity population groups had lower rates of sustained ROSC in 2020. Black, Hispanic and Other persons all had increased rates of TOR, decreased survival to hospital admission and discharge. The proportion of OHCA patients with good neurologic outcomes remained consistent from 2019 to 2020 for all study groups. While the Utstein bystander survival rate had a notable decrease only in males, it remained consistent for all other study groups (Table 2).

In our first series of regression models, we compared the odds ofprehospital cardiac arrest care and outcomes between the pre-pandemic and pandemic periods. The overall odds of receiving BCPR was less during the COVID-19 period than before (aOR = 0.87; 95% CI: 0.79 – 0.95). In general, OHCA patients were half as likely to receive bystander AED (aOR = 0.53; 95% CI: 0.36 – 0.79) during the COVID-19 period than the pre-COVID-19 period. Odds of TOR was higher during the COVID-19 period than prior (aOR = 1.51; 95% CI: 1.36 –1.68). There was lower odds of sus-

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**Table 1 – Patient Cardiac Arrest Characteristics, Stratified by Year.**

|                | 2019 N = 3,619 (45.0%) | 2020 N = 4,418 (55.0%) | P-Value |
|----------------|------------------------|------------------------|---------|
| Age (Years)1, median (IQR2) | 63 (51 – 74)               | 63 (51 – 74)               | 0.70    |
| Gender3, n (%) | Male 2,307 (63.8%)          | 2,781 (62.9%)               | 0.50    |
|                | Female 1,312 (36.3%)            | 1,637 (37.1%)               |         |
| Race & Ethnicity3, n (%) | White 1,591 (44.0%)            | 1,857 (42.0%)                | 0.20    |
|                | Black/African-American 901 (24.9%)   | 1,128 (25.5%)                |         |
|                | Hispanic/Latino 935 (25.8%)         | 1,217 (27.6%)                |         |
|                | Other 192 (5.3%)               | 216 (4.9%)                   |         |

1 P-value determined using two-sample Wilcoxon rank-sum (Mann-Whitney) test.
2 IQR stands for inter-quartile range.
3 P-value determined using Pearson’s χ² test.

Fig. 1 – Study Flowchart for Patient Inclusion and Exclusion.
| Race and Ethnicity | 2019 | 2020 | P-value |
|-------------------|------|------|---------|
| White N = 1,591  |      |      |         |
| Bystander CPR 1, n (%) | 775 (48.7%) | 832 (44.8%) | 0.02 |
| Bystander AED 1, n/N (%) | 50/315 (15.9%) | 21/260 (8.1%) | < 0.01 |
| Sustained ROSC, n (%) | 458 (28.8%) | 416 (22.4%) | < 0.01 |
| Field Termination, n (%) | 621 (39.0%) | 932 (50.2%) | < 0.01 |
| Survival to Hospital Admission, n (%) | 433 (27.2%) | 402 (21.7%) | < 0.01 |
| Survival to Hospital Discharge, n (%) | 170 (10.7%) | 163 (8.8%) | 0.06 |
| Good Neurologic Outcome, n/N (%) | 127/170 (74.7%) | 120/163 (73.6%) | 0.80 |
| Utstein Bystander Survival, n/N (%) | 55/160 (34.4%) | 46/148 (31.1%) | 0.50 |
| Black N = 901 |      |      |         |
| Bystander CPR 1, n (%) | 390 (43.3%) | 478 (42.4%) | 0.70 |
| Bystander AED 1, n/N (%) | 23/186 (12.4%) | 10/148 (6.8%) | 0.10 |
| Sustained ROSC, n (%) | 243 (27.0%) | 214 (19.0%) | 0.01 |
| Field Termination, n (%) | 294 (32.6%) | 433 (38.4%) | < 0.01 |
| Survival to Hospital Admission, n (%) | 248 (27.6%) | 232 (20.6%) | < 0.01 |
| Survival to Hospital Discharge, n (%) | 92 (10.2%) | 81 (7.2%) | 0.02 |
| Good Neurologic Outcome, n/N (%) | 51/89 (57.3%) | 42/81 (51.9%) | 0.50 |
| Utstein Bystander Survival, n/N (%) | 32/65 (49.2%) | 19/57 (33.3%) | 0.08 |
| Hispanic N = 935 |      |      |         |
| Bystander CPR 1, n (%) | 398 (42.6%) | 460 (37.8%) | 0.03 |
| Bystander AED 1, n/N (%) | 10/147 (6.8%) | 10/151 (6.6%) | 0.95 |
| Sustained ROSC, n (%) | 285 (30.5%) | 268 (22.0%) | < 0.01 |
| Field Termination, n (%) | 372 (39.8%) | 609 (50.0%) | < 0.01 |
| Survival to Hospital Admission, n (%) | 244 (26.2%) | 256 (21.1%) | < 0.01 |
| Survival to Hospital Discharge, n (%) | 77 (8.3%) | 71 (5.9%) | 0.03 |
| Good Neurologic Outcome, n/N (%) | 57/77 (74.0%) | 48/71 (67.6%) | 0.40 |
| Utstein Bystander Survival, n/N (%) | 27/71 (38.0%) | 18/62 (29.0%) | 0.30 |
| Other N = 192 |      |      |         |
| Bystander CPR 1, n (%) | 107 (55.7%) | 93 (43.1%) | 0.01 |
| Bystander AED 1, n/N (%) | 7/45 (15.6%) | 2/28 (7.1%) | 0.50 |
| Sustained ROSC, n (%) | 59 (30.7%) | 38 (17.6%) | < 0.01 |
| Field Termination, n (%) | 62 (32.3%) | 89 (41.2%) | 0.06 |
| Survival to Hospital Admission, n (%) | 56 (29.3%) | 33 (15.3%) | < 0.01 |
| Survival to Hospital Discharge, n (%) | 21 (11.0%) | 11 (5.1%) | 0.03 |
| Good Neurologic Outcome, n/N (%) | 15/21 (71.4%) | 10/11 (90.9%) | 0.40 |
| Utstein Bystander Survival, n/N (%) | 10/26 (38.5%) | 4/12 (33.3%) | 1.00 |
| Gender |      |      |         |
| Male N = 2,307 |      |      |         |
| Bystander CPR 1, n (%) | 1,078 (46.7%) | 1,170 (42.1%) | < 0.01 |
| Bystander AED 1, n/N (%) | 80/534 (15.0%) | 32/454 (7.1%) | < 0.01 |
| Sustained ROSC, n (%) | 629 (27.3%) | 568 (20.4%) | < 0.01 |
| Field Termination, n (%) | 841 (36.5%) | 1,272 (45.7%) | < 0.01 |
| Survival to Hospital Admission, n (%) | 624 (27.1%) | 567 (20.5%) | < 0.01 |
| Survival to Hospital Discharge, n (%) | 251 (10.9%) | 211 (7.6%) | < 0.01 |
| Good Neurologic Outcome, n/N (%) | 181/249 (72.7%) | 152/211 (72.0%) | 0.90 |
| Utstein Bystander Survival, n/N (%) | 97/48 (39.1%) | 59/212 (27.8%) | 0.01 |
| Female N = 1,312 |      |      |         |
| Bystander CPR 1, n (%) | 592 (45.1%) | 693 (42.3%) | 0.10 |
| Bystander AED 1, n/N (%) | 10/159 (6.3%) | 11/133 (8.3%) | 0.50 |
| Sustained ROSC, n (%) | 416 (31.7%) | 368 (22.5%) | < 0.01 |
| Field Termination, n (%) | 508 (38.7%) | 791 (48.3%) | 0.50 |
| Survival to Hospital Admission, n (%) | 357 (27.2%) | 356 (21.8%) | < 0.01 |
| Survival to Hospital Discharge, n (%) | 109 (8.3%) | 115 (7.0%) | 0.20 |
| Good Neurologic Outcome, n/N (%) | 69/108 (63.9%) | 68/115 (59.1%) | 0.50 |
| Utstein Bystander Survival, n/N (%) | 27/74 (36.5%) | 28/67 (41.8%) | 0.50 |

1 P-value determined using Pearson's \( \chi^2 \) test.
2 P-value determined using Fisher's exact test.
tained ROSC during COVID-19 than before (aOR = 0.67; 95% CI: 0.60 – 0.75). Survival to hospital admission (aOR = 0.73; 95% CI: 0.65 – 0.82) and odds of survival to hospital discharge worsened during the COVID-19 period (aOR = 0.81; 95% CI: 0.68 – 1.45).

In our second series of regression models, we compared the odds of prehospital cardiac arrest care and outcomes by specific health disparity populations. Black OHCA patients (aOR = 0.73; 95% CI: 0.65 – 0.82) and Hispanic OHCA patients (aOR = 0.78; 95% CI: 0.69 – 0.87) had significantly lower odds of BCPR compared to White OHCA patients. Compared to White OHCA patients, Black OHCA patients were less likely to achieve ROSC (aOR = 0.86; 95% CI: 0.74 – 0.99). Compared to White OHCA patients, Hispanic patients were less likely to have field TOR (aOR = 0.86; 95% CI: 0.75 – 0.99). Black OHCA patients were less likely to have a good CPC score (aOR = 0.47; 95% CI: 0.29 – 0.75) compared to White OHCA patients. Females were less likely to receive bystander AED (aOR = 0.60; 95% CI: 0.37 – 0.98) or experience field TOR (aOR = 0.89; 95% CI: 0.8 – 1.06) but had higher odds of surviving to hospital admission compared to males (aOR = 1.29; 95% CI: 1.15 – 1.44) (see Table 3).

Discussion

In this statewide study analyzing changes in prehospital care and OHCA outcomes by race/ethnicity and gender, we found significant associations between year and outcome. Relative to the reference groups, we found worsening odds for several health disparity populations. There is a paucity of literature examining racial, ethnic and gender disparities in OHCA in setting of the COVID-19 pandemic. To our knowledge, this is the first and only statewide analysis comparing racial/ethnic and gender disparity outcomes for OHCA patients.

While there were absolute increases in the incidence of Black and Hispanic OHCA cases with a corresponding decrease in Whites, this did not reach statistical significance. (Table 1) This trend has been demonstrated in a small but growing body of work conducted during the early pandemic, finding increases in OHCA for Black and Hispanic patients relative to 2019.25,26 Rates of BCPR and PAD worsened in 2020 for the White and male reference groups. However, this trend was not consistent for female and racial/ethnic health disparity outcomes. We found significant decreases in bystander AED for Black patients only and BCPR for Hispanics and Other persons; no statistically significant difference in these outcomes were noted for females. We found lower odds of BCPR for Black and Hispanic persons compared to White persons. In a study conducted prior to the COVID-19 pandemic in Los Angeles County, Bosson, et. al found rates of BCPR to be lower in Black (37%) and Hispanic (37%) patients compared to White patients (44%); these figures are comparable to our results.12

We found significant decreases in odds of bystander AED, sustained ROSC and survival to admission while TOR increased. For all study groups, at least one aspect of prehospital care or OHCA outcomes worsened. This underscores the impact of the pandemic in erasing hard fought gains in improving overall outcomes and disparities that may have been narrower in the past. This also suggests that existing health systems and infrastructure was not sufficient to address this epidemiologic change. Interventions designed to increase BCPR and PAD uptake represents a rich target for future public health interventions.

All study groups had lower rates of sustained ROSC in 2020. This is comparable to other studies which found for all-comers, rates of sustained ROSC decreased from 29.8% in 2019 to 23.0%.27,28 When stratified by race/ethnicity and gender, the figures were similar for White (22.4%) and Hispanic (22.0%) persons, but worse for Black (19.0%) and Other (17.6%) persons. We found increased rates of field TOR for Black (38.4%), Hispanic (50.0%) and Other (41.2%) OHCA patients in 2020, which were slightly lower compared to overall estimates in the literature (53.9%).27,28 Rates of survival to hospital admission and hospital discharge decreased for all health disparity populations. Although Black and Hispanic OHCA patients both had lower rates of sustained ROSC, Black, Hispanic and Other groups all had increased rates of TOR and decreased survival to hospital admission and discharge.

Though the proportion of OHCA patients with good neurologic outcomes remained consistent from 2019 to 2020, Black OHCA patients had nearly half the odds of a good CPC score compared to Whites. These findings are consistent with past research by Monlezun, et. al which found Black patients had greater odds of poor neurologic outcomes (OR = 2.21, 95% CI 1.25–3.92) compared to White patients.29 Whereas the Utstein bystander survival rate had a notable decrease only in males, it remained consistent for all other health disparity populations. (Table 2) We found many survival out-

Table 3 – General Outcomes, Stratified by Pandemic5 and Disparity Group.6

| Pandemic | Bystander CPR | Female Gender1 | Black2 | Hispanic2 | Other2 |
| --- | --- | --- | --- | --- | --- |
| aOR1 [95% CI] | aOR1 [95% CI] | aOR1 [95% CI] | aOR1 [95% CI] | aOR1 [95% CI] | aOR1 [95% CI] |
| Bystander CPR | 0.87 [0.79, 0.95] | 1.02 [0.93, 1.12] | 0.73 [0.65, 0.82] | 0.78 [0.69, 0.87] | 1.01 [0.82, 1.24] |
| Bystander AED | 0.53 [0.36, 0.79] | 0.60 [0.37, 0.98] | 0.85 [0.54, 1.36] | 0.6 [0.34, 1.05] | 1.00 [0.47, 2.13] |
| Sustained ROSC | 0.67 [0.60, 0.75] | 1.40 [1.26, 1.57] | 0.86 [0.74, 0.99] | 1.13 [0.99, 1.30] | 0.92 [0.71, 1.18] |
| Field Termination | 1.51 [1.36, 1.68] | 0.89 [0.8, 0.99] | 0.92 [0.8, 1.06] | 0.86 [0.75, 0.99] | 0.88 [0.69, 1.13] |
| Survival to Admission | 0.73 [0.65, 0.82] | 1.29 [1.15, 1.44] | 0.93 [0.81, 1.08] | 1.06 [0.92, 1.23] | 0.85 [0.65, 1.10] |
| Survival to Discharge | 0.81 [0.68, 0.96] | 1.16 [0.96, 1.39] | 1.01 [0.81, 1.26] | 0.82 [0.65, 1.04] | 0.76 [0.50, 1.16] |
| Good CPC Score | 0.99 [0.68, 1.45] | 0.91 [0.61, 1.35] | 0.47 [0.29, 0.75] | 1.0 [0.59, 1.89] | 0.90 [0.32, 2.53] |
| Utstein Bystander Survival | 0.72 [0.51, 1.02] | 1.22 [0.81, 1.82] | 1.31 [0.81, 2.1] | 1.01 [0.62, 1.63] | 1.01 [0.49, 2.09] |

1 Male gender designated as reference group.
2 White race designated as reference group.
3 aOR stands for adjusted odds ratio.
4 CI stands for confidence interval.
5 Mixed multivariable logistic regression model, adjusting for age, gender, race/ethnicity and other arrest characteristics; EMS agency modeled as a random intercept.
6 Mixed multivariable logistic regression model, adjusting for pandemic, age and other arrest characteristics; EMS agency modeled as a random intercept.
comes worsened for not just health disparity groups, but also the reference groups, demonstrating worsening health inequities. While this may be linked to poorer prehospital care (i.e. lower rates of BCPR and PAD usage), they are likely multifactorial in nature. Socioeconomic inequities such as health care, community characteristics, economic stability and discrimination contribute to health disparities.30,31 The impact of this complex interplay of factors has become more significant during the COVID-19 pandemic and requires a multi-level systemic response for meaningful change.31

Conflicting evidence exists regarding prehospital care and survival outcomes by sex.13–15

In our study, females had better odds of sustained ROSC and survival to admission compared to males. This differs from prior research demonstrating lower rates of BCPR, survival to hospital admission, odds of survival to discharge and good neurologic outcomes for females.32,33 Although we were unable to control for comorbidities or COVID-19 status, prior studies illustrate already existing gender disparities in COVID-19 patient outcomes, such as higher mortality in males.34,35 Further study is necessary to characterize this trend long-term.

Results from this analysis provide evidence of the pandemic affecting most aspects of the cardiac chain of survival, including public bystander interventions and survival outcomes. Although all racial/ethnic and gender groups were affected somewhat, persistent disparities exist even when adjusting for the pandemic. Our results also suggest a novel direction for outcomes of OHCA female patients with greater survival odds. Future efforts to improve cardiac arrest care and outcomes during the COVID-19 pandemic transition period necessitates a multi-pronged approach to reduce disparities.

Limitations

Our analysis was limited to 2019 and 2020 so we were unable to analyze for any additional trends beyond this period. As Texas-CARES is continually growing, we wanted to include two years that had a similar number of CARES participating agencies. Including data prior to 2019 would have increased the size of the pre-pandemic group, but there were also fewer participating agencies, making it less comparable to the 2020 Texas-CARES cohort. Because the study was statewide, there may be unaccounted differences on the local level. Our analysis did not include variables related to post-arrest care. Additionally, our data set did not include comorbidities, COVID-19 status or allow clustering by individual hospital or census tract with socioeconomic variables. Socioeconomic status and geographic location, such as neighborhood, have been shown to contribute to OHCA outcomes but were not included as this was outside the scope of the analysis. Other statistical models such as differences-in-differences and time-interrupted analyses were considered for the analysis but given that all groups were exposed to the pandemic, we selected the models we felt would best evaluate the research questions. Variations among EMS agencies and changes in prehospital protocols during the pandemic may have also affected patient outcomes but could not be specifically identified within the data set.

Conclusion

This analysis provides state-wide evidence demonstrating at least one aspect of worsening prehospital cardiac arrest care or outcomes for every studied group. All-comers experienced worsening rates of ROSC and survival to hospital discharge. Disparities worsened for Black and Hispanic patients compared to White patients. Females had higher odds of ROSC and survival to hospital admission compared to males. Survival with good neurologic outcomes did not change for any group. Our study is significant because of its extended study period and catchment size and while adding to health disparities literature.
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