

# Letters

## RESEARCH LETTER

### HEALTH CARE POLICY AND LAW

#### Automated External Defibrillator Use After Out-of-Hospital Cardiac Arrest at Recreational Facilities

Out-of-hospital cardiac arrest (OHCA) during exercise is often due to a ventricular arrhythmia for which prompt defibrillation from an automated external defibrillator (AED) can be lifesaving.<sup>1</sup> Some US states have enacted laws requiring athletic facilities to have an AED on-site.<sup>2,3</sup> However, contemporary rates of bystander AED application in states that have enacted such laws remain unknown. This cohort study

used the Cardiac Arrest Registry to Enhance Survival (CARES)<sup>4</sup> to examine bystander AED application and survival outcomes for OHCA at recreational facilities in states with and without AED legislation.



Editor's Note



Supplemental content

**Methods** | Using CARES data from January 1, 2013, to December 31, 2021, we identified 10 008 adults (age ≥18 years) with nontraumatic OHCA at recreational facilities. We excluded 669 cases of OHCA witnessed by 911 responders, 39 cases in 1 state that passed AED legislation in 2020, and 10 cases in 3 states with fewer than 5 OHCA cases at recreational facilities. Outcomes were bystander AED application, survival to admission, and survival to discharge. We report demographics, cardiac arrest characteristics, and study outcomes for OHCA at recreational facilities in law and nonlaw states. Given the cross-sectional nature of our analysis and lack of OHCA data before AED laws were passed, we did not directly compare AED rates or survival between law and nonlaw states. Analysis was performed using SAS, version 9.4. This study was approved by the institutional review board at The University of Texas Southwestern Medical Center, which waived the requirement for informed consent because deidentified data were used. This study followed the **STROBE** reporting guideline.

**Results** | A total of 4145 OHCA cases at recreational facilities in 13 AED law states and 5145 cases in 27 nonlaw states were in-

Table. Baseline Demographics and Cardiac Arrest Characteristics Overall and by State AED Law Status

Baseline characteristic	Patients, No. (%)		
	Overall (N = 9290)	States with AED law (n = 4145)	States without AED law (n = 5145)
Age, mean (SD), y	56.9 (16.4)	56.9 (16.4)	56.9 (16.4)
Age categories, y			
18-44	2013 (21.7)	906 (21.9)	1107 (21.5)
45-60	2750 (29.6)	1247 (30.1)	1503 (29.2)
>60	4527 (48.7)	1992 (48.1)	2535 (49.3)
Gender <sup>a</sup>			
Men	7938 (85.5)	3528 (85.1)	4410 (85.7)
Women	1350 (14.5)	616 (14.9)	734 (14.3)
Race and ethnicity <sup>b</sup>			
Asian	402 (4.3)	182 (4.4)	220 (4.3)
Black	971 (10.5)	456 (11.0)	515 (10.0)
Hispanic or Latino	508 (5.5)	264 (6.4)	244 (4.7)
White	5084 (54.7)	2168 (52.3)	2916 (56.7)
Other, multiracial, or unknown <sup>c</sup>	2325 (25.0)	1075 (25.9)	1250 (24.2)
Etiology			
Presumed cardiac etiology	7125 (76.7)	3274 (79.0)	3851 (74.9)
Drowning or submersion	1499 (16.1)	538 (13.0)	961 (18.7)
Drug overdose	276 (3.0)	156 (3.8)	120 (2.3)
Respiratory or asphyxia	258 (2.8)	119 (2.9)	139 (2.7)
Other	132 (1.4)	58 (1.4)	74 (1.4)
Shockable rhythm <sup>d</sup>	4342 (46.8)	1903 (45.9)	2439 (47.4)
Witnessed arrest	6275 (67.6)	2732 (65.9)	3543 (68.9)
Bystander CPR	5693 (61.3)	2399 (57.9)	3294 (64.0)

Abbreviations: AED, automated external defibrillator; CPR, cardiopulmonary resuscitation.

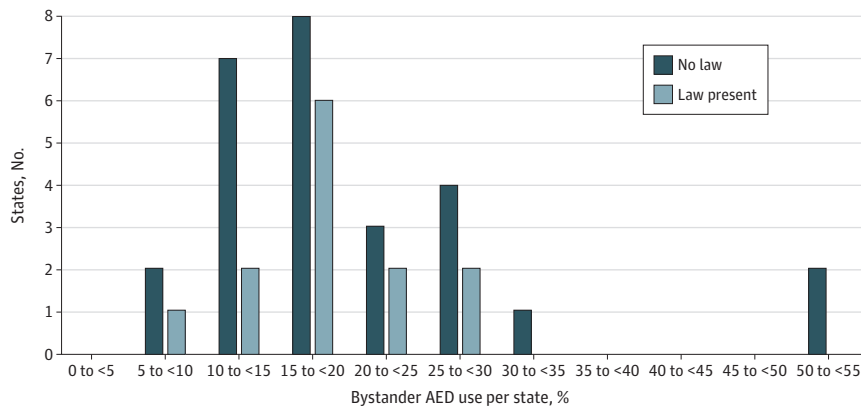
<sup>a</sup> Gender was ascertained via self-report by the patients or their family. One patient was categorized as nonbinary and 1 had missing sex.

<sup>b</sup> Race and ethnicity were ascertained via self-report by the patients or their family and were included in the analysis to describe the characteristics of the study cohort.

<sup>c</sup> Other race and ethnicity includes American Indian or Alaska Native, Native Hawaiian or Pacific Islander, and multiple races. These were combined due to small numbers.

<sup>d</sup> Two patients had missing shockable rhythm status.

**Figure. Rates of Bystander Automated External Defibrillator (AED) Application for Out-of-Hospital Cardiac Arrest at Recreational Facilities by State AED Law Status**



cluded. The initial rhythm was shockable in 4342 cases (46.8%), 6275 cases (67.6%) were witnessed, and bystander cardiopulmonary resuscitation was performed in 5693 cases (61.3%) (Table).

Among law states, the median rate of bystander AED application was 19.0% and varied markedly across states (IQR, 15.1%-22.0%; range, 8.6%-28.8%) (Figure). Median survival to admission was 44.5% (IQR, 39.4%-56.9%; range, 36.0%-58.6%), and median survival to discharge was 31.0% (IQR, 25.2%-32.8%; range, 18.9%-42.9%). Among nonlaw states, the median rate of bystander AED application was 18.2% (IQR, 13.9%-25.0%; range, 7.4%-50.0%) (Figure). Median survival to admission was 45.0% (IQR, 38.4%-52.1%; range, 33.3%-70.0%), and median survival to discharge was 28.4% (IQR, 25.9%-37.5%; range, 15.8%-50.0%).

**Discussion** | Prompt application of an AED is a critical link in the chain of survival.<sup>5</sup> Many US states have passed legislation requiring AEDs at athletic facilities as part of granting an operating license. Despite these well-intended efforts, 19.0% of patients had an AED applied by a bystander in states requiring AEDs at athletic facilities, and this rate was numerically similar in law and nonlaw states even though shockable rhythms comprised 46.8% of all OHCA. Among law states, bystander AED application varied but was still only 28.8% in the best performing state. Our findings highlight that legislative efforts alone may not be sufficient to improve bystander AED use; additional efforts, such as geolocation of available AEDs, ensuring procurement, appropriate signage, dispatcher-assisted guidance, and continued education of facilities staff and the lay public, may be necessary.<sup>6</sup>

Although CARES is the largest OHCA database in the US, our findings may not generalize to nonparticipating sites. In addition to athletic facilities, recreational facilities in CARES can include campsites, beaches, public parks, and trails. The availability of AEDs on-site in law states cannot be confirmed as this information is not collected in CARES. All states had passed AED laws before our study period, which precluded the

use of methods to directly determine a change in bystander AED use after passage of laws.

This study found that rates of bystander AED use in OHCA at recreational facilities remained low through 2021, even in states legislating on-site availability. Additional efforts are needed to overcome barriers for public access defibrillation.

**Ahmed A. Kolkailah, MD, MSc**  
**Paul S. Chan, MD, MSc**  
**Qiang Li, BS, MSc**  
**Anezi Uzendu, MD**  
**Mirza S. Khan, MD, MS**  
**Saket Girotra, MD, SM**

**Author Affiliations:** Division of Cardiology, The University of Texas Southwestern Medical Center, Dallas (Kolkailah, Li, Uzendu, Girotra); Saint Luke's Mid America Heart Institute and the Division of Cardiology, University of Missouri-Kansas City (Chan, Khan).

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**Corresponding Author:** Ahmed A. Kolkailah, MD, MSc, Division of Cardiology, The University of Texas Southwestern Medical Center, 5323 Harry Hines Blvd, Dallas, TX 75390-5404 (ahmed.kolkailah@utsouthwestern.edu).

**Author Contributions:** Dr Kolkailah and Ms Li had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

**Concept and design:** Kolkailah, Uzendu, Girotra.

**Acquisition, analysis, or interpretation of data:** Kolkailah, Chan, Li, Khan, Girotra.

**Drafting of the manuscript:** Kolkailah, Uzendu, Girotra.

**Critical review of the manuscript for important intellectual content:** Kolkailah, Chan, Li, Khan, Girotra.

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