

Title: Evaluating the Accessibility of Automated External Defibrillators (AEDs) in a Community Setting

Purpose:

Outside-of-hospital cardiac arrest (OHCA) has a survival rate of 10.7%, with approximately 357,000 EMS-assessed OHCA events occurring annually in the U.S. Cardiac arrest results from disordered electrical impulses in the heart. Common rhythms during cardiac arrest are ventricular fibrillation and pulseless ventricular tachycardia. High-quality CPR and early defibrillation are the standard care for OHCA. However, bystander AED application remains low. This may be related to the perceived time it takes to locate an AED; for this reason, the purpose of this study is to find the real time it takes to locate an AED by ambulation in a community setting.

Methods: This is a quantitative study that aims to measure the mean time it takes to locate an AED in a community setting. Secondary objectives of this study include reporting the distance to each AED, rating the difficulty of finding them, and their accessibility. These factors will be compared between four Midwest cities and locations investigated. The sample size selected for this study is a minimum of 40 stores per city, with a total of 10 stores in each of four pre-determined categories. Distance was recorded from the main entrances of each location to the handling distance of the AED. If the AED was not immediately visible, a secondary distance was recorded from the entrance to the AED. The data collector aimed for a pace of 4.5-5 mph to mimic bystander response. The collector's average pace was documented for locations with an AED. Lastly, the data collector rated the difficulty of finding and accessing each AED, using two Likert Scales with predefined criteria. The hypothesis is there is a statistically significant difference in the mean time to find an AED among the cities compared, with at least one city's mean time differing from the others. The statistical test that was used is a one-way analysis of variance (ANOVA) followed by a post-hoc analysis; overall summary descriptive data will be provided as well.

Results:

Across all cities studied, AEDs were overwhelmingly unable to be found by the data collector. A total of 177 locations were investigated; only 32 AEDs were found. A breakdown of the discovery rates is as follows: 10/54 locations in St. Louis had an AED, 9/42 in Metro East, 8/41 in Indianapolis, and 5/40 in Nashville. Retail stores had the most AEDs available, followed by grocery stores, then followed by both fast-food restaurants and retail pharmacy locations. Fast-food restaurants and retail pharmacy locations consistently had no publicly available AEDs that the data collector could find across all four cities.

The primary objective of the study was analyzed despite the low discovery rates to determine if any differences could be observed in the small dataset. The mean times to find AEDs in St. Louis, Metro East, Indianapolis, and Nashville were 113.4 seconds, 43.3 seconds, 34.4 seconds, and 29.2 seconds, respectively. The overall mean time to find an AED in any city at any location in this study was 59.72 seconds. A one-way ANOVA analysis revealed a statistically significant difference in

mean times to locate an AED between the four cities ($F(1,6)=7.11$, $p=0.0368$), with a significance level of 0.05. These results indicate that the groups do not share the same average time to locate an AED, suggesting variability in accessibility AEDs across the groups.

The overall average initial distance to an AED was 119.46 feet. Confirmed distances were shorter; 105.12 feet for St. Louis, 70.1 feet for the Metro East, 89.1 feet for Indianapolis, and 82.6 feet for Nashville. AEDs in retail and grocery stores were located near the entrances, which accounts for the actual distance to the AED being shorter than what was initially recorded.

The pace of the data collector ranged from 16'04"- 33'37" (minutes per mile), which converts to 1.8-3.8 mph. This is due to factors such as crowds, anti-theft measures, the data collector avoiding alarming others, and possibly due to inaccuracies in the Apple Watch from the short durations of collecting the data.

The secondary objectives of the study were also impacted by the lack of AED availability. Since it was found that overall fast-food restaurants and retail pharmacy locations did not have publicly available AEDs, all locations in these categories received an "inaccessible" and "unable to find" on the accessibility and difficulty Likert scales, respectively.

Of the AEDs that were located, most (28/32) were rated as "accessible without assistance". On a similar note, most AEDs (24/32) were rated as "very easy" to access on the difficulty Likert scale. Retail stores had the most locations with AEDs rated both "accessible without assistance" and "very easy". It was noted across all cities that retail stores had AEDs located in the front of buildings, near exits, behind registers on the wall, or near customer service desks. Grocery stores had AEDs also located in the front of buildings, but mostly near manager's offices or employee break rooms in addition to behind registers on the wall.

Discussion:

The data presented comes from a very limited data set of AEDs found across all four cities. The results highlight trends in AED accessibility and availability within the community. The mean time to find an AED in all cities investigated and categories of locations was less than two minutes from the entrance of the buildings. The mean difference between the mean times to find an AED in each city was statistically significant ($p < 0.05$), indicating that the observed difference in means is unlikely to have occurred by chance. This finding supports the conclusion that the time to locate an AED differs significantly between the four cities investigated. St. Louis had the longest mean time to AED and Nashville had the shortest; however, this correlates to the number of AEDs found in the city as well, with St. Louis having the most and Nashville having the least. For this reason, it cannot be concluded from this study that AEDs are more accessible in one city over another, just that there is a difference in the mean time to find the limited AEDs available. There was not enough data available to compare the difference in the mean time to locate an AED between categories of locations. These findings suggest that the time required to

locate an AED varies by city, indicating a need for further investigation into the factors contributing to these disparities.