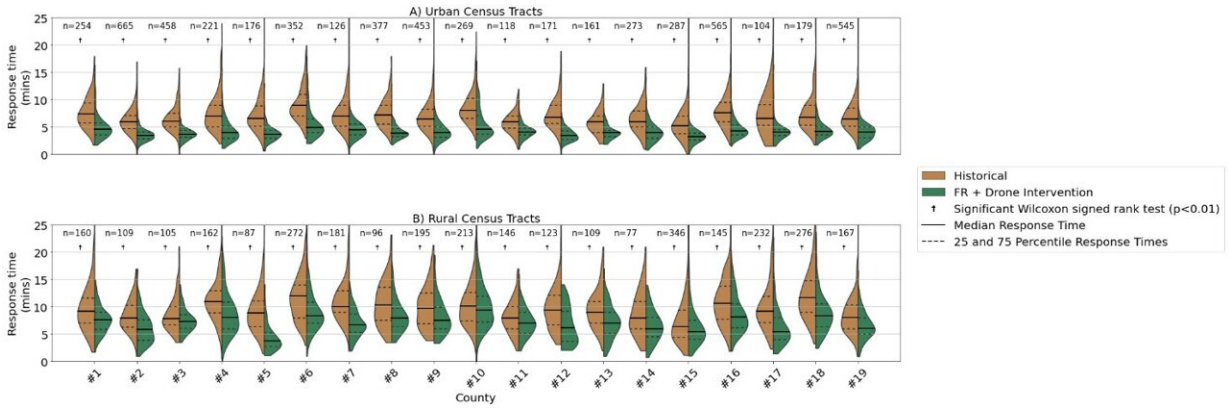
Could drones one day speed AED delivery to cardiac arrest scenes across the US?

November 6 2023



Credit: Jamal Chu et al, Rural-Urban Differences for Integrated First Responder and Drone Automated External Defibrillator Delivery in North Carolina. https://www.abstractsonline.com/pp8/?_ga=2.78066140.931055863.1697053661-731368424.1679607654#!/20094/presentation/6

A research simulation suggests that a drone delivery system could improve access to automated external defibrillators (AEDs), a portable device that can shock the heart rhythm back to normal when a person is experiencing an out-of-hospital cardiac arrest, according to preliminary research to be presented at the American Heart Association's Resuscitation Science Symposium 2023. The meeting, to be held Nov. 11–12, in Philadelphia, is a premier global exchange of the latest scientific advances related to treating cardiopulmonary arrest and life-

threatening traumatic injury.

According to the American Heart Association, more than 350,000 cardiac arrests occur outside of the hospital each year, with a survival rate of only about 10%. The initiation of bystander CPR, including the use of an AED if warranted, is critical in the initial response to an out-of-hospital cardiac arrest and can more than double or triple a person's chances of survival. However, the number of people who experience out-of-hospital cardiac arrest who have an AED applied by a bystander remains low, with timely access to an AED a major barrier, especially in rural areas.

For the study, researchers developed a simulation model that evaluated how quickly an AED could be delivered to the scene of a cardiac arrest in 19 counties in North Carolina. The model hypothesized that all local first responders, including EMS, fire fighters and police officers, would carry an AED and then optimized a network of AED-carrying drones. The simulation model compared the response time until an AED arrived on scene between this hypothetical intervention and the historical first responder/EMS response in each area.

Using the drones to maximize the total number of out-of-hospital cardiac arrests that could have an AED delivered within five minutes, the researchers found:

- Five-minute response time for AED arrival would improve from 24% to 77% for urban areas and 10% to 23% for rural areas.
- Estimated average response times would be reduced by 42% to 4 minutes in urban areas and by 24% to 7.1 minutes in rural areas. The historical median response time was 6.9 minutes in urban areas and 9.4 minutes in rural areas.
- All counties showed significant improvement in response time for urban and rural populations.

"We were a bit surprised that the improvements appeared greater in the urban areas. There's an historical inequity in EMS response times in rural versus urban areas, so we anticipated that drones could provide a bigger improvement in response times in rural areas and, thus, reduce that inequity," said study lead author Jamal Chu, B.A.Sc., a Ph.D. student at the University of Toronto.

"Our optimization model was designed for the drone network to maximize the number of out-of-hospital cardiac arrests responded to within five minutes. This meant that due to the historical response times in both urban and rural areas being mostly longer than five minutes, the algorithm largely ignored the historical inequity in response time and prioritized the densely populated and easier to respond to urban areas.

"For future development of drone delivery systems, we need to consider the demography, geography and historical EMS response times of the intervention region and personalize the algorithm that optimizes the drone locations for that region, or we risk increasing the inequity of emergency response."

The research team has received an American Heart Association Health Equity Research Network grant to investigate solutions to rural health inequities. As part of that research project, they are currently working on the real-life implementation of drone-delivered AEDs in North Carolina and will be using these new findings to further refine their drone delivery system.

"The biggest limitation of this study is that it is computational," Chu said. "Going from computational analysis to implementation will include many hurdles in terms of regulations, infrastructure and community. For example, we assumed whenever an AED was delivered, a bystander would retrieve it and apply it to the patient. Community education programs would have to be integrated with a drone program to achieve

this high level of use."

Study details and background:

- With information from the Cardiac Arrest Registry to Enhance Survival web-based data management system, the research included nearly 9,000 out-of-hospital cardiac arrests (more than 5,700 urban and around 3,200 rural) and 19 North Carolina counties selected between January 2013 and December 2019.
- Within each county, researchers classified census tracts by rural population with less than 25% rural tracts as urban, 25%–75% rural tracts as mixed and more than 75% rural tracts as rural.
- The study included only counties with 10 or more out-of-hospital cardiac arrests per year in rural and urban areas to compare resource allocation for counties with large geographic variation.

Provided by American Heart Association