# Researchers find new ways to improve CPR

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An international research consortium, which included faculty members from the University of Minnesota Medical School, was able to identify what is likely an optimal combination of chest compression frequency and depth when performing CPR.

The investigation was led by Sue Duval, Ph.D., Associate Professor of

Medicine and Biostatistics at the U of M Medical School, assisted by an international team of resuscitation investigators based at UT Southwestern, Medical College of Wisconsin, University of Oklahoma School of Community Medicine, the University Hospital of Grenoble Alpes in France, and Toho University in Tokyo, Japan.

The findings, published in *JAMA Cardiology*, suggest the combination of 107 compressions per minute and a depth of 4.7 cm (about 2 inches) in the first five minutes of CPR can be associated with significantly improved outcomes when Emergency Medical Services (EMS) rescuers are treating cardiac arrest outside the hospital.

In addition, the optimal combination identified did not seem to significantly vary when analyzed according to age, sex, presenting cardiac rhythm or the use of a specialized device attached to the airway during CPR. Moreover, the investigators showed that the use of the device significantly improved outcomes when the target combination of rate and depth was utilized.

The researchers found that even when CPR was performed within 20% of those chest compression values, neurologically intact survival was significantly higher—6% vs. 4.3% outside that range. Considering an estimated 300,000 or more out-of-hospital cardiac arrests occur each year nationally, this could translate into thousands of additional lives being saved annually in the United States alone and perhaps more if the target combination could be achieved routinely.

"What also makes this particular study especially novel for the resuscitation research community is the presentation of the data using contour plots—graphical representation similar to a temperature map—where the hottest points correspond to the best chance for neurologically intact survival," said Duval. "I believe this was another pivotal step in the continuum of research efforts to further save lives

through robust data analysis."

The premise for this work stemmed in large part from prior National Institutes of Health (NIH) studies in which improved outcomes were observed when CPR was performed within a specified range of compression rates (100 to 120 per minute). Soon garnering the moniker the "sweet spot" of CPR, similar studies were performed showing improved outcomes within a range of compression depth as well. But because variations in rate can affect depth, and vice versa, the current investigators sought to take the next step to identify the optimal combination of the two, a "sweeter spot," to better guide rescuers in the future.

"The findings here not only emphasize the importance of quality CPR performance, but they will likely help paramedics and others on the frontlines save many more lives," said Paul Pepe, MD, Professor of Emergency Medicine at UT Southwestern. "We knew that both the depth and frequency of chest compressions could each affect outcomes, but we still had yet to better identify the optimal combination of the two—and, perhaps more importantly, whether that optimal target would vary if you were a man or woman, or if you were older or had a longer period of cardiac arrest before rescuers reached you. This study provided critical new knowledge toward that end."

Whether the findings would be universally applicable in all EMS systems has yet to be confirmed, but this study, conducted across 150 different EMS agencies in the U.S. and Canada, may be the best available findings to date. The researchers still advise that further validation of this target combination is recommended, especially when new devices, procedures or mechanical CPR tools are being introduced into the situation.

The study reviewed data from more than 3,600 patients who experienced cardiac arrest outside the hospital. Compression rate and depth were

being recorded as part of a clinical trial conducted by the NIH Resuscitation Outcomes Consortium, with the use of a specific CPR device called the impedance threshold device (ITD). It was the first multicenter trial to use electronically documented measurements of both chest compression rates and chest compression depth.

**More information:** Sue Duval et al, Optimal Combination of Compression Rate and Depth During Cardiopulmonary Resuscitation for Functionally Favorable Survival, *JAMA Cardiology* (2019). DOI: 10.1001/jamacardio.2019.2717