

## Measuring What Matters: CPR Quality and Resuscitation Outcomes

Mary Fran Hazinski, RN, MSN, FAAN, FAHA, FERC

Although chest compression technique has not changed much since the first report of successful closed chest compression by Kouvehoven, Knickerbocker, and Jude in 1960,<sup>1</sup> it took nearly half a century before the promise of resuscitation would become reality for a significant portion of victims of cardiac arrest. Resuscitation survival has increased in past years as the result of better documentation and analysis of resuscitation outcomes, multicenter studies of resuscitation therapies, improved post-resuscitation care, and greater emphasis on high-quality resuscitation in training and performance. The establishment of the National Registry for CPR (NRPR) in 1999 became a powerful tool in this process.

The NRCPR began collecting data from in-hospital resuscitations in 2000, and published the first report of 14 720 adult cardiac arrests in 2003.<sup>2</sup> The registry, now called Get with the Guidelines-Resuscitation (GWTG-R), has collected data on >300 000 resuscitations from >330 hospitals in the United States. Through participation in this registry, hospitals not only provide specific resuscitation data, but they also receive comparison data from similar hospitals so they can gauge their performance, identify weaknesses, decrease variability, and improve survival from cardiac arrest. The registry provides a wealth of data that enables characterization of cardiac arrests (e.g., most common locations of arrests and most likely pre-arrest rhythms), and identification of trends and observations for further study.

The association of pre-arrest patient characteristics,<sup>3</sup> hospital characteristics,<sup>4-6</sup> arrest location (monitored versus unmonitored<sup>7</sup> bed) and arrest time and day<sup>8</sup> with resuscita-

tion outcome have all been explored and reported by GWTG-R investigators in previous publications. These researchers have also demonstrated the lack of relationship between CPR duration and mortality.<sup>5</sup> In this issue of the *Journal of the American Heart Association (JAHA)*, Khan and colleagues<sup>9</sup> for the GWT-R Investigators attempt to identify patient or hospital factors associated with longer duration of in-hospital resuscitation in “failed” resuscitation attempts. In their primary analysis, the authors characterized >45 000 victims of in-hospital cardiac arrest who never achieved return of spontaneous circulation (ROSC). In a secondary analysis, they characterized >46 000 victims who did demonstrate ROSC, in an attempt to identify any important differences in predictors of CPR duration between the two groups. The authors’ question: Are there any patient or hospital factors associated with persistence in an attempted resuscitation despite lack of success? An important corollary question is, “When is such persistence warranted?” These are compelling questions that remain to be answered.

The authors concluded that young age and female gender were associated with increased duration of CPR in those who never achieved ROSC, although noting that the odds ratios observed were close to 1, so the impact of each factor on CPR duration was small. Khan and colleagues postulate that providers may perceive that younger patients and females have a higher probability of survival and so persist for longer in unsuccessful resuscitation attempts. Other factors associated with increased CPR duration in the unsuccessful resuscitations included witnessed arrest and a shockable rhythm, both factors also known to be associated with improved survival.

The strength of the study is the huge sample size (a size rarely seen in resuscitation studies), the diverse cohort from a wide variety of hospitals and the patient information available. The authors acknowledge that the retrospective nature of the study made it impossible to assess physician decision-making at the time of arrest or to determine the amount of patient information or family wishes known to the clinicians during the resuscitation. In addition, they concede that the very large sample size also makes statistical significance much more likely regardless of clinical significance, so caution in inter-

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From Vanderbilt University School of Nursing, Vanderbilt University Medical Center, Nashville, TN.

**Correspondence to:** Mary Fran Hazinski, RN, MSN, FAAN, FAHA, FERC, 3737 West End Avenue, Unit 304, Nashville, TN 37205. E-mail: mary.f.hazinski@vanderbilt.edu

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pretation of results is appropriate. Finally, the 10-year sampling interval undoubtedly introduced additional variables, because CPR Guidelines recommendations and training methods have changed considerably during this period.

Despite these limitations, this paper raises important points that are well developed in the discussion. The key finding of the study was that CPR duration is highly variable and the variability was only partially explained by patient and hospital factors. This variability in CPR duration is likely a sign of wide variability in CPR knowledge and practice. Such variability will only be reduced when every system that provides resuscitation establishes a process of continuous quality improvement that ensures provision of high-quality CPR for every victim of every cardiac arrest. Hospitals that participate in registries such as GWTG-R have taken that first step by collecting data and using it to benchmark their resuscitation performance.

With the 2013 publication of the AHA CPR Quality statement,<sup>10</sup> resuscitation providers now have very specific metrics of CPR performance to monitor and they have specific methods, such as debriefing to improve team performance. Evidence is now accruing that resuscitation consistent with these recommendations does result in improved survival from in-hospital cardiac arrest.<sup>11,12</sup> It is clear that training providers to perform high-quality CPR with frequent refresher training, measuring and analyzing CPR performance, identifying and correcting errors, and debriefing following resuscitation are all necessary to improve survival from cardiac arrest. Once high-quality CPR and excellent post-resuscitation care are standard, identification of reliable prognostic indicators during and after resuscitation will be much less challenging.

## Disclosures

Ms. Hazinski receives significant compensation from the American Heart Association to serve as Senior Science Editor for the AHA Emergency Cardiovascular Care (ECC) Programs. In this capacity, she will serve as Co-Editor of the 2015 International Consensus on CPR and ECC Science with Treatment Recommendations and as the Editor of the 2015 AHA Guidelines for CPR and ECC. She will also review the scientific content of the ECC training materials.

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