# Sudden Cardiac Death Decreasing: Why Remains Unclear

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The article by El-Assaad et al[1] describes death certificate data from children (excluding infants 0–12 months old) and young adults (<35 years old) who died from sudden cardiac death (SCD) outside a hospital setting. The authors report that annual rates of SCD in young children (1–10 years old) remained steady, whereas rates of SCD among older children, teenagers, and young adults fell significantly over the study years. Additionally, African Americans had consistently higher annual rates of SCD compared with other racial and ethnic groups, but they also experienced the greatest improvement over the 15 study years ending in 2015.

Of note, the composition of underlying cardiac conditions associated with SCD varied across age groups, with congenital heart disease (CHD) and arrhythmia being the most common in young children, whereas ischemic heart disease and arrhythmia were the most prevalent in young adults. However, autopsies were performed in less than one-third of the deaths,[1] and physician coding for death certificates is known to vary widely.[2] Likewise, the authors did not detail how cases with multiple *International Classification of Diseases, 10th Revision* codes for overlapping cardiac conditions were classified. It is thus likely that a fraction of the deaths attributed to primary arrhythmia versus other cardiac conditions may have been misclassified. An accurate diagnosis of any underlying cardiac condition is vital to evaluate prevention measures for these seemingly preventable deaths.

The authors could not adjust for racial and/or ethnic variations in the prevalence of each underlying heart condition with risk for SCD using death certificate data (ie, accounting for the at-risk population within each racial and/or ethnic and age group).[3,4] Thus, the etiology for the overrepresentation of African American children with SCD is speculative but concerning because racial, ethnic, and class disparities in outcomes from heart disease are common.[3,5] Previous case studies of SCD that were not adjusted for the at-risk population led to inaccurate medical conclusions and actions.[6] A cluster of SCD among otherwise healthy children with attention-deficit disorder treated with methylphenidate led to a black box warning in Canada. However, population-based studies of 2.5 million children found no association between treatment with methylphenidate and SCD in children without heart disease.[7] Estimating the at-risk population for SCD across racial and/or ethnic groups is essential to verify an increased risk of SCD among African American children by cardiac condition. Nonetheless, this study concurs with many others documenting racial and/or ethnic disparities in outcomes among patients with pediatric and adult heart disease.[8]

Finally, El-Assaad et al[1] proposed potential explanations for falling rates of SCD in older children and young adults, including improved diagnosis and care of CHD as well as improved out-of-hospital (OH) cardiac arrest (CA) resuscitation care. Surgical mortality has decreased substantially across centers of all surgical volumes.[9] However, although in-hospital (IH)

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mortality after surgical procedures has improved over the past 2 decades, associated changes in postsurgical rates of SCD in children after congenital heart surgery have not been quantified. Furthermore, improvements in CHD diagnosis and care should be linked to decreases in SCD among children with CHD because this is the only population that should be affected by these technological gains. Treatments to decrease the risk of SCD, such as the implantable cardioverter-defibrillator, may be employed for multiple cardiac conditions[10,11] but with differing indications[12] and/or effects, and thus, they need to be evaluated separately. The impact of these potentially important factors on reducing SCD needs to be quantified.

Continued low survival after OH CA makes improvements in resuscitation care unlikely to account for large decreases in OH SCD rates. Although survival rates vary substantially by eligibility criteria, hospital survival among all patients presenting to an emergency department after an OH CA is <10%, whereas <40% of those with restoration of spontaneous circulation in the emergency department survive to hospital discharge.[13–15] Trials in which researchers compare hypothermia to normothermia after pediatric CA found no difference in survival with acceptable neurologic performance.[16,17] Serial reports from the American Heart Association's National Registry of Cardiopulmonary Resuscitation (CPR) document improving hospital survival after IH CA among children.[18,19] Again, reasons that account for improved survival are not quantified but may be due in part to improved provider adherence to recommended CPR standards from education with medical simulation training[20] and/or the use of extracorporeal membrane oxygenation[21] to rescue IH CA refractory to conventional CPR.

However, it is unclear if mechanisms that improve IH CA are the same drivers that improved OH SCD.

Nevertheless, studies regarding the prevalence of SCD, such as the work by El-Assaad et al,[1] are the current best available evidence but raise questions directing future investigations: Of all the improvements in cardiac, emergency, and critical care in the past 15 years, which has had the greatest impact on reducing SCD? What can we do to further reduce these tragedies?

## ABBREVIATIONS

CA: cardiac arrest
CHD: congenital heart disease
CPR: cardiopulmonary resuscitation
IH: in-hospital
OH: out-of-hospital
SCD: sudden cardiac death

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