



Clinical paper

Outcomes of sudden cardiac arrest in a state-wide integrated resuscitation program: Results from the Minnesota Resuscitation Consortium[☆]



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ABSTRACT

Background: Despite many advances in resuscitation science the outcomes of sudden cardiac arrest (SCA) remain poor. The Minnesota Resuscitation Consortium (MRC) is a statewide integrated resuscitation program, established in 2011, to provide standardized, evidence-based resuscitation and post-resuscitation care. The objective of this study is to assess the outcomes of a state-wide integrated resuscitation program. **Methods:** We examined the trends in resuscitation metrics and outcomes in Minnesota since 2011 and compared these to the results from the national Cardiac Arrest Registry to Enhance Survival (CARES) program. Since 2011 MRC has expanded significantly providing service to >75% of Minnesota's population. **Results:** A total of 5192 SCA occurred in counties covered by MRC from 2011 to 2014. In this period, bystander cardiopulmonary resuscitation (CPR) and use of hypothermia, automatic CPR device and impedance threshold device increased significantly ($p < 0.0001$ for all). Compared to CARES, SCA cases in Minnesota were more likely to be ventricular fibrillation (31% vs. 23%, $p < 0.0001$) but less likely to receive bystander CPR (33% vs. 39%, $p < 0.0001$). Survival to hospital discharge with good or moderate cerebral performance (12% vs. 8%, $p < 0.0001$), survival in SCA with a shockable rhythm (Utstein survival) (38% vs. 33%, $p = 0.0003$) and Utstein survival with bystander CPR (44% vs. 37%, $p = 0.003$) were greater in Minnesota than CARES.

Conclusions: State-wide integration of resuscitation services in Minnesota was feasible. Survival rate after cardiac arrest is greater in Minnesota compared to the mean survival rate in CARES.

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Introduction

Sudden cardiac arrest (SCA) remains a leading mode of death in the U.S., representing approximately 10–15% of all deaths.^{1,2}

Except for a few recent encouraging reports,^{3–6} survival after SCA has been stagnant around 7–8%, despite decades of research and efforts to improve cardiac resuscitation. However, there is a significant geographical variation in survival rates after SCA in North America.^{7,8} One of the potential reasons for this variability could be the lack of a well-coordinated, standardized response among various emergency medical service (EMS) agencies and hospitals.⁹ Thus, the American Heart Association (AHA) recommended development of regional systems of care for patients resuscitated from cardiac arrest.^{9,10} More recently, the Institute of Medicine (IOM) report on cardiac arrest recommended standard-

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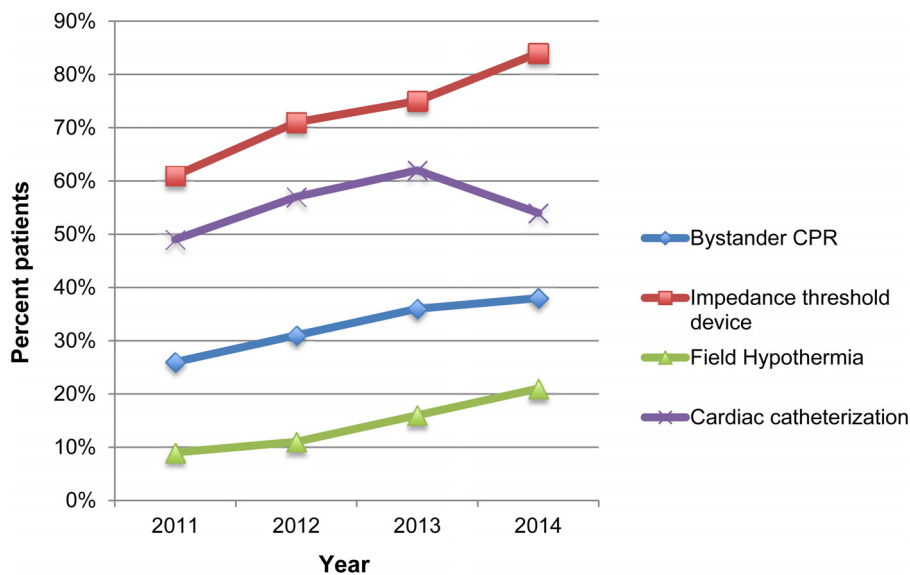


Fig. 1. Temporal trends of key resuscitation variables in Minnesota from 2011 to 2014.

ization of protocols and training and implementation of continuous quality improvement strategies.¹¹ However, few data exist showing the feasibility and effectiveness of such systems in the U.S.^{12,13}

Minnesota Resuscitation Consortium (MRC) was established in 2011 with a grant from Medtronic Heart Rescue Project as a statewide effort to improve survival from SCA in Minnesota (<http://www.mrc.umn.edu>). The overarching goal of MRC was to gather all stakeholders under the same organization to provide excellent resuscitation and post-resuscitation care in Minnesota via common, evidence-based protocols and to foster an environment of collaboration and continuous improvement among them.¹⁴ As part of the agreement among its members, MRC collects data about the details and outcome of each cardiac arrest using the Cardiac Arrest Registry to Enhance Survival (CARES).¹⁵

The objectives of this study are to report the trends of resuscitation metrics and outcomes in areas of Minnesota covered by MRC since 2011 and to compare Minnesota's resuscitation outcomes with those from the national CARES program in the U.S.

Methods

Setting

Minnesota (population 5.3 million) is the 12th largest state in the U.S. with a land area of almost 80,000 square miles divided into 87 counties. Based on the 2010 census data, nearly 60% of its residents live in the Minneapolis-St. Paul metro area (population 3.3 million), which is the 16th largest city in the U.S. and has a population density of 515.4 persons/square mile.

Minnesota Resuscitation Consortium

Since its inauguration, MRC has expanded significantly, providing service to greater than 75% of Minnesota's population (Supplemental Fig. 1). Partnering with existing groups and programs, MRC aims to increase public's awareness and bystander response by holding training sessions for cardiopulmonary resuscitation (CPR) and automatic external defibrillator use in schools, workplaces and special events.

MRC gathers first responders, EMS, police and fire departments, hospital emergency departments, cardiology, intensive care unit,

neurology, and physical therapy/rehabilitation services under the same organization (Supplemental Fig. 2). It works with EMS directors in the state and an interdisciplinary team of experts from the area hospitals to improve the quality of pre-hospital CPR, to increase the utilization of therapeutic hypothermia, emergency cardiac catheterization and, when necessary, coronary revascularization by implementing standardized and evidence-based protocols.

Data source

To collect data MRC uses an internet-based registry also used by CARES. Details of the SCA are entered through a secure portal by the EMS and the hospitals involved in the care of each patient. These data are reviewed by experienced MRC staff. Cases with a questionable cardiac etiology are referred back with request for more information. The final database is de-identified to respect patient privacy and to enhance provision of unbiased data by the participating agencies.

The CARES program began in 2004 as a cooperative agreement between the Centers for Disease Control and Prevention, the AHA and the Emory University School of Medicine to identify incidents of prehospital cardiac arrest (<https://mycares.net/>). The CARES utilizes an internet-based registry accessed securely by the participant sites and is designed to help local EMS administrators and medical directors identify the characteristics and monitor the outcomes of SCA to determine the practices and processes associated with success versus those that need improvement.

Study patients

The cases in this study include all patients with SCA who were resuscitated by the EMS participating in MRC from 2011 to 2014. Arrests due to respiratory causes, trauma, submersion, homicide, suicide, drug overdose, asphyxia, exsanguination or any other non-cardiac cause were excluded after reviewing the EMS and hospital records. The final study cohort was 5192 patients with SCA. The comparison group included 129,828 cases of SCA recorded in the national CARES registry during the same period.

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