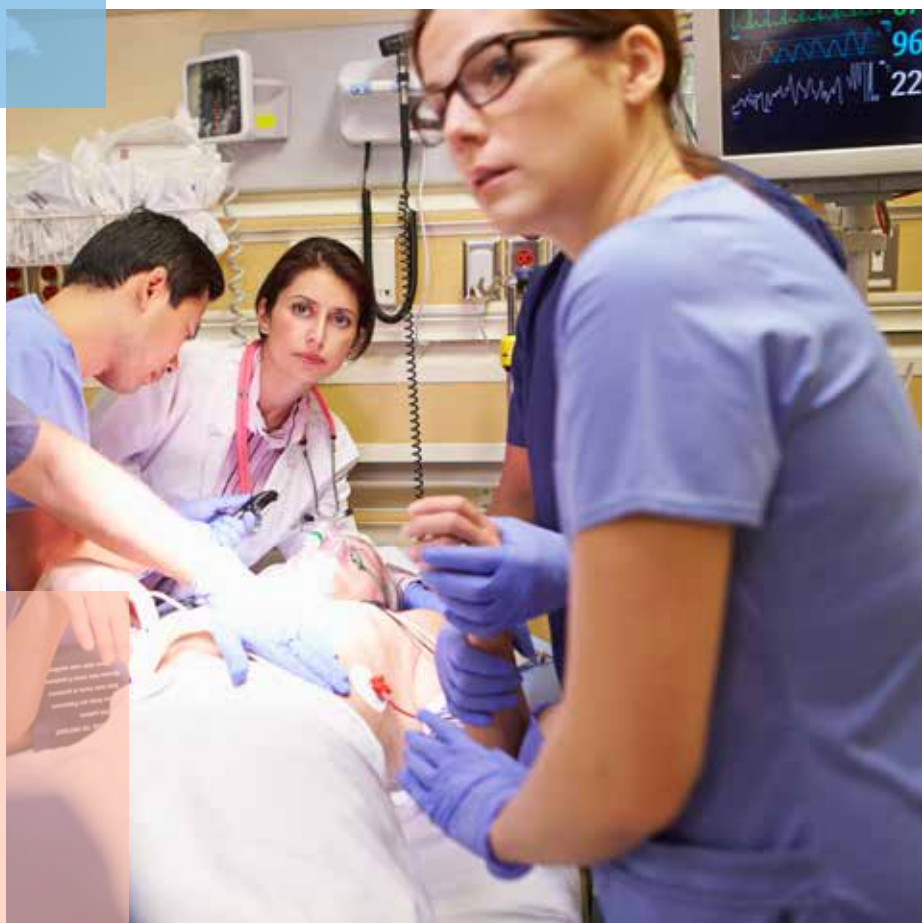
In-Hospital Cardiac Arrest (IHCA)

How Hospitals Can Increase Survival Rates by Improving Code Blue Performance



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EXECUTIVE SUMMARY

In-hospital cardiac arrest (IHCA) is a life-threatening emergency condition with a low likelihood of survival. Only 1 in 4 adults who experience it are expected to live to hospital discharge, and survival rates have remained low with only gradual improvement in the past 20 years.[1-3]

The outcomes are poor but not inevitable: Studies have shown significant variability between hospitals that demonstrates improvement is possible.[3-5] This whitepaper will examine the current data on IHCA in the United States, discuss the challenges to further progress, and provide steps that hospitals can take to improve code blue performance and IHCA survival.

KEY TAKEAWAYS

- **IHCA is a significant public health problem** that claims the lives of thousands of patients each year. Survival rates are low and vary considerably across hospitals.[1-5]
- **The potential for improvement is substantial.** Wide variation in outcomes across hospitals[3-5] shows that more deaths can be prevented through process improvement and implementation of best practices.
- **Code blue perfomance involves more than CPR quality and response time alone.** Hospitals need to consider the entire system of care when seeking to improve outcomes. This includes recognizing and addressing all factors that affect patient outcomes — before, during, and after code blue events.
- **Accurate, comprehensive data is needed** at the national and local levels to advance research and inform best practices.

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IHCA: LOW SURVIVAL RATE, SLOW PROGRESS

Of the estimated 292,000 adults who experience IHCA each year, approximately 25% will survive to hospital discharge.[1,6] The outlook for pediatric patients is better with a survival rate of roughly 38%-41%, but still represents a less than 50% chance of recovery.[1]

The low IHCA survival rate persists despite years of advocacy by organizations such as the American Heart Association (AHA). In 1999, the AHA established what is now Get With The Guidelines®-Resuscitation (GWTG-R), a program that gathers and analyzes data from hospitals across the country, publishes guidelines for inpatient cardiopulmonary resuscitation (CPR), and provides participating hospitals with resources and training.

In 2010, the AHA set a 10-year goal to increase the survival rate for hospitalized adults from 19% to 35%, pointing to strong evidence of variability between hospitals to show that the target was attainable with more widespread application of clinical guidelines and best practices.[7] Five years later, the Institute of Medicine published a call to action, citing an "unacceptably low" cardiac arrest survival rate and urging a renewed national effort to advance resuscitation research and improve outcomes.[3]

Despite these efforts, progress has been limited. For adults, the survival rate hasn't even approached the 35% target, remaining at approximately 25% in GWTG-R since 2013 with only minor fluctuations.[1] In addition, the most recent annual incidence estimates for IHCA — 292,000 in adults and 15,200 in children — are higher than previously thought, and those totals increase to 357,900 adults and 19,900 children when recurrent cardiac arrests are included (this data was published prior to COVID-19).[6] Given the incidence, high death rate, and the potential for neurologic injury and hospital readmission in survivors, the overall impact of IHCA in the United States is significant.

OBSTACLES TO PROGRESS

Insufficient Attention and Awareness

The problem is partly about visibility and largely about data. Even with its poor outcomes, cardiac arrest receives less attention than other cardiovascular conditions, such as stroke and myocardial infarction.[2] The attention it does receive has typically focused on out-of-hospital cardiac arrest (OHCA), although similar numbers of OHCA and IHCA occur yearly and there are notable differences between the two conditions that warrant separate consideration.

Data and Research Limitations

Both the larger field of resuscitation research and individual hospitals suffer from a lack of high-quality, comprehensive IHCA data. Nationally, the United States does not have a single registry that tracks all IHCA data and outcomes. Registries such as GWTG-R are voluntary and only a minority of hospitals currently participate, which limits the representativeness of the data it collects.

IHCA research is also hampered by a limited number of randomized clinical trials. Much of our understanding of IHCA is instead based on observational studies of voluntary registries, or on OHCA data applied to the in-hospital setting.[2] Obstacles to obtaining accurate, reliable data extend to individual hospitals as well. For many hospitals, code blue documentation remains paper based and is uploaded to the medical record as a static PDF file, a format that does not lend itself to hospital-wide analysis and reporting. This is a crucial concern because the success of IHCA continuous quality improvement initiatives depends on comprehensive, usable data.

WHY ARE IHCA SURVIVAL RATES SO LOW?

- **Less attention on IHCA** compared to other cardiovascular conditions
- **Limited number** of randomized clinical trials
- **Lack of national registry** to capture and analyze all IHCA data across the country
- **Data deficiencies** and inadequate data collection methods at hospitals

IMPROVING CODE BLUE PERFORMANCE: WHAT CAN HOSPITALS DO TODAY?

VARYING RESUSCITATION QUALITY AND OUTCOMES ACROSS HOSPITALS

IHCA is a complex clinical condition, and many of the factors influencing likelihood of survival stem from fixed patient characteristics, such as age and comorbidities. Yet multiple studies have shown significant differences in outcomes across hospitals that persist even after adjusting for these variables.[3-5] These studies point to disparities in care that disproportionately affect minorities and low-income patients.[3,5,8] Worse IHCA outcomes have also been reported during night and weekend shifts.[5] Importantly, the same data also indicates that improvement is possible: More hospitals can increase their survival rate closer to the 35% target, and some already are.

FOUNDATIONS: AWARENESS AND PROCESS IMPROVEMENT

The first steps are to recognize IHCA as a problem, prioritize accurate data collection during code blues, and commit to using that data for process improvement. Participation in GWTG-R is also important because it provides a dual benefit to the hospital and the larger field of research. The hospital can take advantage of the program's resources and benchmarking capabilities to improve its own IHCA survival rate. In fact, results of a 2018 study showed an association between increased duration of GWTG-R participation and improved quality of IHCA care.[2] Nationally, better data in the registry may help to inform research that pushes survival targets past their current boundaries.

With that foundation in place, hospitals are better positioned to identify and address areas of weakness in their processes **before, during, and after code blues.**

BEFORE:
CODE BLUE READINESS

Readiness consists of prevention; training; and preparation of the emergency medication, supplies, and equipment needed to effectively respond to an emergency event. The importance of each and specific action steps are summarized below.

PREVENTION

IHCA is often preceded by acute respiratory compromise or circulatory shock, and most patients demonstrate signs of deterioration beforehand. Post-IHCA analysis often reveals missed opportunities to observe and respond effectively to changes in vital signs and patient status.[2,5]

Takeaways

- ✔ Use early warning score systems to identify at-risk patients.[9]
- ✔ Increase monitoring of deteriorating patients.
- ✔ Train rapid response teams to stabilize patients prior to arrest.

TRAINING

Code blues are innately stressful, time-sensitive emergency events that require advanced levels of teamwork and coordination. Teams may consist of staff members who do not work together regularly outside of emergency events, and infrequent code occurrence makes it challenging for responders to stay up to date on their knowledge and skills. Ongoing staff training is needed in this context to maintain a constant state of readiness.

Takeaways

- ✔ Have a designated code blue team available at all times.
- ✔ Conduct mock code blues throughout the year.
- ✔ Provide training for registered nurses who play three important roles in IHCA response: bedside first responder, resuscitation team member, and clinical or administrative leader.

CRASH CART PREPARATION AND ORGANIZATION

Crash carts are an important but easily overlooked aspect of code blue preparation. Even the most efficient code blue response can be undermined by common problems associated with crash carts: trouble locating the cart, disorganized or expired medications and supplies, and missing or malfunctioning equipment. The Joint Commission drew attention to the issue in a 2017 publication, noting that crash carts often contain hidden safety risks that can adversely affect patient outcomes.[10]

The underlying problem is that crash cart preparation today is still a manual job for most hospitals. The automation technology that has addressed the same medical inventory management challenges elsewhere in hospitals has been slow to expand to crash carts. Hospitals have instead filled the gap by checking, re-checking, and re-stocking carts. These manual processes are inherently error prone and unreliable.

The biggest improvements in this area are expected to come from crash cart automation technology, but hospitals can also take steps to reduce manual error and inefficiencies.

Takeaways

- Invest in automation technology to better manage crash cart inventory.
- Keep carts in well-known, easily accessible locations.
- Use checklists to reduce manual error.

DURING:
RAPID, EFFICIENT RESPONSE

CPR QUALITY

Response time and CPR quality are key determinants of outcomes in IHCA patients. High-quality CPR consists of minimal interruptions in chest compressions, adequate rate and depth of compressions, and avoidance of excessive ventilation and leaning on the patient's chest between compressions.[11]

Although the AHA publishes guidelines on each component and studies have demonstrated the link between CPR quality and improved patient outcomes, the implementation of best practices varies considerably among hospitals and responders.[11,12] In a 2013 consensus statement, the AHA stated that poor-quality CPR is a "preventable harm" and should be a key focus for all responders.[11]

RESPONSE TIME

The consequences of delayed initiation of CPR are widely understood and documented in the cardiac arrest literature, but newer research suggests that the time to the next intervention — defibrillation or epinephrine administration, depending on the type of rhythm — matters as well.[13] Both affect the likelihood of survival, and the benefit of prompt CPR can be reduced by subsequent delays.

Hospitals seeking to improve IHCA outcomes need to consider the speed and efficiency of the entire code blue response, not just the time to initiation of CPR.

AFTER: REVIEW, ANALYSIS, AND POST-CARDIAC ARREST CARE

POST-CARDIAC ARREST CARE

Surviving cardiac arrest is only the first step. Patients face a complex mix of conditions in the aftermath of the event, known generally as post-cardiac arrest syndrome. Careful monitoring and treatment of patients after arrest will increase the likelihood of continued survival and optimal neurologic recovery.[5]

Takeaways

Ensure the following components are included in post-cardiac arrest care, as appropriate for the patient[2,5]:

- ✔ Treatment of underlying causes
- ✔ Targeted temperature management
- ✔ Optimization of hemodynamics
- ✔ Respiratory support

REVIEW AND ANALYSIS

Hospitals can use debriefing sessions to identify gaps in care and make adjustments going forward. Studies have shown that regular debriefing sessions are associated with higher survival rates and better outcomes.[3,5]

Takeaways

- ✔ Review the early warning score from the previous 24 hours. Determine if there was a failure to respond to changes in the patient's level of consciousness prior to IHCA.
- ✔ Conduct "hot debriefs" with the code blue team immediately following the event to ensure no data or important takeaways are lost.
- ✔ Include additional staff in "cold debriefs" to share information across teams and units.
- ✔ Establish a reporting and accountability structure to share baseline data, set goals, and report progress. For example:

1. The **Code Blue Committee** reviews IHCA cases monthly or quarterly and reports data to the Patient Safety Council.
2. The **Patient Safety Council** identifies IHCA trends and supports opportunities to improve the survival rate.
3. The Patient Safety Council reports progress to the **Hospital Board** on a predetermined schedule, ensuring awareness and support for process improvement throughout the year.

The debrief can only be as useful as the data that informs it.

The challenges surrounding data collection at hospitals are significant. In a 2017 AHA webinar series, Houston Methodist Code Blue Subcommittee Director Dr. Ronald Galfione referenced numerous data-related obstacles that many hospitals will be familiar with today: inaccuracies and omissions, illegible handwriting, and slow documentation turnaround time.[14]

Houston Methodist initially tackled these problems by educating staff on the importance of data for process improvement and trying to assign a dedicated documenter for each shift. But the biggest progress came with a switch from paper to electronic code documentation. Dr. Galfione noted that the electronic version produced better data and eliminated the issues of slow turnaround time that plagued his previous efforts.

Hospitals looking to improve their own data collection efforts can pursue a similar combination of staff education, process improvement, and improved technology.

CONCLUSION

Although IHCA outcomes have improved slowly since 2000, progress has been gradual and has fallen short of targets. Survival rates remain low and variable across hospitals. The strategies summarized here can help hospitals increase their survival rates closer to current targets, but the best possibility of significant, sustained progress in IHCA outcomes lies at the intersection of increased awareness, widespread adoption of continuous quality improvement initiatives, development and promotion of a culture of safety,[15,16] and better data and research to inform best practices.

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ABOUT NUVARA®

With over 50 years of combined experience in medication management and emergency care, the Nuvara team is committed to helping hospitals improve IHCA survival rates. In 2021, Nuvara introduced EMMIT®, the first and only Emergency Care System — a fully integrated medication, equipment, and information management solution designed to optimize factors that impact clinical performance before, during, and after code blue events.*

For more information or to get in touch with the team, visit www.nuvara.com.

*Patent pending.

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