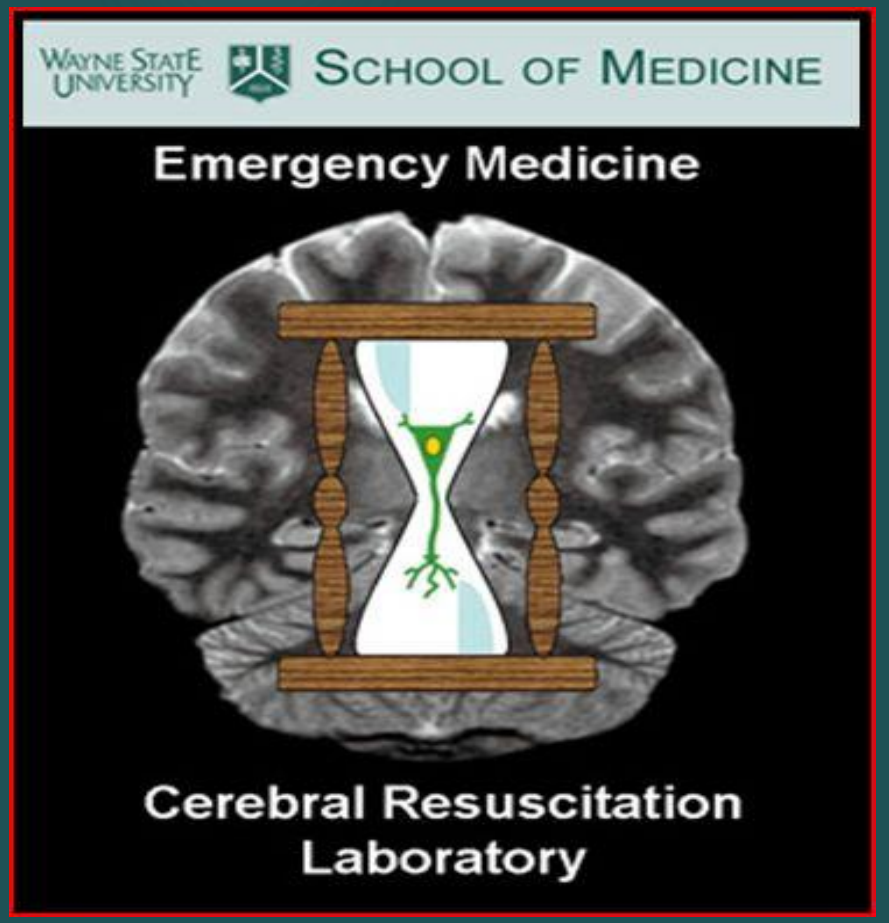
Take Heart America: In-hospital Committee Recommendations



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DISCLOSURES:

MUCH TO CONFESS, LESS TO DISCLOSE

- PI for Zoll Sponsored COOL-ARREST trial
- Advisory Committee: ZOLL, BRAINSCOPE, Seriquis
- ILCOR and AHA ALS and Scientific Committee

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THA In-Hospital Work Group: *POSITION STATEMENT*

- IHCA is different from OHCA, particularly with regard to etiology and initial rhythm, and the clinical trial data is not as robust as with OHCA. Based upon this, the THA position is grounded in the literature that proves that operational, educational and continuous quality processes that can be implemented to improve IHCA outcomes. In this chapter we will give the background, evidence and toolkit to improve IHCA outcomes.

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THA In-Hospital Committee: Process

- Structural accountability: ownership of this process
  - ART model
- Responsible and empowered multiple specialty CPR committee
- Review institutional data and follow trends for:
  - Rapid response
    - Including specialized training by unit
  - Resuscitation and post-resuscitation care
    - Hypothermia, GDT
  - Neurocritical care with prognostication
    - Adopt the ECC society algorithm
  - Outcomes: Hospital discharge and neurologic outcome
    - CPC and mRS

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THA In-Hospital Cardiac Arrest: Recommendations

- Patient Risk stratification at hospital Admission:
  - MEWS or NEWS, PEWS score, Edelson Score
- Preventable deaths: Review all unmonitored arrest that are not DNR
- Implementation of a highly effective and repeatedly trained RRT/METs
- Bedside team adaptive strategy to train to the majority of the arrest etiologies
- Overall quality assurance: template
- Template for debriefing

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Metrics: Compliance > 90% of the time

- (1) device confirmation of correct endotracheal tube placement,5
- (2) a monitored or witnessed cardiac arrest event,6
- (3) time to first chest compression less than or equal to 1 minute,
- (4) time to first defibrillation delivered at less than or equal to 2 minutes for ventricular tachycardia (VT) or ventricular fibrillation (VF),4
- (5) administration of epinephrine or vasopressin for pulseless events (pulseless VT or VF or pulseless electrical activity or asystole) within 5 minutes.12

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Controversies:

- Hypothermia post arrest
- Goal Directed Therapy: bundle / no bundle
- Etiology specific therapies
- Massive PE management pathway
- IHCA post resuscitation care protocols

- Any others?

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OVERVIEW

- Provide:
  - Summary of the current data
  - Emphasize the Pearls and Pitfalls
  - A Toolkit for improvement

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IN-HOSPITAL CARDIAC ARREST: DEMOGRAPHICS

- 200,000 cases of IHCA annually in` the US (Merchant et al., 2011)
  - 6,000 IHCA cases occur in children each year, Nadkarni et al., 2006)
- IHCA Survival rates improved over the past decade
  - Approximately50% achieve ROSC following an IHCA, and
  - < 25% survive to hospital discharge (Chan, 2015; Girotra, 2012)
- Between 200 and 2013
  - Rates of clinically significant neurologic disability (CPC score >1) decreased (33 to 28 percent) (Girotra et al., 2012)
  - Survival rates increased from 16 to 24 percent (Chan, 2015).

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OOHCA v IHCA: Not the Same Beast

- 90 percent of OHCAs are of cardiac etiology and occur unexpectedly (Daya et al., 2015)
- IHCA < 50% half of the time is cardiac in etiology , and patients often demonstrate deterioration prior to the event (Chan, 2015; Morrison et al., 2013).
- PEA is more than double in IHCAs than double OHCA
- asystole is 1/3 higher in OHCAs than IHCAs.
- IHCA patients often have more secondary comorbidities and additional acute disease
- In IHCA response times are shorter and arrests are frequently witnessed,

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IHCA: Disparities Across Systems

- Significant differences in outcomes across systems differences due to:
  - the quality of hospital personnel training
  - adherence to evidence-based protocols
  - the implementation of internal quality control mechanisms
- Risk-adjusted survival rates vary from 12.4 to 22.7 in hospitals included in the GWTG-R registry (Merchant et al., 2011).
- Studies demonstrate that coordinated, high-quality, and comprehensive post-resuscitation care is provided, survival-to-hospital discharge with favorable neurologic outcome can be dramatically increased (Knafelj et al., 2007; Sunde et al., 2007).

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Transitions of Care: Every hand off is a chance for a FUMBLE

- The handoff between care teams can increase adverse events through medication errors, incomplete communication of relevant patient medical history affecting treatments, (Coleman et al., 2006; Cook et al., 2000; Moore et al., 2003).
- Hospital transition protocols and communication infrastructure should be in place to ensure that important information regarding cardiac arrest patients be relayed efficiently and seamlessly among health care providers who work in different teams and units.

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Prevent Secondary Damage

- Post Resuscitation care optimize:
  - neurologic recovery
  - therapy focused on prevention of recurrent events:
    - management of heart failure and myocardial ischemia burdens
    - ICD placement
    - comfort care
    - Requires coordination between multidisciplinary providers.

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Outcomes: Start with the definitions

- Defining an appropriate at-risk population for the denominator:
  - only individuals who experience a cardiac arrest or whether all visits to the hospital should be included.
  - concern about variability in do-not-attempt-resuscitation (DNAR) status orders across hospitals
- AHA's consensus recommends:
  - the numerator that includes all patients who receive chest compressions and/or defibrillation
  - the denominator reflects the total number of patients admitted to the hospital,(Morrison et al., 2013).
  - recommended that patients with DNAR status be removed from both the numerator and the denominator.

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What to Tweek for IHCA

- Studies shown that younger physicians and physicians-in-training lack competence and confidence in the nontechnical skills, such as leadership and teamwork, required to respond to cardiac arrests (Hayes et al., 2007).
- Delay in defibrillation more than 2 minutes after the initial arrest occurs in 30 percent of patients and associated with a significantly lower surviving to hospital discharge after multivariable risk adjustment (Chan et al., 2008).
- Adjusted rates of delays in time to defibrillation that was nearly 25-fold:
  - rates ranging from 2 to 51
  - likely because of differences in hospital-level factors (Chan et al., 2009; Merchant et al., 2009).

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Factors Influencing Outcomes: Toolkit

- Overall IHCA incidence represents the patient burden of illness, the facility's ability to detect deterioration in patients and prevent the cardiac arrest from occuring, and the effectiveness of a faculty's resuscitation response system (Morrison et al., 2013)
- ILCOR data reporting form:
  - measures team performance along multiple, clinically relevant dimensions
    - including team composition, structure, coverage, activation, and interventions
    - the patient's physiological data prior to, and during, the resuscitation;
    - outcomes for both the patient and the hospital (Peberdy et al., 2007).
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Resources: Resuscitation Teams

- considerable variability in the implementation:
  - 439 hospitals from across the United States:
    - nearly one-quarter of facilities failed to report having a pre-nontechnical designated, dedicated resuscitation team
    - one-third did not have standardized defibrillators available throughout their facility (Edelson et al., 2014).
- RRTs and METs, although evidence demonstrating their effectiveness in improving overall survival rates remains controversial (Chan et al., 2010).
  - failure of RRTs to properly communicate and activate transitions of care for appropriate patients was identified as a significant limitation.

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Early Detection: Prevention

- Early recognition would allow for transition and escalation of care prior to the event. Currently
  - multiple risk stratification tools are proposed, based primarily on including the Modified Early Warning Score for adult and pediatric patients.
- Randhawa and colleagues (2011) reduced by 23 percent the cardiac arrest frequency after the implementation of a bedside PEWS tool
- Clinical deterioration risk scores based on non-vital sign criteria (e.g., age, presence of specific underlying disease, enteral tube, and hemoglobin levels) could also improve outcomes (Bonafide et al., 2012b, 2014; Winberg et al., 2008)
- Using clinical deterioration scores, combined with METs, showed the cost-benefit ratio of METs was positive, especially in hospitals with bundled reimbursement.

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POST-ARREST CARE: Prevent Ongoing Damage and stimulate Repair

- rapidly assessing cardiac arrest patients who have achieved ROSC
  - optimizing cardiopulmonary function
  - stabilizing blood flow
  - minimizing neurologic injury
  - TTM
  - mechanical ventilation to minimize lung injury
  - Conduct prognostication (Peberdy et al., 2010).
- Neurological injury is primary cause of death:
  - 68 % in OHCA
  - 23 % in IHCA patients (Laver et al., 2004; Peberdy et al., 2010)
  - Potentially the reason why the effect of TTM is less in IHCA

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POST ARREST CARE: PEARLS

- time interval between the onset of the cardiac arrest and ROSC is a critical determinant of the severity of the post–cardiac arrest syndrome.
- customize post-arrest treatment protocol based on the neurologic and functional status of individual patients (Nolan et al., 2008; Rittenberger et al., 2011).
- two recent studies that found no survival benefit related to EGDT in septic shock states, further evaluation of EGDT for the post–cardiac arrest state is needed (Peake et al., 2014; Yealy et al., 2014).

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RRC/METS: PEARLS

- "patient-centric" CPR protocol was correlated with a significant 24-hour survival benefit over CPR performed according to the AHA guidelines (Sutton et al., 2014)
- These studies support recommendations for physiological monitoring of CPR during resuscitation, in cases where the monitoring systems are already in place (Meaney et al., 2013).
- The majority of IHCAs now occur in ICUs,

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NEUROPROGNOSTICATION

- Simple, bedside risk assessments allow for accurate predictions of long-term neurologic status (Chan et al., 2012).
- Neurologic assessments should include multidisciplinary care coordination to accurately evaluate and treat post–cardiac arrest survivors who do not immediately regain consciousness, in order to maximize the likelihood of complete recovery.
- The most robust prognostic estimates are usually obtained from a combination of neurologic examinations and neuro-electrophysiological tests (Booth et al., 2004, Kamps et al., 2013).
- However, serial neurologic observations beyond the first 24 to 72 hours, and in some cases, more than 96 hours following an arrest, are often required to provide reliable prognostic information (Neumar et al., 2008; Peberdy et al., 2010).

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NEUROPROGNOSTICATION

- As shown in Box 5-5, multiple tools available for neurologic assessment and scoring have demonstrated prognostic value.
- *Neurologic consultative expertise* should be used to assess the patient within the first 24 hours of a cardiac arrest to provide a baseline comprehensive neurologic examination,
- Determination of neurologic prognosis can be difficult during the period immediately following ROSC and, as a result, some experts have recommended waiting at least 72 hours or longer to allow the brain to recover from ischemia after an arrest before making major decisions (Neumar et al., 2008; Peberdy et al., 2010). Neuroprognostication is often delayed to beyond 96 hours for patients who have been treated with TTM, to allow recovery from the possible side effects of sedation and other drugs.

WITHDRAWAL OF LIFE SUSTAINING THERAPY

- Patient preferences should be of paramount importance in determining end-of-life care decisions (IOM, 2015).
- These decisions are determined by multiple factors: older age and secondary comorbidities of patients, race, a poor initial neurologic exam, and multiple organ failure (Albaeni et al., 2014).
- Factors such as the existence of living wills, health care proxies, family perspectives, and religious beliefs of patient and family members also influence such decisions.
- Existence and early implementation of a DNAR order portends a fatal outcome and has been associated with less aggressive hospital care (Jackson et al., 2004), including lower rates of potentially critical hospital interventions, procedures, and survival to discharge (Richardson et al., 2013).

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Delivering high-quality cardiopulmonary resuscitation in-hospital.
Soar J1, Edelson DP, Perkins GD.

- Delivering high-quality CPR in-hospital requires a multifaceted approach.
  - Collecting data during arrests and feeding back in real time
  - Post-event during debriefings can be used to improve delivery of high-quality CPR
  - There are few studies that show improvement in actual patient outcomes (e.g., survival to hospital discharge) with improvements in delivery of high-quality CPR
  - Recognizing the importance of both technical and nontechnical skills (human factors) to deliver high-quality CPR is essential.

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THA In-Hospital Committee

- The **brain arrest neurologic outcome scale** is a 16-point scale composed of three variables: duration of arrest, reversed GCS, and Hounsfield unit density ratio of the caudate nucleus over the posterior limb of the internal capsule on noncontrast CT scan of the head (Torbey et al., 2004).
- The s**even-point 5-R score** consists of the following variables: VF or VT as the first presenting cardiac rhythm, arrest-to-first CPR attempt time interval of less than 5 minutes, arrest-to-ROSC time interval of less than 30 minutes, recovery of pupillary light reflex in the ED, absence of rearrest before leaving the ED (Okada et al., 2012).
- The **Cardiac Arrest Survival Post-Resuscitation In-hospital (CASPRI) score** was developed specifically for IHCA and includes 11 predictor variables: age, initial cardiac arrest rhythm, duration of resuscitation, mechanical ventilation, defibrillation time, baseline neurologic status, sepsis, malignancy, renal insufficiency, hepatic insufficiency, and hypotension (Chan et al., 2012; Girotra et al., 2014). Although a relatively simple score, it is perceived as being unwieldy and has not been validated in OHCA patients. It can, however, provide estimates of the probability of favorable neurologic survival after IHCA.
- The **Good Outcome Following Attempted Resuscitation (GO-FAR)** score is used to predict neurologically intact survival after in-hospital cardiopulmonary resuscitation has also been developed. This score is based on 13 pre-arrest variables and can identify patients likely to survive IHCA with good neurologic prognosis or with minimal deficits (Ebell et al., 2013).

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An institutional resuscitation program should include:

- An institutional resuscitation program should target preventable deaths by addressing the following: prevention, resuscitation, post-resuscitative care, and end-of-life issues.
  - Arrest prevention should emphasize early recognition of deteriorating patients, including integration of available technology and physiological sensors.
  - Arrest resuscitation should focus on performance of high-quality CPR.
  - Postarrest care should optimize supportive critical care, consider targeted temperature management, and facilitate early coronary revascularization.
  - Endoflife discussions should provide patients and families with compassionate but realistic expectations regarding goals of therapy and various therapeutic options.

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An institutional resuscitation program should include:

- A multidisciplinary, multispecialty collaborative team should be assembled to assume primary responsibility for institutional resuscitation outcomes.
- An institutional approach to resuscitation should be defined, considering patient population, provider capabilities, available technology, and institutional interpretation of scientific evidence.
- Data regarding resuscitation performance and outcomes should be collected to give feedback to providers and inform decisions regarding training and other interventions

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An institutional resuscitation program should include:

- Training should ensure competency regarding the institutional approach to resuscitation, including provider-specific roles and expectations.
- Cultural change should be effected by targeting individual ownership, accountability, and empowerment.
- Program success should ultimately be defined by clinical outcomes.

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The Advanced Resuscitation Training (ART) program contains the following unique features:

- An organized approach – or scaffolding – to help institutions achieve the core elements of a successful resuscitation program as outlined above.
- Integration of all institutional activities related to patient safety and reducing preventable deaths.
- A unique architecture that integrates an evolutionary approach to data collection and performance improvement ("Afferents") to provide feedback, benchmarking, and identification of opportunities for improvement including special projects and training ("Efferents").

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The Advanced Resuscitation Training (ART) program contains the following unique features:

- Performance improvement efforts organized around the ART Matrix, a unique taxonomy to categorize arrest etiologies and identify opportunities for prevention, resuscitation, and end-of-life discussions.
- A modular, multi-modal curriculum to facilitate adaptive, contextual training.
  - Training is linked to performance improvement elements.
  - Several unique paradigms provide a foundational framework for providers to understand the acute care of patients and act according to the core ART principles and facilitate integration of future clinical and technological advances.
  - Cognitive psychology strategies are employed to engage providers, prime for learning, and provide clear identification of core objectives.
- Clinical outcomes across multiple institutions and various care environments have been unparalleled and remarkably consistent.

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