Regionalization of Post-Cardiac Arrest Care

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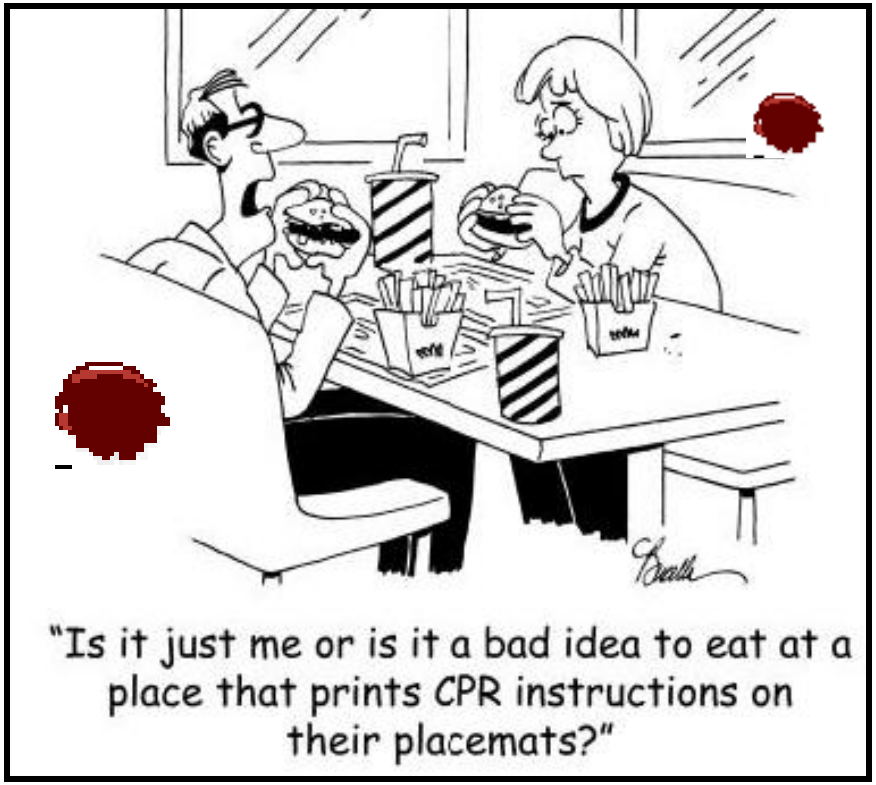
Uncompromising Excellence. Commitment to Care.

Disclosures

I have no financial interest, arrangement, or affiliations and no commercial interests, ties, or grants related to material covered in this lecture.

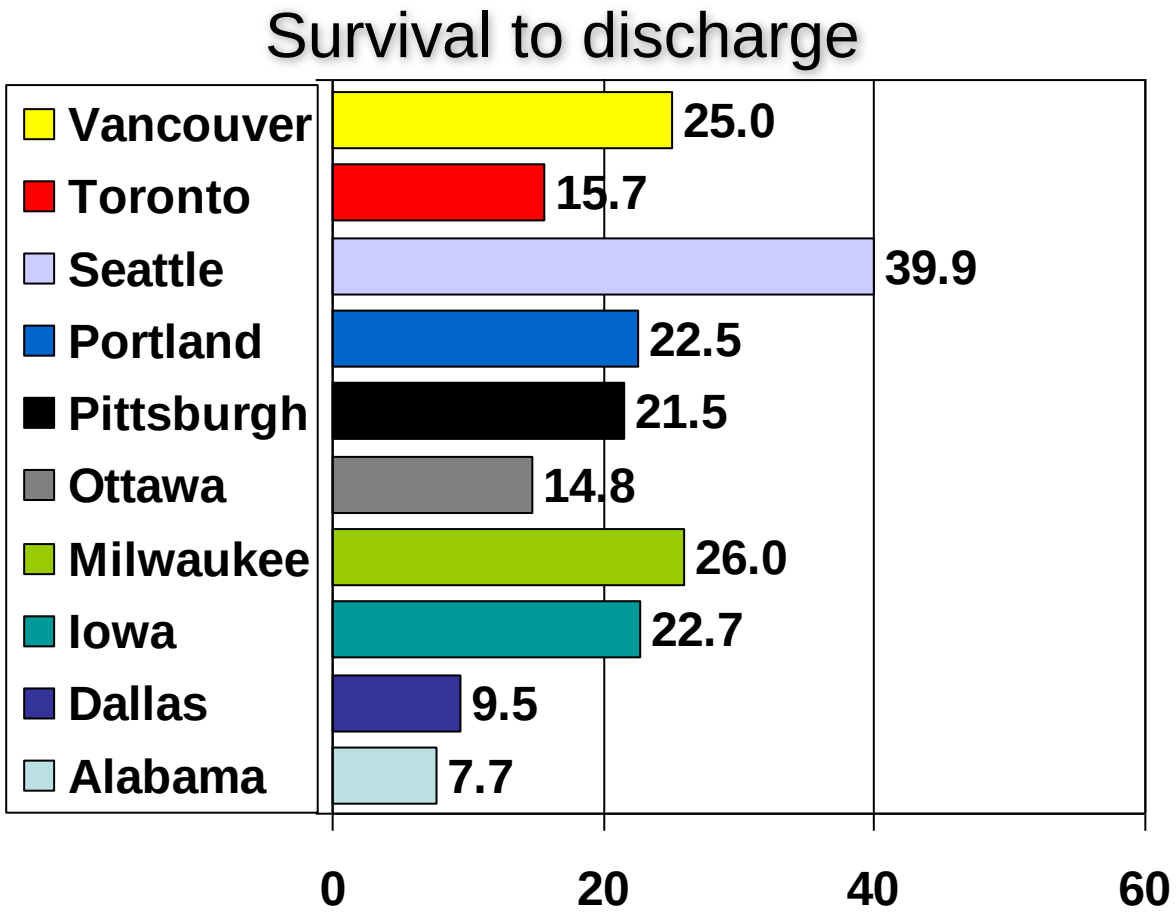


Objectives - Regionalization

- ❑ Background
- ❑ Evidence: Code Cool™
- ❑ Best Practices

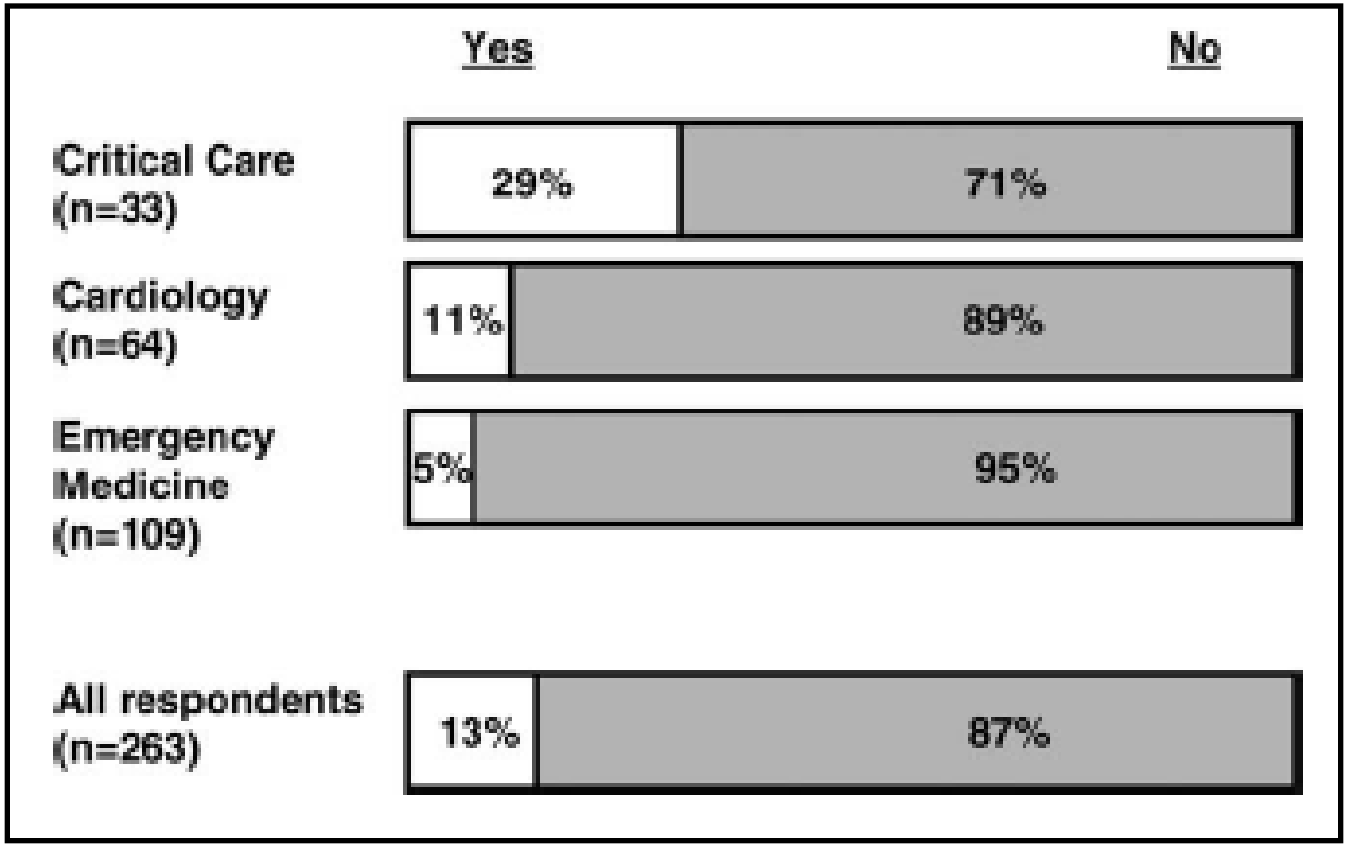
Variation in Survival VF arrest

Resuscitations Outcomes Consortium



Nichol JAMA. 2008;300(12):1423-1431

U.S. Implementation 2005



Abella B, et al. *Resuscitation* 2005.
Merchant RM, et al. *Crit Care Med* 2006.
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Regionalization Rationale

- IOM & AHA endorse regionalized systems
- Increase utilization of proven interventions
- Specialized resources at certain centers
- Correlation between case volume and patient outcome

Mooney, et al. *Circulation*. 2011.

Adult Chain of Survival

1. Immediate recognition & activation of EMS
2. Early CPR - emphasis on chest compressions
3. Rapid defibrillation
4. Effective advanced life support
5. *Integrated post–cardiac arrest care*

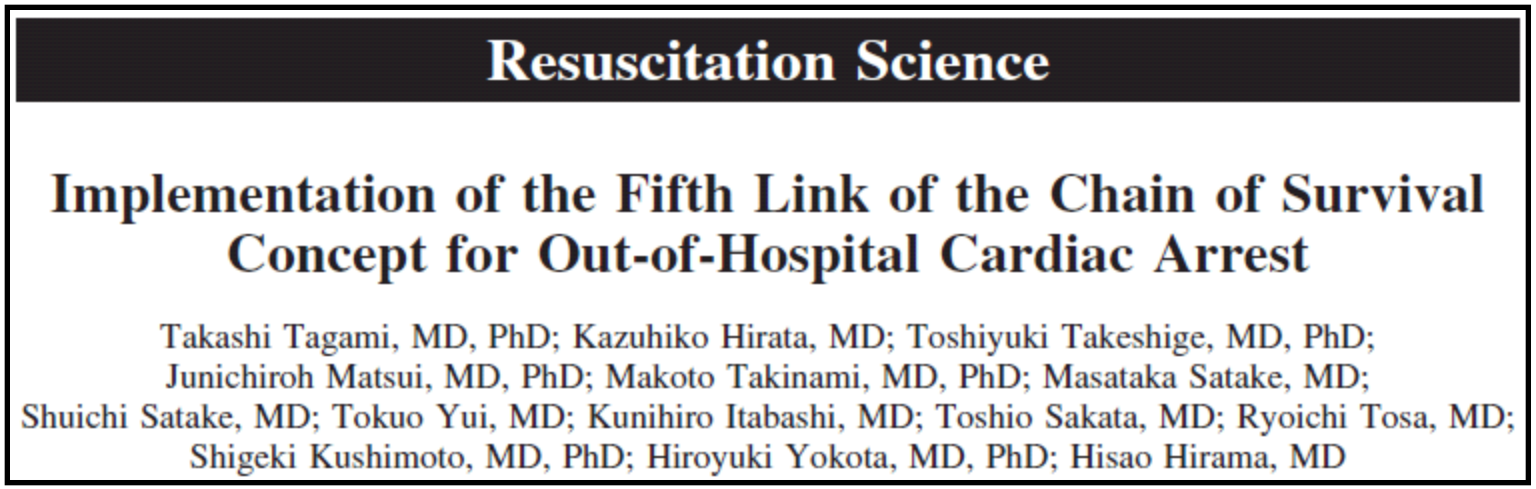
AHA 2010: Post-Arrest Guidelines

- ❑ Optimize perfusion
- ❑ Identify & treat precipitating cause
- ❑ Transport to comprehensive post-cardiac arrest treatment system
  - Acute coronary interventions
  - Goal-directed critical care
  - Hypothermia

AHA 2010: Fifth Link to Survival

Transport to comprehensive post-cardiac arrest treatment center

Japanese Experience



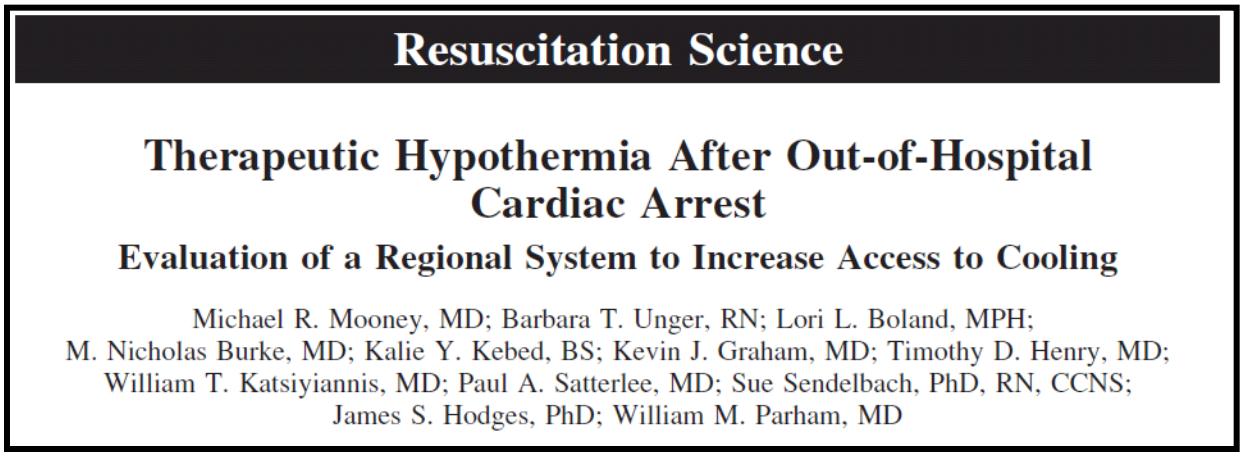
Resuscitation Science

Implementation of the Fifth Link of the Chain of Survival Concept for Out-of-Hospital Cardiac Arrest

Takashi Tagami, MD, PhD; Kazuhiko Hirata, MD; Toshiyuki Takeshige, MD, PhD; Junichiroh Matsui, MD, PhD; Makoto Takinami, MD, PhD; Masataka Satake, MD; Shuichi Satake, MD; Tokuo Yui, MD; Kunihiro Itabashi, MD; Toshio Sakata, MD; Ryoichi Tosa, MD; Shigeki Kushimoto, MD, PhD; Hiroyuki Yokota, MD, PhD; Hisao Hirama, MD

- Second link (early defibrillation) most important
- Fifth link (multidisciplinary post-resuscitation care in a regional center) next most important

Minneapolis Experience



Resuscitation Science

Therapeutic Hypothermia After Out-of-Hospital Cardiac Arrest

Evaluation of a Regional System to Increase Access to Cooling

Michael R. Mooney, MD; Barbara T. Unger, RN; Lori L. Boland, MPH; M. Nicholas Burke, MD; Kalie Y. Kebed, BS; Kevin J. Graham, MD; Timothy D. Henry, MD; William T. Katsiyiannis, MD; Paul A. Satterlee, MD; Sue Sendelbach, PhD, RN, CCNS; James S. Hodges, PhD; William M. Parham, MD

- 150 mile catchment area
- 140 out-of-hospital cardiac arrest patients
- ROSC < 60 minutes
- Included: any initial rhythm, HD instability, STEMI
- Excluded: DNR, active bleeding, comatose before arrest

Minneapolis Experience: Arrest Characteristics

- ❑ Witnessed: 82%
- ❑ Bystander CPR: 66%
- ❑ VT/VF 76%
- ❑ PEA/asystole 24%
- ❑ STEMI 49%
- ❑ Shock 44%
- ❑ Downtime 22 minutes

Mooney, et al. *Circulation*. 2011.

Minneapolis Experience: Outcomes

- 56% survived
- **51% good neurological outcome**
- 20% increased risk of death with every hour delay in initiation of cooling
- Time to goal temperature not significantly associated with survival

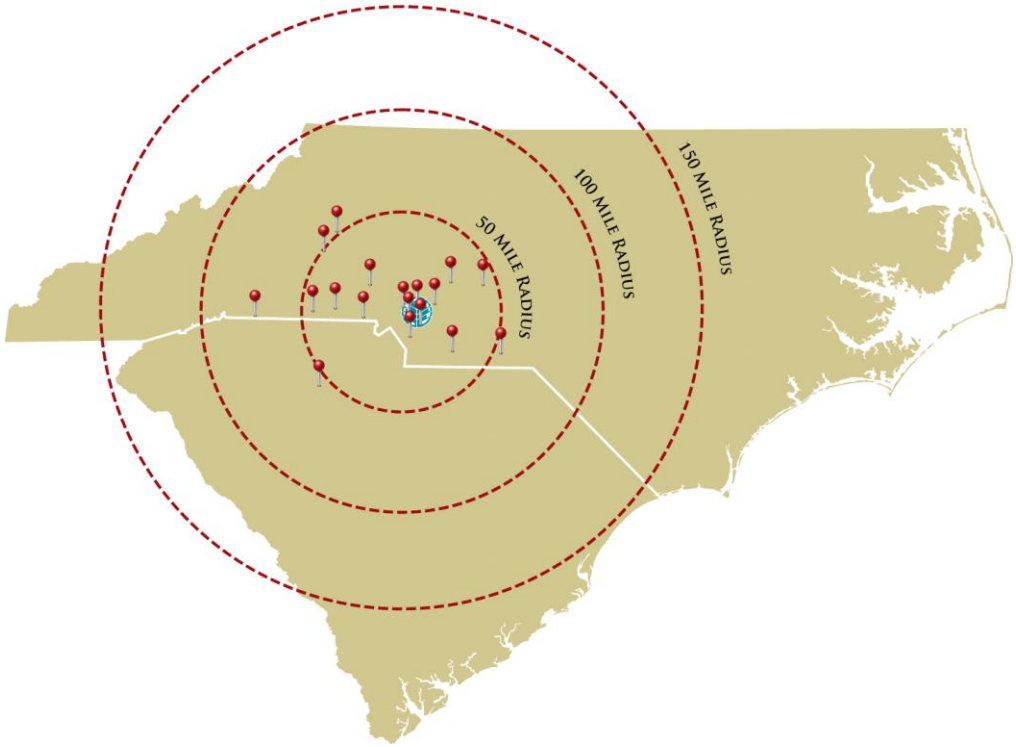
Mooney, et al. *Circulation*. 2011.

Minneapolis Heart Institute's "Cool It"

Patient Group	Good Neurologic Outcomes
Local (n=17/33)	42%
Referred/Transfer (n=58/107)	54%
Age > 75 (n=9/30)	**30%**
Asystole/PEA (n=7/32)	**22%**
Downtime > 30 min (n=16/45)	**36%**

CMC Experience

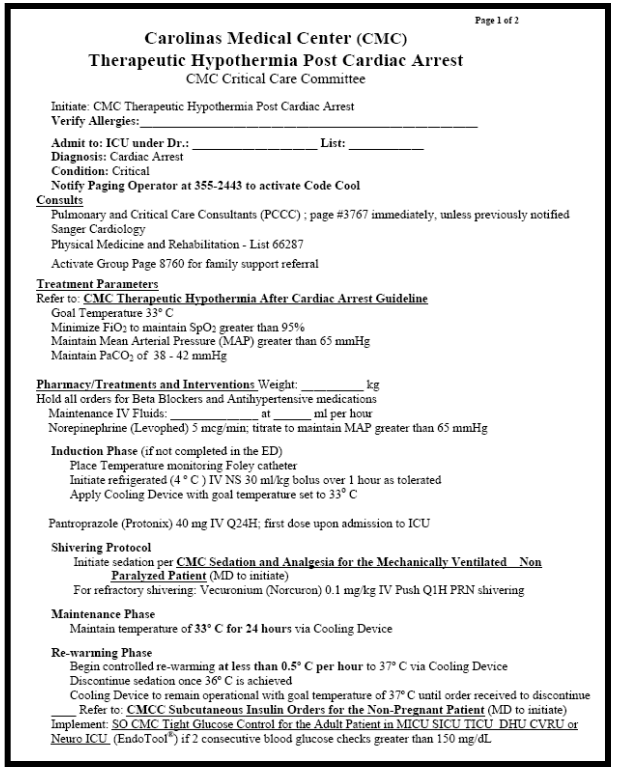
- ❑ Local: 46% good neurological outcome
- ❑ Referred: 39% good neurological outcome



Heffner, et al. AHJ. 2012.

Code Cool: More Than Cooling

- ❑ Post-arrest resuscitation bundle
- ❑ Fluid resuscitation via cold IVF
- ❑ MAP > 70 mmHg
- ❑ Therapeutic hypothermia
- ❑ Avoid hyperoxia
- ❑ Avoid hyperventilation



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Carolinas Medical Center (CMC)
Therapeutic Hypothermia Post Cardiac Arrest
CMC Critical Care Committee

Initiate: CMC Therapeutic Hypothermia Post Cardiac Arrest
Verify Allergies:_____

Admit to: ICU under Dr.: _____ **List:** _____
Diagnosis: Cardiac Arrest
Condition: Critical
Notify Paging Operator at 355-2443 to activate Code Cool

Consults
Pulmonary and Critical Care Consultants (PCCC) ; page #3767 immediately, unless previously notified
Sanger Cardiology
Physical Medicine and Rehabilitation - List 66287
Activate Group Page 8760 for family support referral

Treatment Parameters
Refer to: **CMC Therapeutic Hypothermia After Cardiac Arrest Guideline**
Goal Temperature 33° C
Minimize FiO_2 to maintain SpO_2 greater than 95%
Maintain Mean Arterial Pressure (MAP) greater than 65 mmHg
Maintain $PaCO_2$ of 38 - 42 mmHg

Pharmacy/Treatments and Interventions Weight: _____ kg
Hold all orders for Beta Blockers and Antihypertensive medications
Maintenance IV Fluids: _____ at _____ ml per hour
Norepinephrine (Levophed) 5 mcg/min; titrate to maintain MAP greater than 65 mmHg

Induction Phase (if not completed in the ED)
Place Temperature monitoring Foley catheter
Initiate refrigerated (4 ° C) IV NS 30 ml/kg bolus over 1 hour as tolerated
Apply Cooling Device with goal temperature set to 33° C

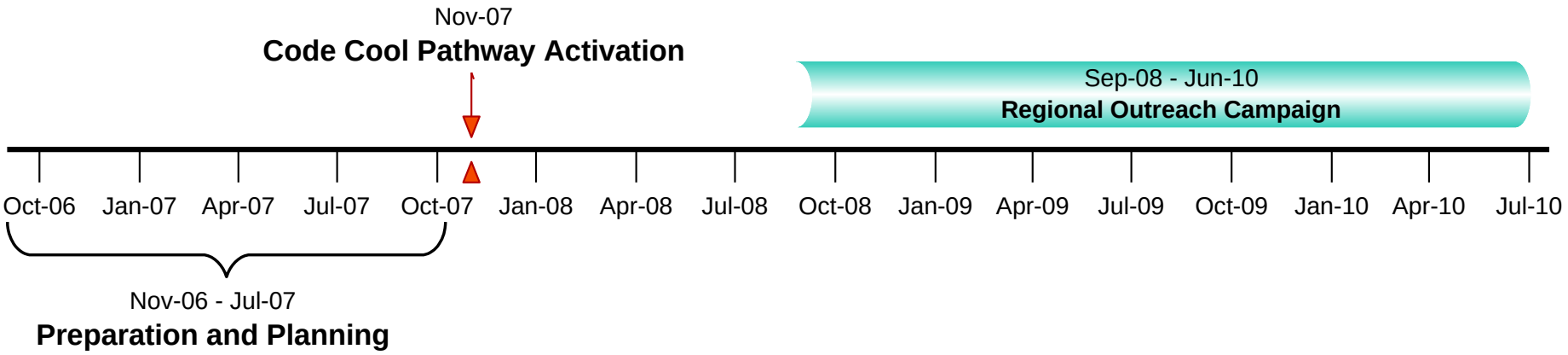
Pantroprazole (Protonix) 40 mg IV Q24H; first dose upon admission to ICU

Shivering Protocol
Initiate sedation per **CMC Sedation and Analgesia for the Mechanically Ventilated Non Paralyzed Patient** (MD to initiate)
For refractory shivering: Vecuronium (Norcuron) 0.1 mg/kg IV Push Q1H PRN shivering

Maintenance Phase
Maintain temperature of **33° C for 24 hours** via Cooling Device

Re-warming Phase
Begin controlled re-warming **at less than 0.5° C per hour** to 37° C via Cooling Device
Discontinue sedation once 36° C is achieved
Cooling Device to remain operational with goal temperature of 37° C until order received to discontinue
____ Refer to: **CMCC Subcutaneous Insulin Orders for the Non-Pregnant Patient** (MD to initiate)
Implement: SO CMC Tight Glucose Control for the Adult Patient in MICU SICU TICU DHU CVRU or Neuro ICU (EndoTool®) if 2 consecutive blood glucose checks greater than 150 mg/dL

Code Cool Implementation Timeline



Post-Cardiac Arrest Resuscitation
Carolinas Medical Center CODE COOL™

For Code Cool Transfer, contact: CMC Physician Connection Line (PCL)
704-512-7878, Toll Free 877-262-6397 or Yellow Phone

CODE COOL™

Carolinas Medical Center

Inclusion Criteria
- Adults (age ≥ 18 years)
- Return of spontaneous circulation (ROSC) within 30 minutes of arrest
- Persistent coma: inability to follow commands and/or GCS < 9

Exclusion Criteria
- Severe or terminal illness with anticipated non-aggressive care
- Active hemorrhage
- Systemic infection/sepsis
- Severe refractory shock

Resuscitation Priorities
- Airway: Intubation
- Breathing
  - Avoid hyperventilation (goal PaCO2 of 38 – 42mmHg)
  - Avoid hyperoxia (rapidly decrease FIO2 to maintain SpO2>95%)
- Circulation
  - Goal MAP>70
  - Anticipate and avoid hypotension
  - Norepinephrine is the preferred vasopressor
  - ECG screen for STEMI

Cooling Induction
- Initiate cooling as soon as possible after ROSC
- Refrigerated (4°C) NS 30 cc/kg IV bolus as tolerated
- Ice packs to groin, axilla and neck
- Shivering control with Propofol 10 mcg/kg/min
- Paralyze patient with Vecuronium 0.1mg/kg q1hr

Do
- Initiate transfer early
- Use paralytics during induction phase of cooling
- Document time of arrest, time of ROSC and neuro exam

Don't
- Delay cooling for CT scanning or extensive testing before transfer, unless clinically indicated

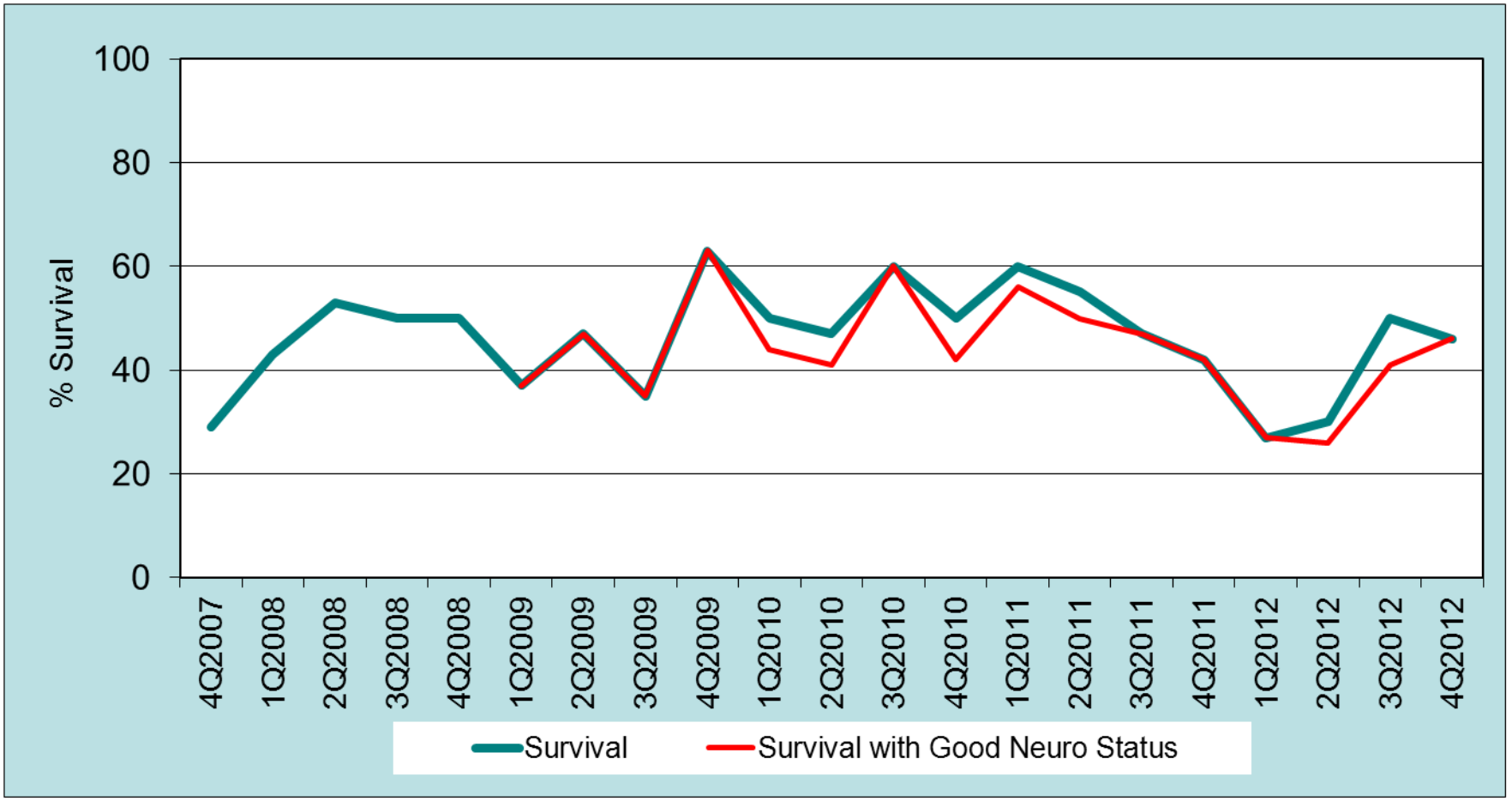
Code Cool 2007-2012

- Started November 2007
- Total patients: 437 patients (Code Cool Protocol initiated)
- Total patients: 360 patients (Included in analysis)
- Transfers: 43%
- In-hospital arrests: 3%
- STEMIs: 9%

Code Cool Demographics

	2010	2011	2012
Total patients (Completed protocol, included in analysis)	52	84	106
Transfers	23	36	50
In-patient arrests	2	3	0
STEMI	5	9	8

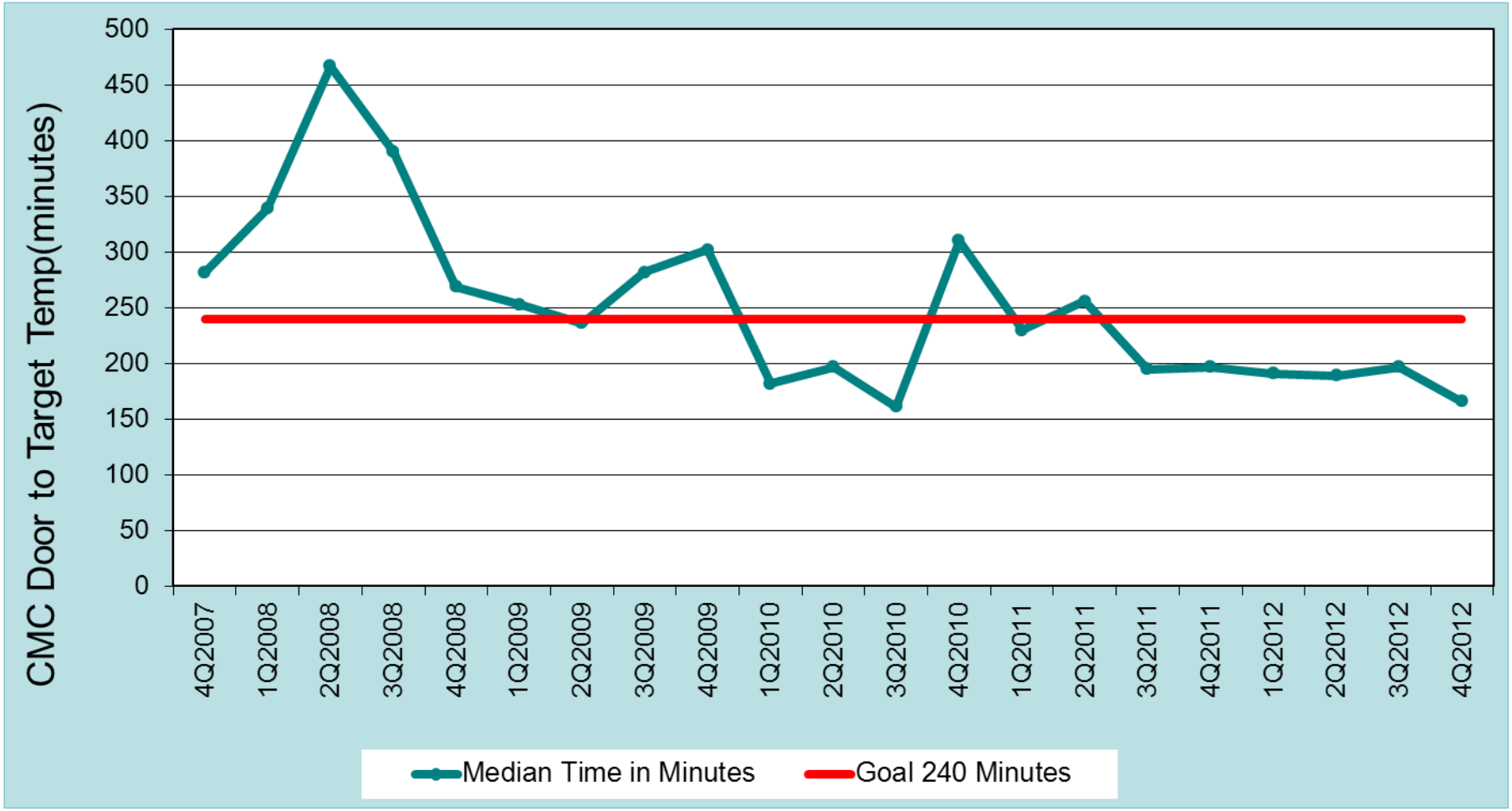
Code Cool Outcomes: % Survival



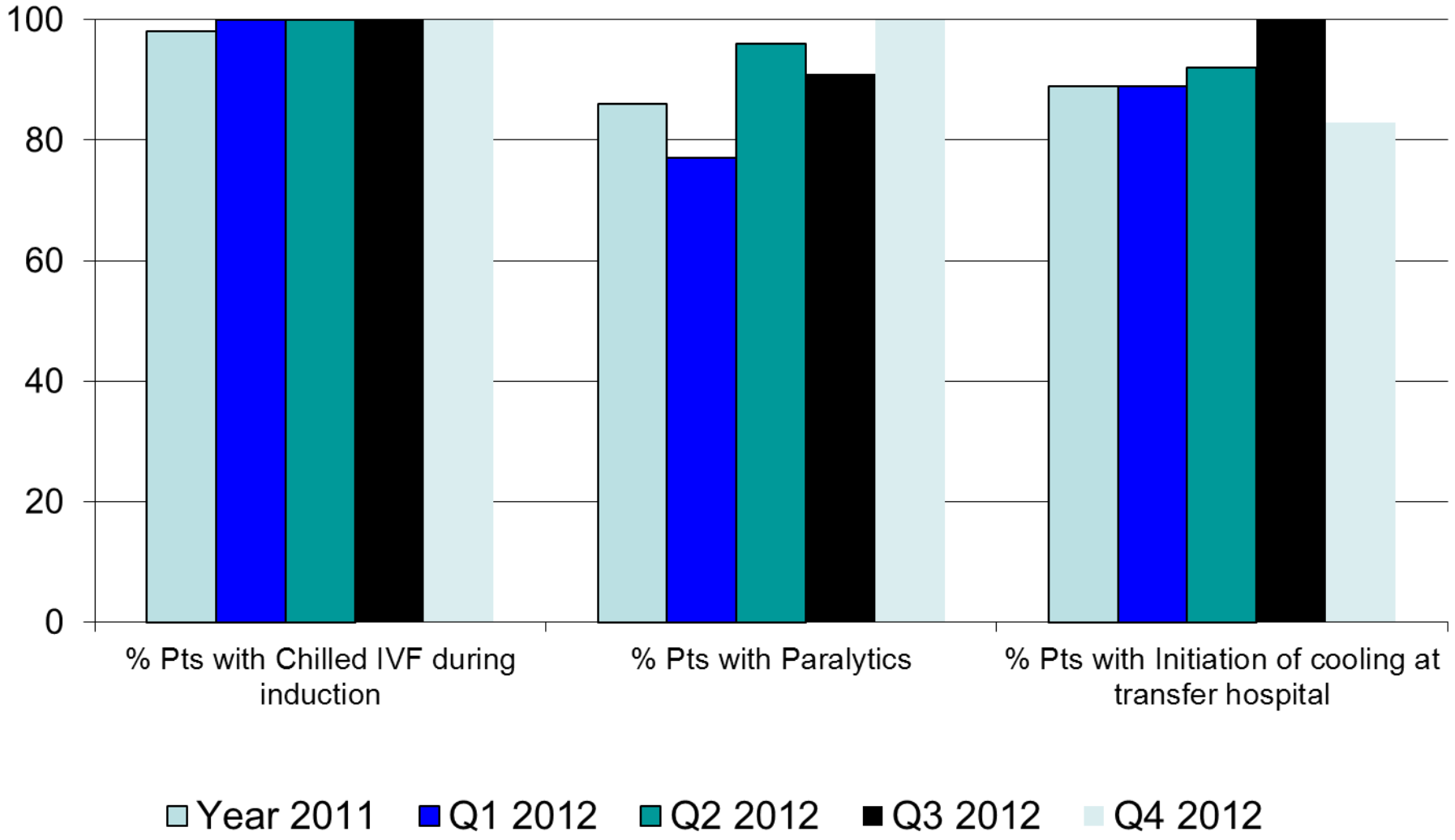
Survival and Initial Rhythm

	2010 n=52		2011 n=84		2012 n=106	
Initial Rhythm	Survived	Survived with good neuro outcome	Survived	Survived with good neuro outcome	Survived	Survived with good neuro outcome
VT/VF	57.6%	54.5%	59.6%	57.9%	56.1%	55.4%
PEA	42.9%	35.7%	33.3%	33.3%	22.2%	12.5%
Asystole	20%	0%	33.3%	26.7%	16.7%	16.7%

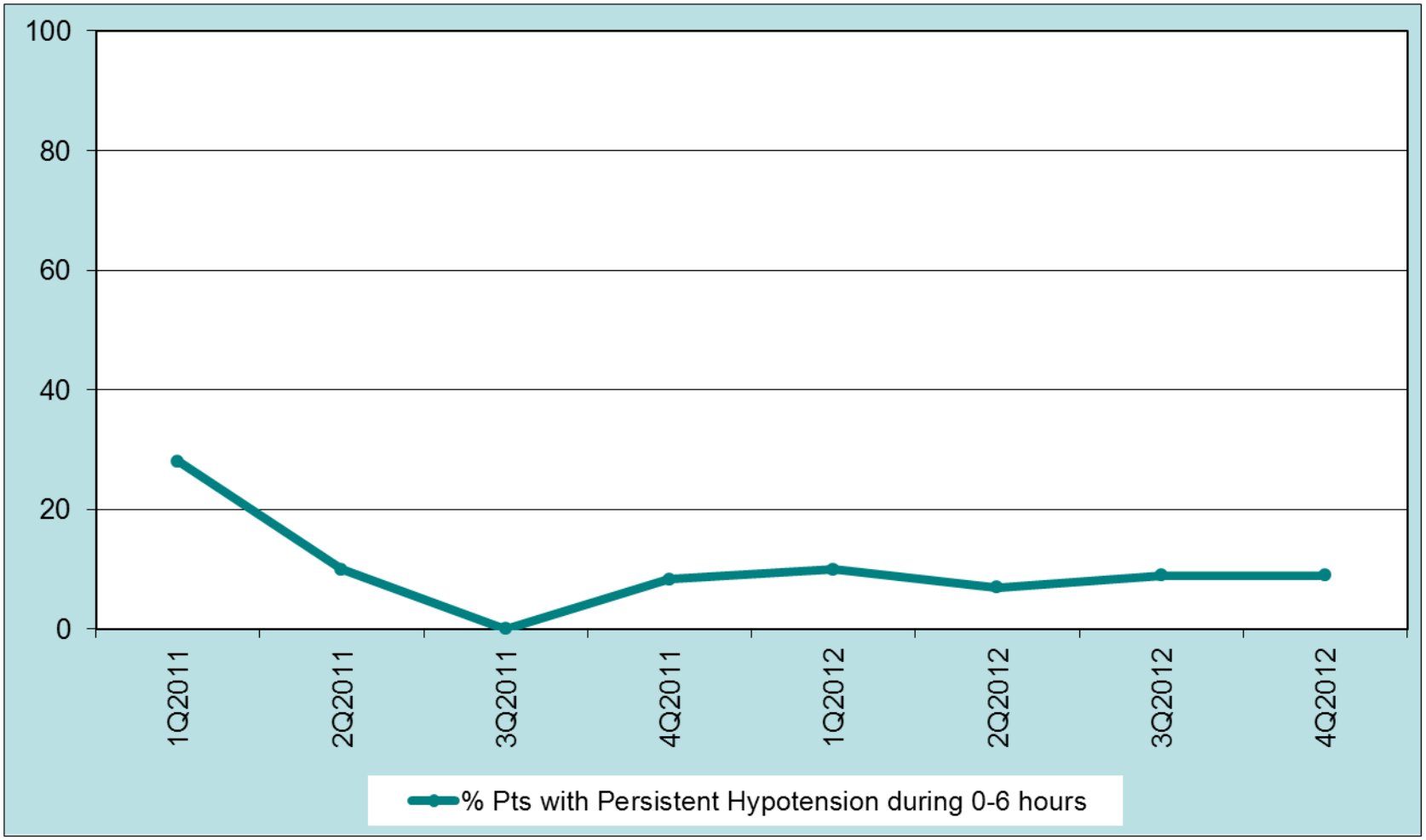
Code Cool Process: CMC Door to Target Temp Median Time



Code Cool Process Measures



Code Cool Outcome: % Pts with Persistent Hypotension during 0-6 hours



Medtronic FOUNDATION

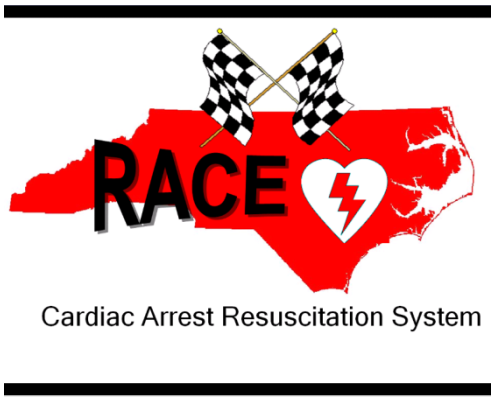
HeartRescue PROJECT

Every second counts. Every action matters.

ARE YOU READY TO SAVE MORE LIVES?

Regional Approach to Cardiovascular Emergencies

Cardiac Arrest Resuscitation System



Goal: To improve the survival from cardiac arrest by 50%

Hospital Response

Resuscitation-Capable Hospital

- ❑ Resuscitate
- ❑ Initiate cooling
- ❑ Transfer

Cardiac Arrest Center

- ❑ Hypothermia
- ❑ PCI
- ❑ ICD assessment & placement

Resuscitation-Capable Hospital

- ❑ ACLS protocols
- ❑ Baseline neurologic exam
- ❑ 2 large bore IV
- ❑ ECG = STEMI: activate STEMI plan
- ❑ Implement tx protocols for STEMI and cardiac arrest

Resuscitation-Capable Hospital

- ❑ Early notification of receiving hospital
- ❑ Early activation of transport plan
- ❑ Send medical records and EMTALA

Resuscitation-Capable Hospital

- ❑ Optimize BP to MAP > 80 mmHg
- ❑ Titrate EtCO2 for 35-40
- ❑ Consider CT imaging
- ❑ Induction of hypothermia (cold IVF)
- ❑ Sedation and paralysis
- ❑ Data measurement and feedback

Cardiac Arrest Center

- ❑ Ongoing neurological assessment & care
- ❑ Early coronary angiography if not a STEMI
- ❑ ICD evaluation
- ❑ 24/7 cath lab availability for STEMI
- ❑ Rehabilitation Plan

Hospital Response

Resuscitation Capable Hospital

- ❑ Resuscitate
- ❑ Initiate cooling
- ❑ Transfer

Cardiac Arrest Center

- ❑ Hypothermia
- ❑ PCI
- ❑ ICD assessment & placement

Take Home

- ❑ Aggressively resuscitate
- ❑ Establish transfer protocols
- ❑ Cardiac arrest centers

Questions?