

# Out-of-Hospital Cardiac Arrest Survival after the Sequential Implementation of 2005 AHA Guidelines for Compressions, Ventilations, and Induced Hypothermia

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## Disclosure

- ✦ Paul Hinchey, Eric Reyer, and Brent Myers serve on the speaker's bureau for Alsius Corporation



## Capital County Research Consortium

- ✦ Community-based research group representing Rex Healthcare, Wake County EMS System, and WakeMed Health and Hospitals
- ✦ Includes nurses, physicians, paramedics, and research support



## Community Wide Project

- ✦ Multi-phase before and after clinical trial
- ✦ All out-of-hospital cardiac arrests (OOH-CA) on a community wide basis were eligible for inclusion



## Protocol Revision Timeline

- ✦ Baseline [Jan 2004-Apr 2005]: Traditional CPR, focus on airway
- ✦ New CPR [Apr 2005-Apr 2006]: Continuous compressions, delayed intubation for VF/VT
- ✦ Impedance Threshold Device (ITD) [Apr 2006-Oct 2006]
- ✦ Induced Hypothermia [Oct 2006-Oct 2007]



## Methods

- All EMS records are maintained in an electronic database
- Records with any of the following characteristics are reviewed to determine if cardiac arrest occurred:
  - EMS Patient Disposition = cardiac arrest
  - CPR procedure is recorded
  - Defibrillation is recorded



## Cases Excluded from Review

- Age less than 16
- Obvious traumatic origin of arrest
- EMS witnessed arrest
- Arrest not in EMS control
  - Prison facilities
  - Out-of-system intercept
  - Arrests under direction of non-EMS physician



## Methods

- Data were analyzed using logistic regression
- Covariates offered for the regression:
  - Age
  - Gender
  - Response time for the first defibrillator
  - Witnessed status
  - Location



## Methods

- Primary outcome was the proportion of OOH-CA patients for whom resuscitation was attempted that survived to discharge in baseline vs. hypothermia phases
- Secondary outcomes include (by phase):
  - Pulse at emergency department, survival to admission, neurological intact survival to discharge
- Additionally, results were stratified by initial rhythm



## Methods

- Neurologically intact survival was defined as CPC 1 or 2 at time of hospital discharge or discharge from rehabilitation if transferred directly from hospital
- 2 blinded physician reviewers from each hospital independently assigned CPC scores based on patient records



## Results

- 3124 OOH-CA occurred during the study period
- 1442 obvious deaths (no resuscitation attempted)
- 1682 attempted resuscitations
- 484 of 1682 were excluded due to:
  - 119 not under EMS control/not a code
  - 109 obvious traumatic origin
  - 70 under the age of 16
  - 206 EMS witnessed
- 1198 met inclusion criteria



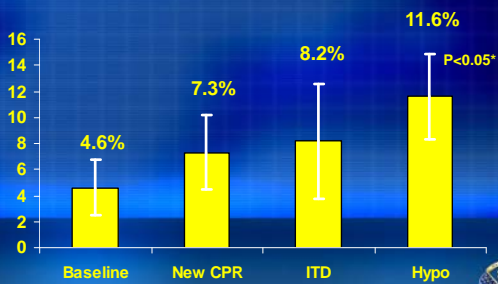
## Results

Total OOH-CA	N= 1198
Baseline	N = 372
New CPR	N= 319
ITD	N= 148
Hypothermia	N= 359

Mean Age	65
Percent male	58%
Private Residence	81%
Witnessed Status	36%
Bystander CPR	36%
Mean Defibrillator Response	5.3 – 6.1 mins
Initially VF/VT	26%

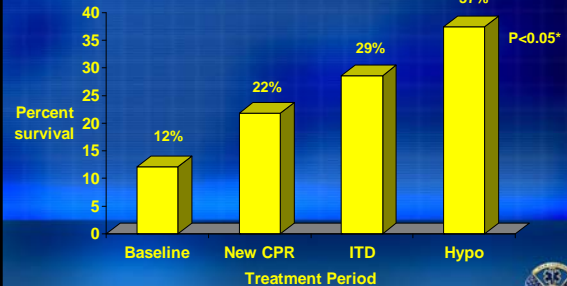
NOTE: no statistically significant difference between study periods

## Survival – All Rhythms



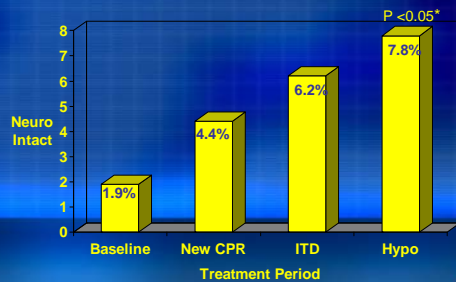
\* when compared with baseline

## Survival – VF/VT



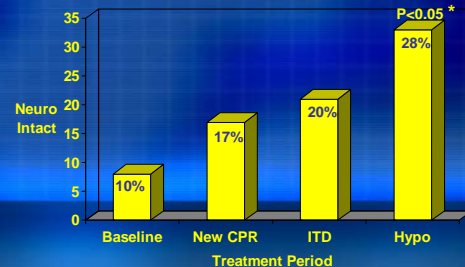
\* When compared with baseline

## Percentage of All Attempted Resuscitations Neuro Intact

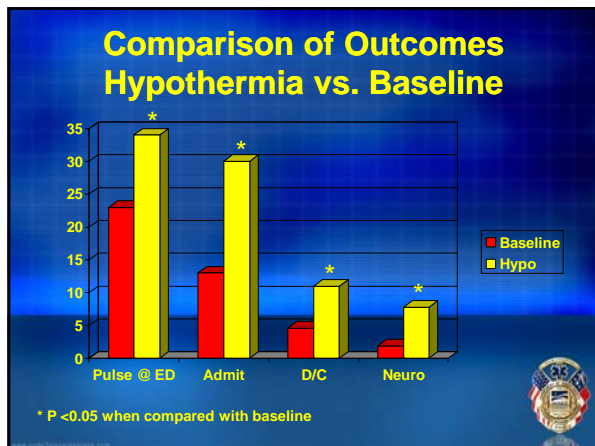


\* When compared with baseline

## Neurologically intact – VF/VT



\* When compared with baseline



### Multivariate Odds of Survival

Factor	Odds	95% CI
Age	0.97	0.96-0.98
Residence	0.50	0.31-0.82
Bystander CPR	2.18	1.34-3.54
New CPR	2.37	1.10-4.96
ITD	2.99	1.29-6.95
Hypothermia	3.67	1.86-7.26

- ### Discussion
- + Confounders
    - + Removal of stacked defibrillations
    - + Protocol-driven pre- and post-resuscitation cardiac arrest care
    - + Improvement with procedures due to repetition
  - + Hawthorne effect
  - + Intention-to-treat analysis

### Conclusion

The sequential implementation of 2005 AHA guidelines for compressions, ventilations, and induced hypothermia lead to significant improvements in neurologically intact survival for cardiac arrest in this urban/suburban community.



- ### Criteria for Induced Hypothermia
- + ROSC after cardiac arrest not related to trauma or hemorrhage
  - + Age 16 years or greater
  - + Female without obviously gravid uterus
  - + Initial temperature >34 C
  - + Patient is intubated (no RSI)
  - + Patient remains comatose without purposeful response to pain

## Multivariate Odds of Neuro Intact Survival

Factor	Odds	95% CI
Age	0.97	0.96-0.98
Bystander CPR	2.65	1.49-4.71
New CPR	3.19	1.10-9.26
ITD	4.95	1.61-15.21
Hypothermia	6.21	2.35-16.41



## Sample Database Entry

Index Number	(AutoNumber)	Call Hour	Airway	Circulatory Access	<input type="checkbox"/> Print to File?
Date		EMS Agency	Vasopressin	Lidocaine	<input type="checkbox"/> Sent to Hospital?
PCR#		Fire Agency	Any ROSC?	Pulse at ER	<input type="checkbox"/> Received from Hospital
Run Number		Disposition	Follow Up/PEA?	Admitted to Hospital?	
Last Name		Resuscitation	Initial Rhythm	First Responder AED	
First Name		Witnessed	First Responder ROSC?	Known Trauma?	
Middle		First CPR	Survived to Discharge?	First Responder On Scene?	
DOB		Initial Rhythm	Out-of-County Call?	PAI CPR Confirmed?	
Patient Age		First Responder AED			
Gender		First Responder ROSC?			
Ethnic Origin		Known Trauma?			
Call Address		Out-of-County Call?			
Crew 1		Description	Crew Type		
Crew 2		Vehicle Number	Net A Code		
Reviewer 1 CPC Score:		Reviewer 2 CPC Score:			

## Background

- Wake County/Raleigh, NC:
  - Single, 3<sup>rd</sup> service EMS System with 65,000 calls/year
  - Reliable firefighter first response
  - Resident population of ~825,000 (add 100 per day)
  - Post-resuscitation patients are selectively transported to one of 2 high volume PCI centers



## Cardiac Arrest Response

- All calls receive EMD from a single, high-volume center
  - Fire first response with AED and compressions
  - Paramedic response with transport ambulances
  - Supervisory response at paramedic level

