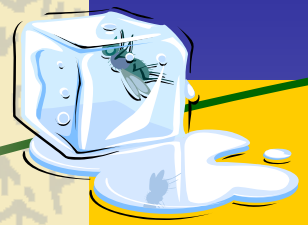
New Developments in Post Resuscitation Care:



MILD THERAPEUTIC HYPOTHERMIA

Feel free to use these slides in part or whole as you see fit for internal educational purposes only

Resuscitation After Cardiac Arrest:
A 3-Phase Time-Sensitive Model

The Electrical Phase: *0 – 4 min post VF onset*

- if defibrillation achieved, excellent outcomes
- little need for ventilation, drugs

The Circulatory Phase: *4 - 10 min post VF onset*

- cardiac, CNS hypoxia
- poor organ function even if defibrillation achieved
- provide circulation to 'prime the pump', ± adjuncts
- refibrillation common – consider antiarrhythmics

The Metabolic Phase: *> 10 min post VF onset*

- consider hypothermia
- is epinephrine harmful?

Weisfeld et al, JAMA 2002;288:23

Improving ACLS

- Delaying defibrillation (CPR first)
- Improving CPR- better thoracic vacuum during decompression
- Mono vs. biphasic defibrillation
- Constant vs. incrementing energy defibrillation
- Vasopressors
  - epinephrine
  - vasopressin
- Antiarrhythmic drugs

But what about the 4th Link…

…Post Resuscitation Care

Why do we need to improve our care in the 4th Link?

- Only 10% of cardiac arrests that arrive at hospital alive survive to go home !
- About 60% of cardiac arrest survivors regain consciousness
- 1/3 experience irreversible cognitive disabilities

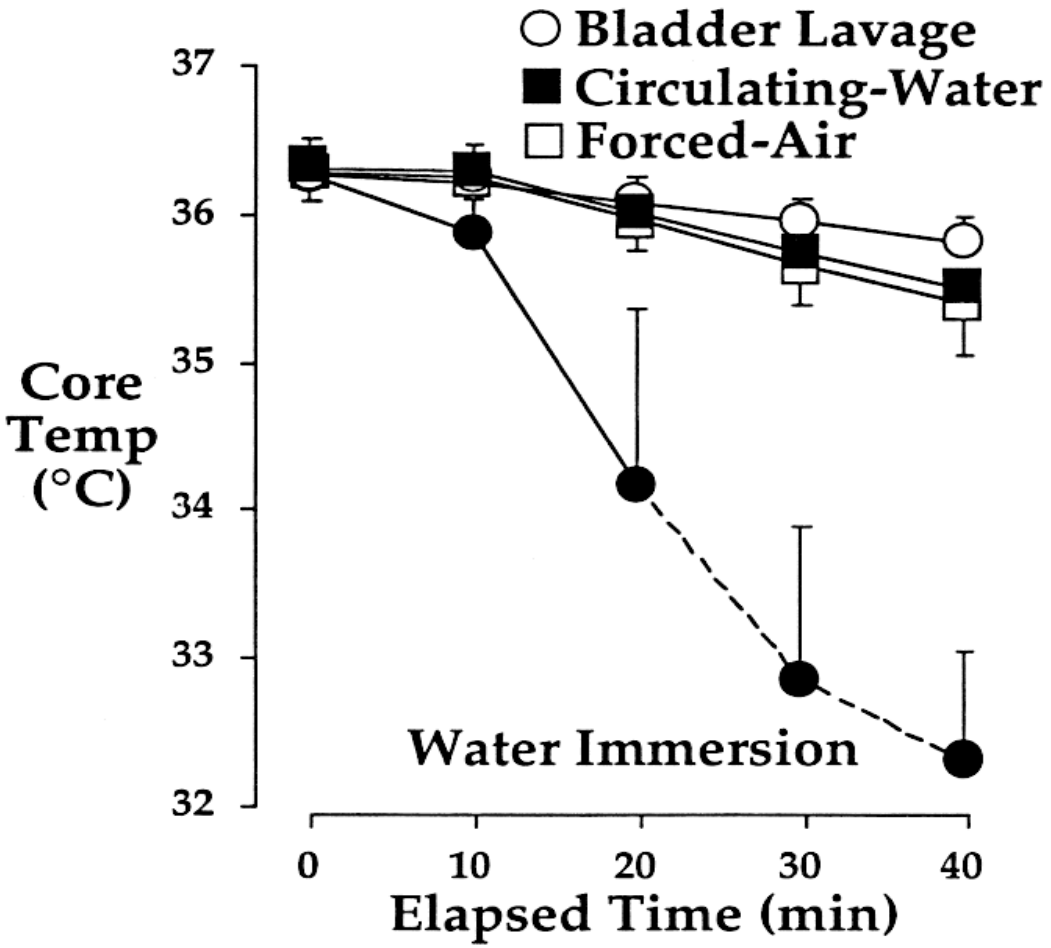
…this is where therapeutic hypothermia has its effect

Mild Therapeutic Hypothermia

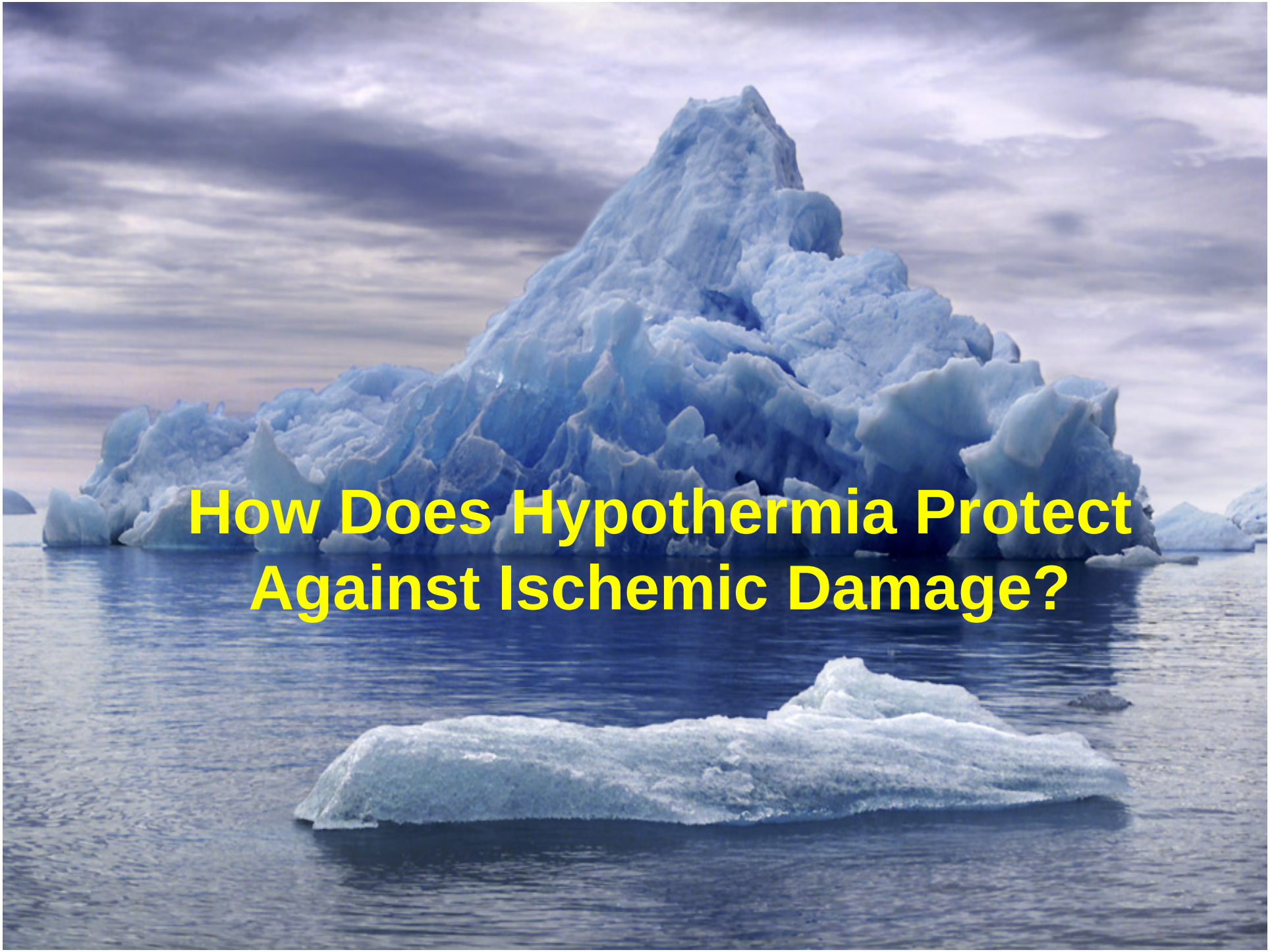
- The goal of therapy =
  - **initiate within 2-4 hours** of return of spontaneous circulation
  - target core temperature of **32-34°C reached within 6 hours** after initiation of treatment.

- Theory is based in its ability to prevent the cascade of events following a cardiac arrest which inhibit neurologic functioning

Prior Studies of Cooling*



Plattner O et al, "Efficacy of Intraoperative Cooling Methods", *Anesthesiology: Volume 87(5)* November 1997 pp 1089-1095


How Does Hypothermia Protect
Against Ischemic Damage?

How It Is Thought to Work

- Slows ongoing hypoxic neurologic damage following cardiac arrest
- Several mechanisms:
  - Reduces cerebral metabolic rate
  - Suppresses free radical production
  - Suppresses excitatory amino acid release
  - Suppresses calcium shifts
- Effects recognized since the 1950's

Clinical Studies

RCT's

- Bernard S et al – NEJM 2002; 346(8)
- Holtzer M et al – NEJM 2002; 346 (8)

Other Designs

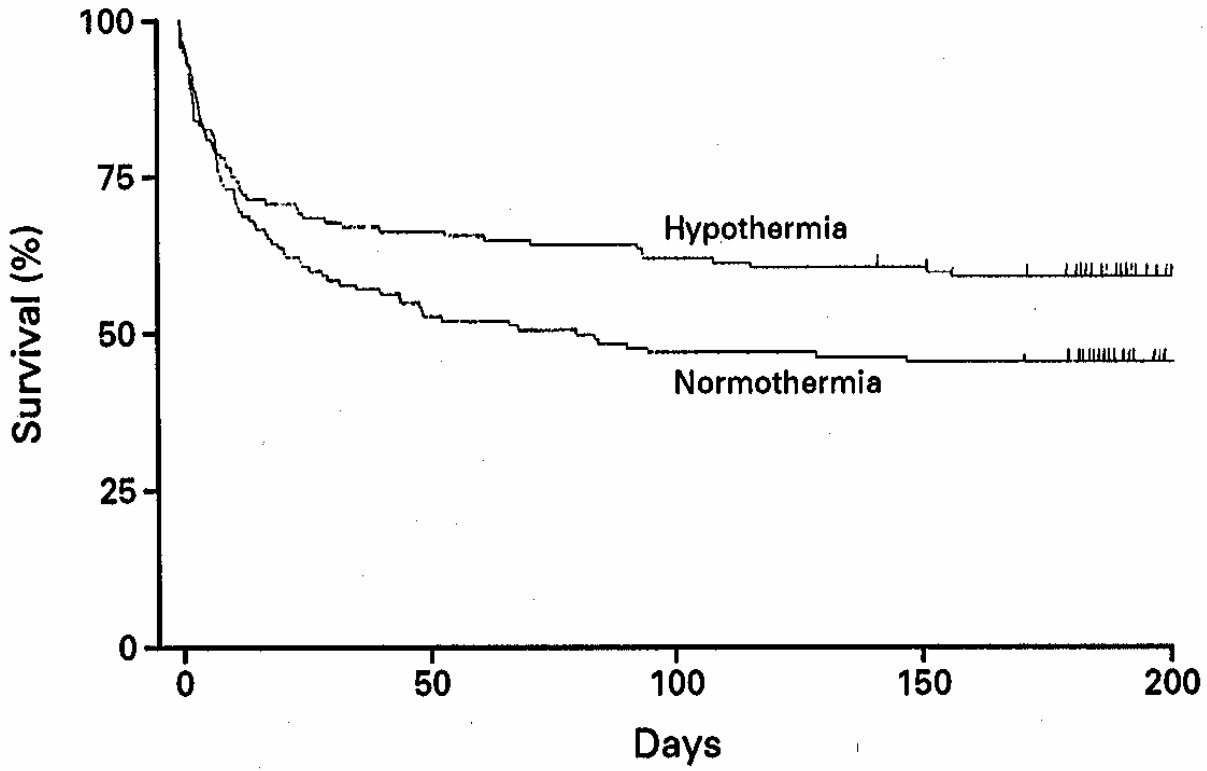
- Benson D et al – Anaes Analg 1959; vol 38
- Bernard S et al – Ann Emerg Med 1997; 33(2)
- Bernard S et al – Resuscitation 2003; 56(1)

Meta-analysis

- Holtzer M et al – Crit Care Med 2005; 33(2)

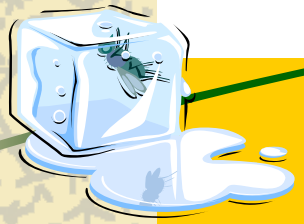
Therapeutic Hypothermia to Improve Neurologic Outcome After CA

Attrition after resuscitation from cardiac arrest (VF)



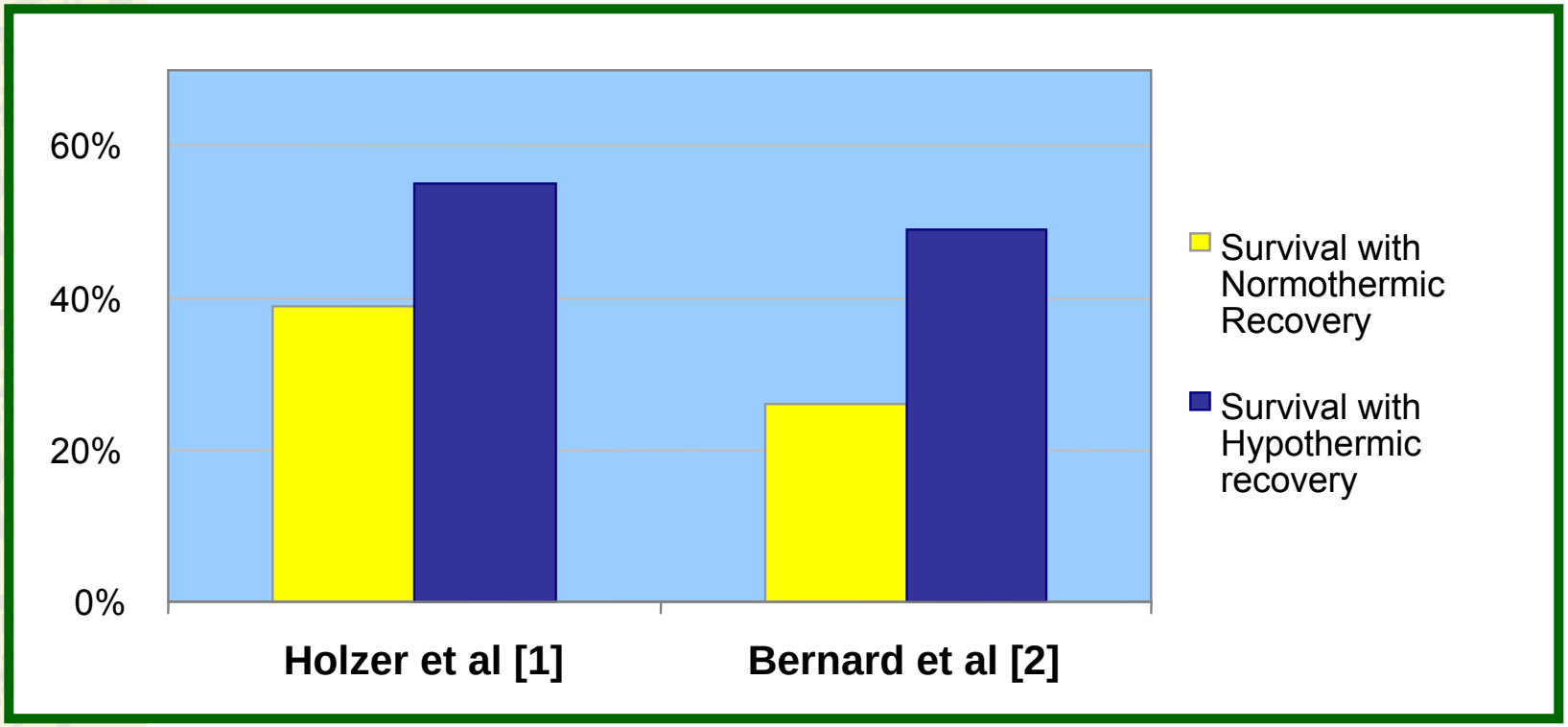
No. at Risk					
Hypothermia	137	92	86	83	11
Normothermia	138	74	66	64	9

Hypothermia after Cardiac Arrest Study Group, NEJM 2002;346(8): 549



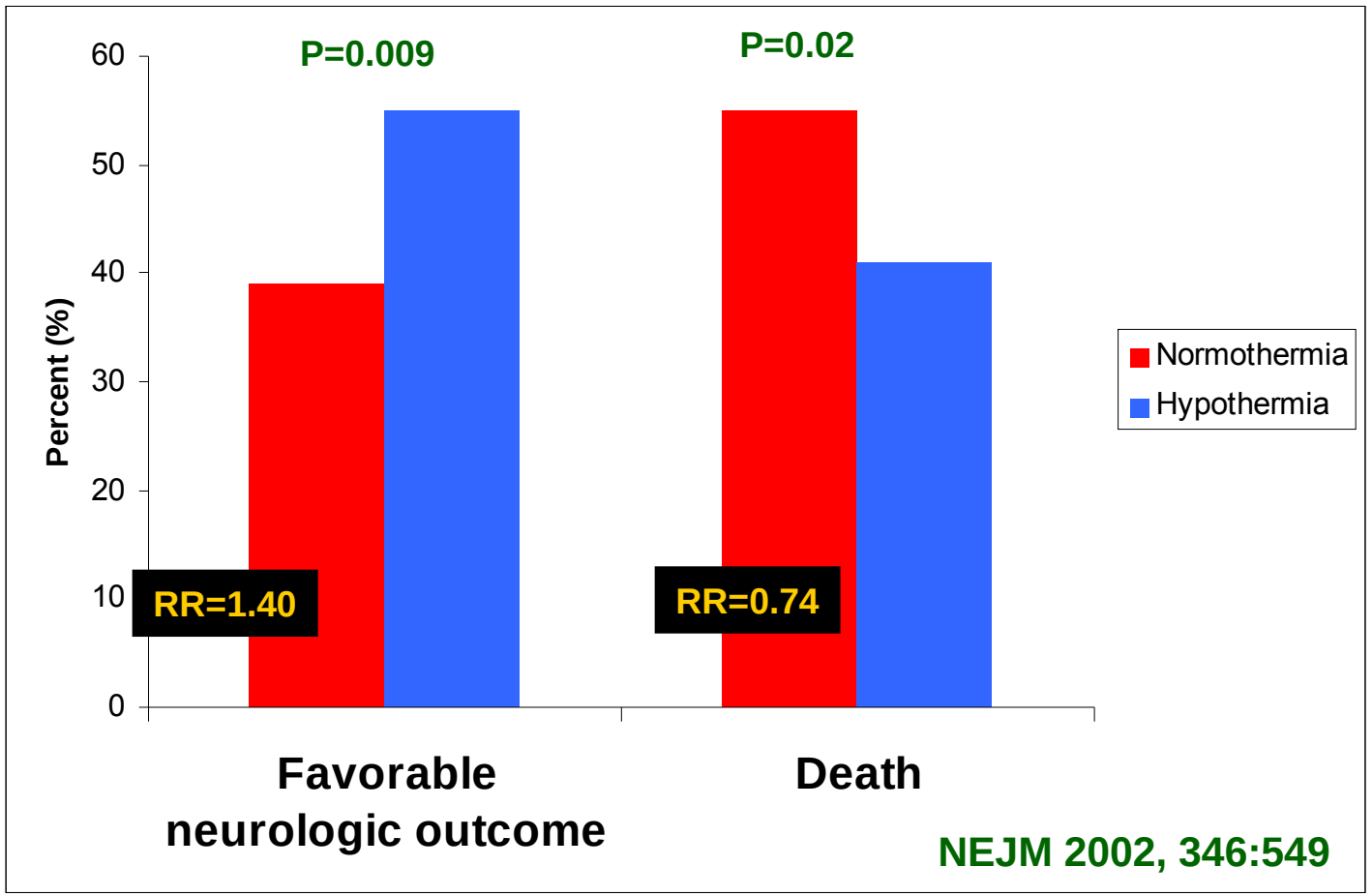
Post-Resuscitation Therapeutic Hypothermia

Patients cooled to 33ºC after resuscitation

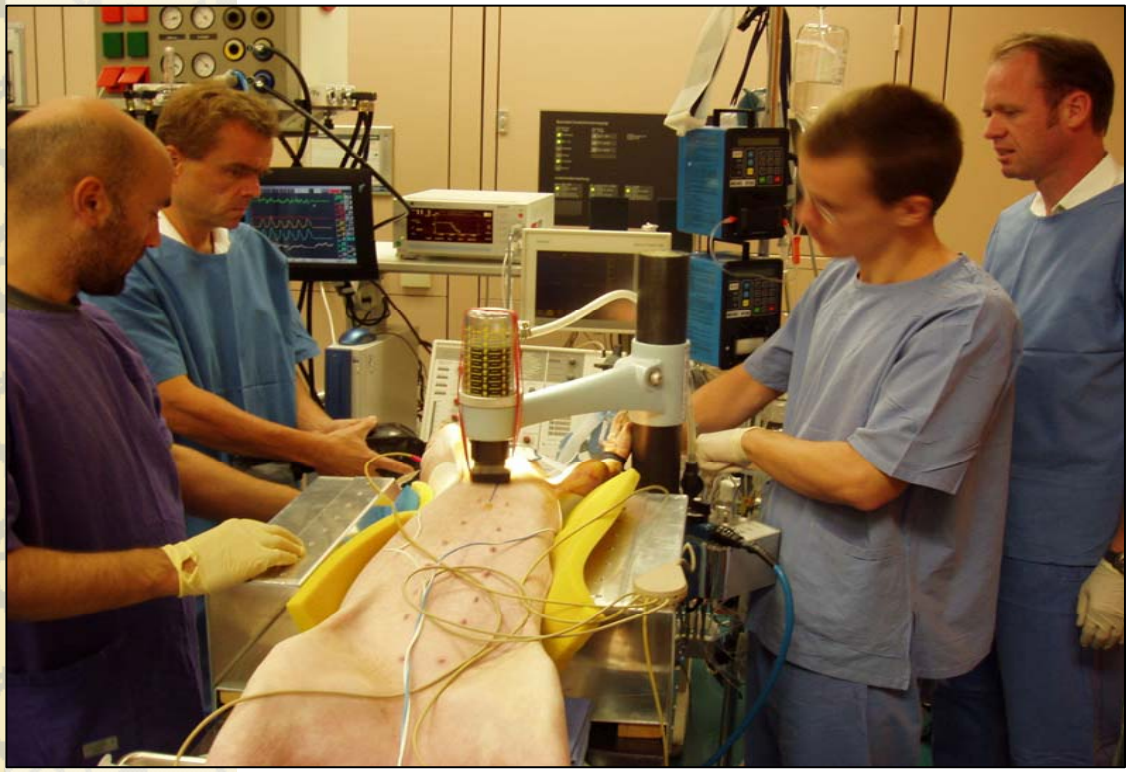


[1] Holzer et al, NEJM 2002; 0.3C/hr cooling with cold air and ice packs
[2] Bernard et al, NEJM 2002; 0.9C/hr cooling with ice packs

Neurological Outcome & Survival at 6 months



Swine study of P-R cooling with LRS ThermoSuit - Vienna *



10 minutes cardiac arrest

↓

8 minutes CPR + drugs

↓

Defibrillation

↓

Randomize

↙ ↘

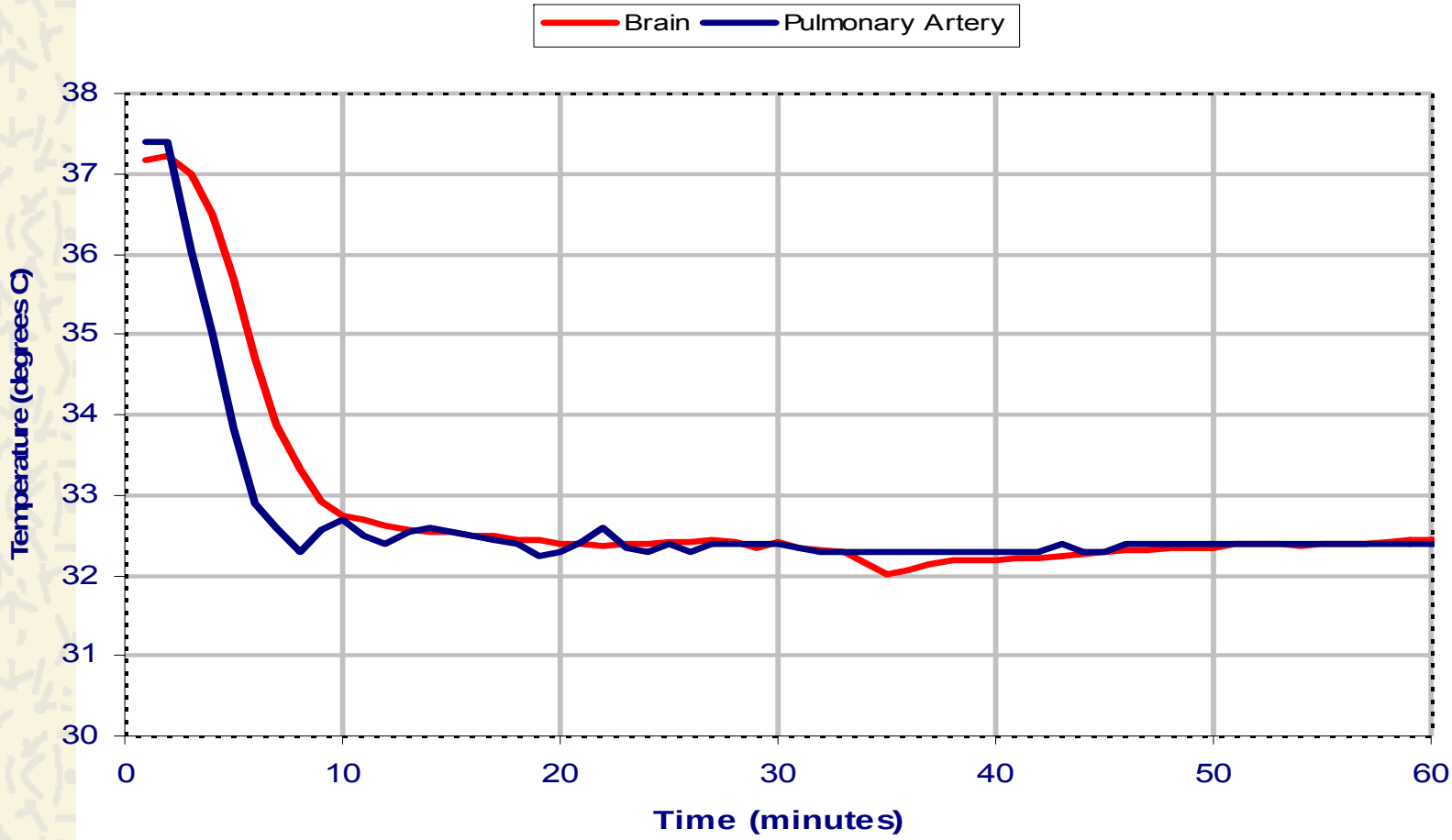
Cool to 33°C → Rewarm @ 14 hrs → 9 days recovery

Normal temperature → 9 days recovery

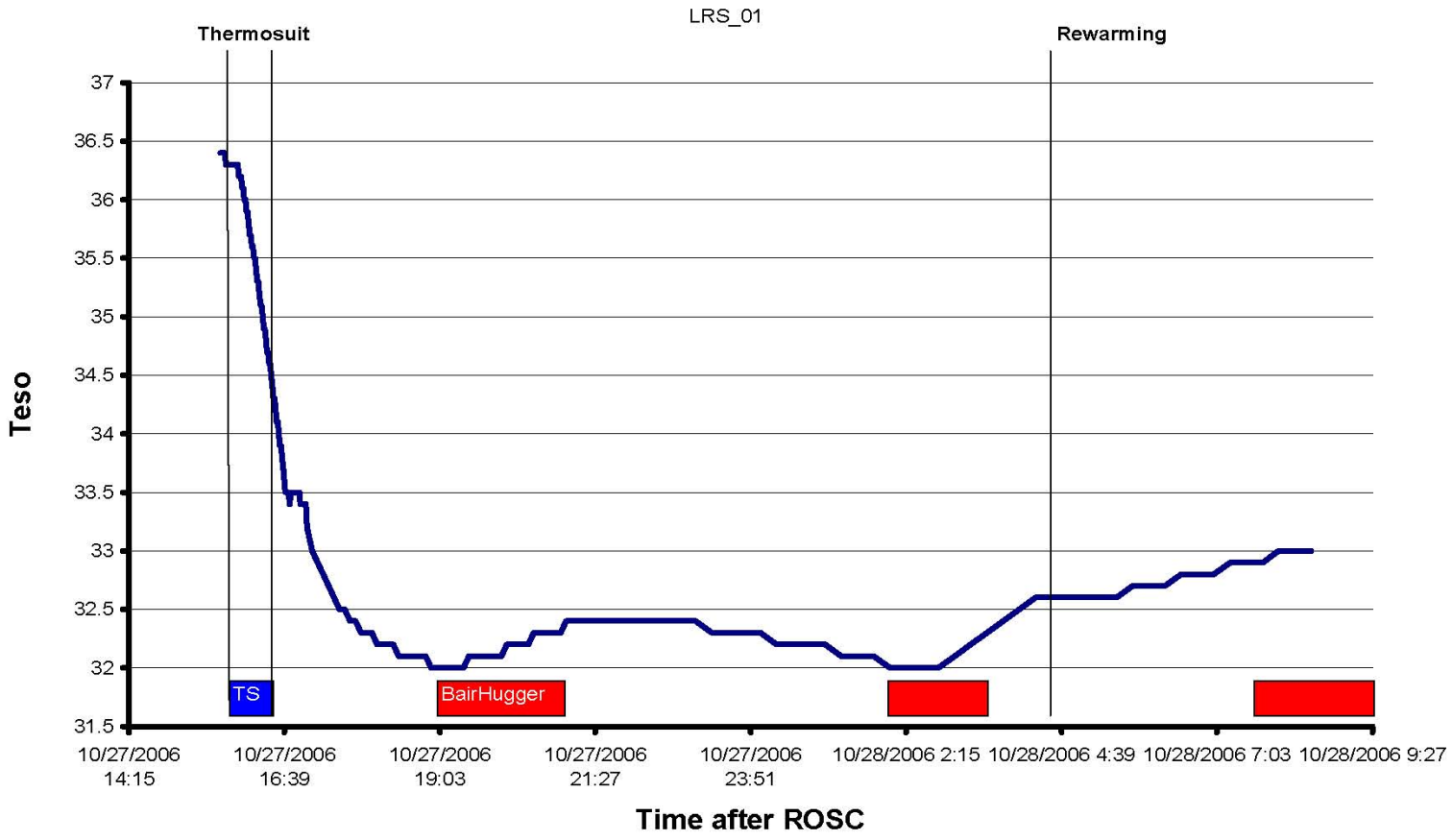
*Janata A, Weihs W, Bayegan K, Schratter A, Robak O, Schock R, Coté M, Freedman R, Losert U, Laggner A, Sterz F, "Mild Therapeutic Hypothermia with LRS Thermosuit™ after Prolonged Cardiac Arrest in Pigs", *American Heart Association Scientific Sessions, Nov 2005*.

LRS Vienna Studies - Results

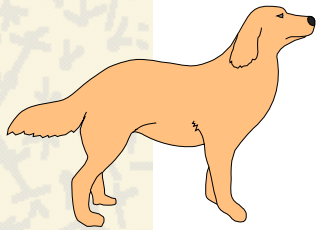
LRS ThermoSuit Cooling Performance in Post-Resuscitation Swine Model (Typical Case)

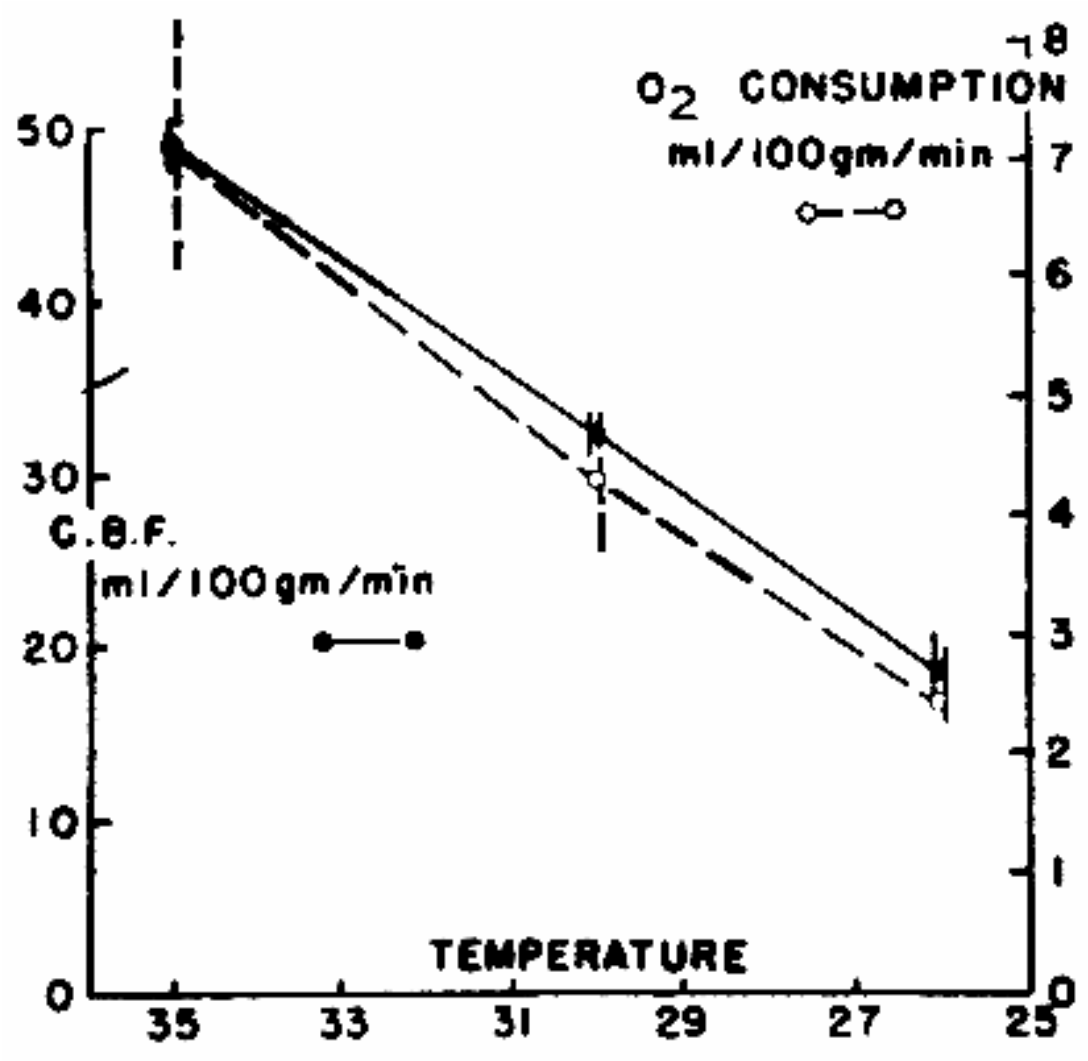


Temperature vs. Time: First Patient Cooled by LRS ThermoSuit® System



Hypothermia and $CMRO_2$





Rosomoff HL
Ann Surg; 1954
(179):85-88

International Support

- International Liaison Committee on Resuscitation (ILCOR)
- American Heart Association (AHA)
- European Resuscitation Council (ERC)
- Utstein Research Group

An Evolving Standard of Care

AHA Guidelines

Nov 2005 - New treatment recommendations adopted :

- Unconscious adult patients with spontaneous circulation **after out-of-hospital cardiac arrest <u>should be cooled</u>** to:
  - 32°C to 34°C
  - for 12 to 24 hours when the initial rhythm was ventricular fibrillation (VF).
- Such cooling may also be beneficial for other rhythms or in-hospital cardiac arrest. *(Level of Evidence: IIb)*

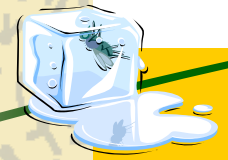
CIRCULATION AHA :105, 166560 V1 (1).

So who should get cooled?

- Greater than 18 years of age
- Non-traumatic cardiac arrest due to ventricular fibrillation or pulseless ventricular tachycardia
- return of spontaneous circulation without full neurological recovery (i.e. comatose)

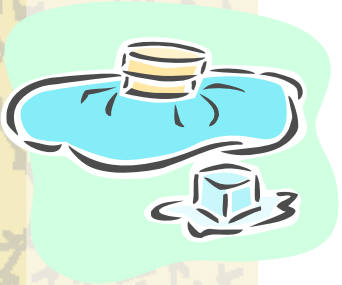
Who should not get cooled?

- Pregnancy
- Severe cardiogenic shock
- Primary coagulopathies
- DNR status
- Coma unrelated to cardiac arrest
- Received CPR greater than 45 minutes
- Suffered a cardiac arrest that is not due to primary VF or Vtach *(e.g. PEA, asystole, non-cardiac, etc)*

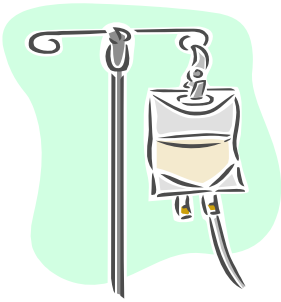


Various Cooling Methods

These differ greatly by time to cool & cost:



Ice bags at axillae & groin



Rapid infusion of cold saline

Cooling Blanket

ThermoSuit

Ice Bath (Artic Sun)

Neural Cooling device

Etc

What does the treatment involve?

- Temperature goal 32˚ - 34˚ C. within 2-6 hours.
- Monitor temperature with esophageal probe Q1h
- MAP goal 60-80 mm/Hg
- Maintain HOB at 30 ˚ C elevation.
- No heated humidification on the ventilator
- Maintain PO2 90 – 100 mmHg
- Maintain pH within normal range
- Begin enteric feeding as soon as practical.
- Passively re-warm (no heating blanket) after 24 hours of cooling has been completed.

Example of a Hypothermia Protocol

Out-of-hospital Cardiac Arrest

Pre-alert from EMS

↓

Triage RN informs Major MD

↓

Major MD / Change RN pages
MSICU resident on-call

↓

Major MD & MSICU resident
identify study candidate

In-hospital Cardiac Arrest

Cardiac Arrest Team responds

↓

Cardiac Arrest Nurse Specialist
identifies possible study candidate

↓

Eligibility confirmed by MSICU resident with on-call Principal Investigator

↓

MSICU resident pages ThermoSuit Expert

↓

Verify bed availability with MSICU charge nurse & *begin TSS set-up*

↓

Ongoing patient care as per current standards, then transfer patient to MSICU

↓

Fill in physician orders (MSICU Admission orders)
to include: hypothermia using TSS, sedation, paralysis etc…

In use at St. Michael's Hospital, Toronto.

The S.P.A.R.C. Project!

- Network of 43 Ontario hospitals
- Focusing on improving the use of hypothermia in post-arrest patients – other best practices to follow
- Provides access to resources such as:
  - Up to date evidence reviews
  - Standardized protocols
  - Implementation tools
  - Education tools
  - Data collection and feedback
  - Networking & sharing experiences with other hospitals

Get Involved in SPARC Today!

Be a “Cooling Champion”!

”Never doubt that a group of thoughtful, committed people can change the world.

Indeed, it is the only thing that ever has.”

- Margaret Mead