Significance of CPC/PCPC Scores in Resuscitation

Presenter: Todd Sweberg, MD, MBA

December 15, 2017
12:00pm – 1:00pm Central
Our Presenter

Todd Sweberg, MD, MBA

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Pediatric Intensive Care Unit
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Disclosures

- I have no financial disclosures or conflicts to report.
Aims

• Discuss development of Cerebral Performance Category (CPC) and Pediatric Cerebral Performance Category (PCPC) scores
• Review significant GWTG articles relying on CPC/PCPC
• Discuss utilization and reliance of GWTG research on CPC/PCPC
• Present trends in CPC/PCPC documentation in the GWTG database
Cerebral Performance Category

Assessment of outcome after severe brain damage: a practical scale
B Jennett, M Bond - The Lancet, 1975

Cited 7220 times
# Cerebral Performance Categories Scale

## CPC Scale

**Note:** If patient is anesthetized, paralyzed, or intubated, use “as is” clinical condition to calculate scores.

**CPC 1.** Good cerebral performance: conscious, alert, able to work, might have mild neurologic or psychologic deficit.

**CPC 2.** Moderate cerebral disability: conscious, sufficient cerebral function for independent activities of daily life. Able to work in sheltered environment.

**CPC 3.** Severe cerebral disability: conscious, dependent on others for daily support because of impaired brain function. Ranges from ambulatory state to severe dementia or paralysis.

**CPC 4.** Coma or vegetative state: any degree of coma without the presence of all brain death criteria. Unawareness, even if appears awake (vegetative state) without interaction with environment; may have spontaneous eye opening and sleep/awake cycles. Cerebral unresponsiveness.

**CPC 5.** Brain death: apnea, areflexia, EEG silence, etc.

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Assessing the outcome of pediatric intensive care

Debra Henry Fiser, MD

In this study it has been demonstrated that the POPC and PCPC scales are both reliable and valid for the measurement of short-term morbidity in children after pediatric intensive care. They are also responsive, detecting longitudinal changes in status during the term of hospitalization.\textsuperscript{12}
### Pediatric/Neonate Cerebral Performance Categories/PCPC Scale

- **PCPC 1:** Normal - Age-appropriate level of functioning; preschool child developmentally appropriate; school-age child attends regular classes.
- **NEONATE:** Normal - No obvious neurological abnormalities.
- **PCPC 2:** Mild cerebral disability - Able to interact at an age-appropriate level; minor neurological disease that is controlled and does not interfere with daily functioning (e.g., seizure disorder that is well controlled with medication); preschool child may have minor developmental delays, but more than 75% of all daily living developmental milestones are above the 10th percentile; school-age child attends regular school, but grade is not appropriate for age, or child is failing appropriate grade because of cognitive difficulties.
- **NEONATE:** Mild cerebral disability - Minor neurological abnormality, neurological disease that is controlled and does not interfere with daily functioning (e.g., seizure disorder that is well controlled with medication).
- **PCPC 3:** Moderate cerebral disability - Below age-appropriate functioning; neurological disease that is not controlled and severely limits activities; most activities of preschool child’s daily living developmental milestones are below the 10th percentile; school-age child can perform activities of daily living, but attends special classes because of cognitive difficulties and/or has a learning deficit.
- **NEONATE:** Moderate cerebral disability - Neurological disease that is not controlled (e.g., breakthrough seizures despite medications which affect responsiveness to environment).
- **PCPC 4:** Severe cerebral disability - Preschool child’s activities or daily living milestones are below the 10th percentile, and child is excessively dependent on others for provision of activities of daily living; school-age child may be so impaired as to be unable to attend school; school-age child is dependent on others for provision of activities of daily living; abnormal motor movements for both preschool and school-age child may include non-purposeful, decorticate, or decerebrate responses to pain.
- **NEONATE:** Severe cerebral disability - Obvious severe neurological disorder: Abnormal motor movements may include non-purposeful, decorticate or decerebrate response to pain.
- **PCPC 5:** Coma or vegetative state - Coma; unawareness.
- **NEONATE:** Coma or vegetative state - Coma; unawareness.
- **PCPC 6:** Brain death
- **NEONATE:** Brain death
CPC/PCPC

- Most sites don’t chart this in the medical record
  
  - You need to “calculate” it!!

- It is easy to calculate!
  
  - Don’t check undocumented in the GWTG forms because it isn’t written in the medical record
  - Only score as not documented if there is no information in the chart to help you score it (which would be really, really, really, unusual)

- Even if there is not data on admit to score the CPC/PCPC, there will be some on discharge
  
  - There should always be a discharge CPC/PCPC!
For patients that are less than 30 days old at the time of system entry date, enter the patient’s head circumference. Indicate "inches" or "centimeters." If multiple head circumference measurements are documented, enter the first documented head circumference. If head circumference is not documented, select "Unknown/Not Documented."

Admission CPC

Admission PCPC

Using the CPC/PCPC Scale (see Scoring Definitions), enter the patient’s Cerebral Performance Category (Adults – Age > 18) or Pediatric Cerebral Performance Category (Pediatrics – Age < 18). If the CPC/PCPC is not documented AND cannot be calculated from information in medical record, select the "Unknown/Not Documented" option. The intent of this data element is to determine the patient’s cognitive function prior to the index event.

If patient died
Was Life Sup抑 Withdrawn?
Were organs
If patient still
CPC at Disch
PCPC at Disch

Admission scoring is based on the following:

- **Hospital Inpatients**: Time of hospital admission.
- **ED Patients**: Time of ED admission.
- **Outpatients**: Time of ambulatory registration.
- **Newborns age greater than 24 hr**: Immediately prior to event.
- **Newborns in the delivery room and/or age less than 24 hr**: No score should be entered.
- **Rehab facility, SNF, Mental Health inpatients (separate admission)**: Immediately prior to event.
- **Visitor/Employee**: Immediately prior to event.

Adult Cerebral Performance Categories/CPC Scale

The Adult CPC scale is defined by the following:

- **CPC 1**: Good cerebral performance – Conscious, alert, able to work, might have mild neurologic or psychologic deficit.
- **CPC 2**: Moderate cerebral disability – Conscious, sufficient cerebral function for independent activities of daily life. Able to work in sheltered environment.
- **CPC 3**: Severe cerebral disability – Conscious, dependent on others for daily support because of impaired brain function. Ranges from ambulatory state to severe dementia or paralysis.
- **CPC 4**: Coma or vegetative state – Any degree of coma without the presence of all brain death criteria. Unawareness, even if appears awake (vegetative state) without interaction with environment, may have spontaneous eye opening and sleep/wake cycles. Cerebral autonomic-reflex.
- **CPC 5**: Brain death – Apnea, areflexia, EEG silence, etc.

Pediatric/Neonate Cerebral Performance Categories/PCPC Scale

The pediatric/neonate PCPC scale is defined by the following:

- **PCPC 1**: Normal – Age-appropriate level of functioning; preschool child developmentally appropriate; school-age child attends regular classes.
- **PCONAT**: Normal – No obvious neurobehavioral abnormalities.
CPC/PCPC in the literature

- Surrogate for long term survival
- Measure of therapeutic effectiveness
- Prognostic value
  - Pre arrest
  - Post arrest
- Hypothesis generation
- Changes in practice!
Does induction of hypothermia improve outcomes after in-hospital cardiac arrest?

Graham Nichol, a,b, Ella Huszti, a, Francis Kim, c,d, Deborah Fly, e, Sam Parnia, e

Duration of resuscitation effort in-hospital cardiac arrest: an
hospital variation in time to epinephrine for non-shockable

Hospital Cardiac Arrest

Rohan Khara, MD; Paul S. Chan, MD, MSc; Michael Dominno, MD; Saker Girotra, MD, MSc

For the American Heart Association’s Get With The Guidelines-Resuscitation Investigators

Outcomes of Critically Ill Patients with Cardiopulmonary Resuscitation: Alignment of Patients’ Likelihood of Favorable Neurologic Outcomes and In-Hospital Cardiac Arrest

Lars W. Andersen, 1,2,3 Tobias Kurth, 4, Maureen C. Clifton Callaway, 2 Michael W. Dominno, 1,5 for the American Heart Association’s Get With The Guidelines-Resuscitation Investigators

Physiologic Monitoring of CPR Quality During Adult Cardiac Arrest: A Propensity-Matched Cohort Study

Robert M. Sutton, MD, MSCE; Benjamin French, PhD; Peter A. Meaney, MD, MPH; Alexis A. Topjian, MD, MSCE; Christopher Parshuram, MBCHB, D.Phil, Dana P. Edelson, MD, MS; Stephen Schexnayder, MD; Benjamin S. Abella, MD, MPH; Raina M. Merchant, MD, MS; Melanie Dembke, MD; Robert A. Berg, MD; Vinay M. Nadkarni, MD, MS, and for the American Heart Association’s Get With The Guidelines-Resuscitation Investigators

Association Between Therapeutic Hypothermia and Survival After In-Hospital Cardiac Arrest

Paul S. Chan, MD; Robert A. Berg, MD, Yuenyen Tang, PhD; Leslie H. Curtis, PhD; John A. Spertus, MD, MPH; for the American Heart Association’s Get With The Guidelines-Resuscitation Investigators

A Validated Prediction Tool for Initial Survivors of In-Hospital Cardiac Arrest

John A. Spertus, MD, MPH; Harlan M. Krumholz, MD, SM; Robert A. Berg, MD; Chan, MD, MSc; J. Randall Curtis, MD, MPH; Brahmade K. Nallamothu, MD, MPH;
CPC as a primary or secondary outcome

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>CPC</td>
<td>7</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>21</td>
<td>30</td>
</tr>
<tr>
<td>%</td>
<td>41%</td>
<td>48%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Figure 2: Unadjusted Rates of Survival to Hospital Discharge by Calendar Year. Observed (crude) rates for survival to discharge are shown for the overall cohort and separately for shockable cardiac-arrest rhythms (ventricular fibrillation [VF] and pulseless ventricular tachycardia [VT]) and nonshockable cardiac-arrest rhythms (asystole and pulseless electrical activity [PEA]). P<0.003 for trend for each survival curve.
Cardiopulmonary resuscitation of adults in the hospital: A report of 14,720 cardiac arrests from the National Registry of Cardiopulmonary Resuscitation

Mary Ann Peberdy *, William Kaye, Joseph P. Ornato, Gregory L. Larkin, Vinay Nadkarni, Mary Elizabeth Mancini, Robert A. Berg, Graham Nichol, Tanya Lane-Trultt, for the NRCPR Investigators

• First publication from NRCPR
  • (later named GWTG)
• Goals: … “describe the NRCPR and provide the first comprehensive, Utstein-based, standardized characterization of in-hospital resuscitation in the United States.”
• Analysis of 14,720 adult arrests
“30% of survivors were discharged to either a rehabilitation center or a skilled nursing home when less than 6% had lived in such a facility before their arrest.”

It is reassuring that 86% of patients with a Cerebral Performance Category-1 (CPC-1) at the time of admission had a CPC-1 at discharge.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Index event characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event location</td>
<td>ICU 40%</td>
</tr>
<tr>
<td></td>
<td>Inpatient 32%</td>
</tr>
<tr>
<td></td>
<td>ED 11%</td>
</tr>
<tr>
<td></td>
<td>Diagnostic area 4%</td>
</tr>
<tr>
<td></td>
<td>Operating room 2%</td>
</tr>
<tr>
<td></td>
<td>PACU 0%</td>
</tr>
<tr>
<td>Other 0%</td>
<td></td>
</tr>
<tr>
<td>None 21%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Treatment characteristics and percentage of patients who received specific treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 4</td>
<td>Treatment characteristics of VF or pulseless VT arrest</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 6</th>
<th>Neurological and functional status of survivors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preadmission (%)</td>
<td>Postdischarge (%)</td>
</tr>
<tr>
<td>Home</td>
<td>84</td>
</tr>
<tr>
<td>Other hospital</td>
<td>8</td>
</tr>
<tr>
<td>Rehabilitation center</td>
<td>0.6</td>
</tr>
<tr>
<td>Nursing facility</td>
<td>5.6</td>
</tr>
<tr>
<td>Other supervised residence</td>
<td>1</td>
</tr>
<tr>
<td>Hospice</td>
<td>0.2</td>
</tr>
<tr>
<td>Other</td>
<td>1.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cerebral performance category</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Good cerebral performance</td>
</tr>
<tr>
<td>(2) Moderate cerebral disability</td>
</tr>
<tr>
<td>(3) Severe cerebral disability</td>
</tr>
<tr>
<td>(4) Coma or vegetative state</td>
</tr>
<tr>
<td>(5) Brain death</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall performance category</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Good performance</td>
</tr>
<tr>
<td>(2) Moderate disability</td>
</tr>
<tr>
<td>(3) Severe disability</td>
</tr>
<tr>
<td>(4) Coma or vegetative state</td>
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<tr>
<td>(5) Brain death</td>
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</tbody>
</table>

The NRCPHR hospitals participating in this study do not represent a random sample of US hospitals, although the relationship between the characteristics of these hospitals and those of general US hospitals is known. Compared with the average US acute medical/surgical hospital, NRCPHR hospitals have a larger mean number of beds (77 vs 152) [47]. A significantly greater proportion of NRCPHR facilities have > 500 beds (45.7% vs 27.5%).

12/15/2017

Resuscitation 58 (2003) 297/308
• Get with the Guidelines–Resuscitation registry between January 1, 2000, and December 31, 2008
  – A total of 19,373 patients had a pulseless in-hospital cardiac arrest and survived to discharge
  – 9057 patients who were younger than 65 years of age, leaving 10,316 Medicare age-eligible patients

• Primary outcome: survival and freedom from readmission 1 year after discharge
  – Secondary outcome: Survival and freedom from readmission 2 years after discharge

• Analysis: Multivariable logistic-regression models with generalized estimating equations were used to examine predictors of survival
Figure 1. Kaplan–Meier Estimates of Rates of Survival over Time among Patients Who Have Survived an In-Hospital Cardiac Arrest.

Shown below the graph are the estimated rates of survival at specific follow-up time points. The cerebral-performance category (CPC) scores are used to assess neurologic status at discharge after a cardiac arrest. Scores range from 1 to 5, with 1 indicating mild or no neurologic disability, 2 indicating mild neurologic disability, 3 indicating severe neurologic disability, 4 indicating coma or vegetative state, and 5 indicating brain death.
In conclusion, we found that 59% of elderly survivors of an in-hospital cardiac arrest were alive at 1 year, and one third were not readmitted to the hospital during that time. Survival and readmission rates differed according to the patients’ age, sex, race, and neurologic status at discharge.
Physiologic Monitoring of CPR Quality During Adult Cardiac Arrest: A Propensity-Matched Cohort Study

Robert M. Sutton, MD MSCE, Benjamin French, PhD, Peter A. Meaney, MD MPH, Alexis A. Topjian, MD MSCE, Christopher Parshurum, MBChB D.Phil, Dana P. Edelson, MD MS, Stephen Schexnayder, MD, Benjamin S. Abella, MD MPhil, Raina M. Merchant, MD MS, Melanie Bembea, MD, Robert A. Berg, MD, Vinay M. Nadkarni, MD MS, and for the American Heart Association’s Get With The Guidelines – Resuscitation Investigators

- “Measurements of myocardial blood flow during CPR are not available to the rescuer”
- “The American Heart Association (AHA)... recommends using surrogates related to myocardial blood flow (ETCO₂) or diastolic blood pressure (DBP) to monitor resuscitation quality”
- “…Clinical studies supporting the titration of these parameters during human CPR are lacking”
Adult patients with a CPR event requiring chest compressions with an invasive airway or arterial catheter in place at the time of arrest

- Excluded
  - events lasting < 1 minute
  - delivery room events
  - events missing either outcome or variables necessary for propensity matching
Clinician-reported use of ETCO₂ or DBP was associated with improved rates of ROSC.

Survival to hospital discharge and survival with favorable neurological outcome were not different between groups.
• In the subset of events with ETCO$_2$ CPR quality monitoring...

• ETCO2 >10mmHg during CPR was reported in 65% events

• Associated with improved survival to hospital discharge
  • 24% versus 11%; OR 2.41, CI95 1.35 – 4.30, p=0.003

• Improved survival with favorable neurological outcome
  • 18% versus 8%; OR 2.31, CI95 1.31 – 4.09, p=0.004
Clinician-reported use of physiologic monitoring of CPR quality with ETCO₂ or diastolic blood pressure was associated with an improved rate of ROSC.

- Survival to hospital discharge and survival with favorable neurological outcome were not different between groups.

Subset of events where CPR quality was monitored with ETCO₂ only

- Improved rates of patient survival to hospital discharge
- Improved rates of survival with favorable neurological outcome when ETCO₂ was >10mmHg
80% of in-hospital cardiac arrests (IHCA) have initial rhythms of asystole or pulseless electrical activity (PEA)

- Evidence for therapeutic hypothermia is unclear in these rhythms

Study to evaluate the association of hypothermia treatment

- Survival to hospital discharge
- Favorable neurological survival at hospital discharge
• Inclusion:
  • ROSC after index in-hospital cardiac
  • Patients on mechanical ventilation at the time of cardiac arrest or after cardiac arrest

• Primary outcome: survival to hospital discharge

• Secondary outcome: favorable neurological survival
  • Survival to hospital discharge with a Cerebral Performance Category score of 1 or 2
6.0% of patients were treated with therapeutic hypothermia

- Patients treated with hypothermia were younger
- Less likely to have a cardiac arrest in the intensive care unit
- More likely to have an initial cardiac arrest rhythm of ventricular fibrillation
- More likely to have a myocardial infarction prior to their cardiac arrest
- Less likely to have hypotension, respiratory insufficiency, renal insufficiency, hepatic insufficiency, pneumonia, acute stroke, and a metastatic or hematologic malignant neoplasm
## Table 2. In-Hospital Outcomes and Model Results

<table>
<thead>
<tr>
<th>Survival to discharge</th>
<th>Patients, No./Total No. (%)</th>
<th>Relative Risk With Hypothermia (95% CI)&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Risk Difference With Hypothermia, % (95% CI)&lt;sup&gt;b&lt;/sup&gt;</th>
<th>P Value&lt;sup&gt;c&lt;/sup&gt;</th>
<th>P Value for Interaction&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>All cardiac arrests</td>
<td>417/1524 (27.4)</td>
<td>0.88 (0.80 to 0.97)</td>
<td>-3.6 (-6.3 to -0.9)</td>
<td>.01</td>
<td>.74</td>
</tr>
<tr>
<td>Nonshockable cardiac arrests</td>
<td>247/1112 (22.2)</td>
<td>0.87 (0.76 to 0.99)</td>
<td>-3.2 (-6.2 to -0.3)</td>
<td>.01</td>
<td>.74</td>
</tr>
<tr>
<td>Shockable cardiac arrests</td>
<td>170/412 (41.3)</td>
<td>0.90 (0.77 to 1.05)</td>
<td>-4.6 (-10.9 to 1.7)</td>
<td>.88</td>
<td>.74</td>
</tr>
</tbody>
</table>

**Favorable neurological survival**

<table>
<thead>
<tr>
<th>Survival to discharge</th>
<th>Patients, No./Total No. (%)</th>
<th>Relative Risk With Hypothermia (95% CI)&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Risk Difference With Hypothermia, % (95% CI)&lt;sup&gt;b&lt;/sup&gt;</th>
<th>P Value&lt;sup&gt;c&lt;/sup&gt;</th>
<th>P Value for Interaction&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>All cardiac arrests</td>
<td>246/1443 (17.0)</td>
<td>0.79 (0.69 to 0.90)</td>
<td>-4.4 (-6.8 to -2.0)</td>
<td>&lt;.001</td>
<td>.88</td>
</tr>
<tr>
<td>Nonshockable cardiac arrests</td>
<td>137/1054 (13.0)</td>
<td>0.78 (0.64 to 0.93)</td>
<td>-3.7 (-6.2 to -1.1)</td>
<td>&lt;.001</td>
<td>.88</td>
</tr>
<tr>
<td>Shockable cardiac arrests</td>
<td>109/389 (28.0)</td>
<td>0.79 (0.65 to 0.97)</td>
<td>-7.3 (-13.3 to -1.3)</td>
<td>.88</td>
<td>.74</td>
</tr>
</tbody>
</table>

<sup>a</sup> Both relative risks and absolute risk differences are reported for propensity score-matched cohorts.

<sup>b</sup> Risk difference is calculated as the absolute survival rate with hypothermia treatment minus the rate with no hypothermia treatment.

<sup>c</sup> For comparison of outcomes in the overall cohort.

<sup>d</sup> Interaction between hypothermia and initial cardiac arrest rhythm tests whether the estimates of effect were different in the shockable and nonshockable rhythm subgroups.

<sup>e</sup> Survival to discharge with a Cerebral Performance Category score of 1 or 2. Information on neurological status was not available for 81 hypothermia-treated patients and 185 non-hypothermia-treated patients.
Among patients IHCA, use of therapeutic hypothermia compared with usual care was associated with a lower likelihood of survival to hospital discharge and a lower likelihood of favorable neurological survival.

These observational findings warrant a randomized clinical trial to assess efficacy of therapeutic hypothermia for in-hospital cardiac arrest.
Despite advances in resuscitation care in recent years, it is not clear whether survival and neurologic function after in-hospital cardiac arrest have improved over time.

All adults who had an in-hospital cardiac arrest at 374 hospitals in the Get with the Guidelines–Resuscitation registry between 2000 and 2009.

Using multivariable regression, we examined temporal trends in risk-adjusted rates of survival to discharge.

Additional analyses explored …and whether they occurred at the expense of greater neurologic disability in survivors.
Table 2. Trends in Survival and Neurologic Outcome

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Survival to Discharge</th>
<th>Acute Resuscitation Survival</th>
<th>Postresuscitation Survival</th>
<th>Neurologic Outcome in Survivors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2000</td>
<td>2001</td>
<td>2002</td>
<td>2003</td>
</tr>
<tr>
<td>VF and VT</td>
<td>35.0%</td>
<td>37.0%</td>
<td>39.0%</td>
<td>41.0%</td>
</tr>
<tr>
<td>Overall</td>
<td>15.0%</td>
<td>15.0%</td>
<td>15.0%</td>
<td>15.0%</td>
</tr>
<tr>
<td>Asystole and PEA</td>
<td>10.0%</td>
<td>10.0%</td>
<td>10.0%</td>
<td>10.0%</td>
</tr>
<tr>
<td>Adjusted Rate Ratio per Year</td>
<td>(95% CI)</td>
<td>P Value for Trend</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04 (1.03–1.06)</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03 (1.02–1.04)</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02 (1.01–1.03)</td>
<td>0.001</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Figure 2. Unadjusted Rates of Survival to Hospital Discharge by Calendar Year.

Observed (crude) rates for survival to discharge are shown for the overall cohort and separately for shockable cardiac-arrest rhythms (ventricular fibrillation [VF] and pulseless ventricular tachycardia [VT]) and nonshockable cardiac-arrest rhythms (asystole and pulseless electrical activity [PEA]). P<0.001 for trend for each survival curve.
• “In conclusion, we found that survival after in hospital cardiac arrest has improved significantly during the past decade at hospitals participating in a large, national quality-improvement registry.”

• “This improvement was accompanied by a parallel decrease in rates of neurologic disability over time.”

• “Data on CPC scores at discharge were missing for 14% of survivors. …our findings on the secondary outcome of neurologic disability should be interpreted with caution.”
Assessing the outcome of pediatric intensive care

Debra Henry Fiser, MD

In this study it has been demonstrated that the POPC and PCPC scales are both reliable and valid for the measurement of short-term morbidity in children after pediatric intensive care. They are also responsive, detecting longitudinal changes in status during the term of hospitalization.12

(J PEDIATR 1992;121:68-74)
Pediatric/Neonatal CPC

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**NEONATE:** Normal - No obvious neurological abnormalities.

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**PCPC 5:** Coma or vegetative state - Coma; unawareness.

**NEONATE:** Coma or vegetative state - Coma; unawareness.

**PCPC 6:** Brain death

**NEONATE:** Brain death
Pediatric GWTG-R: PCPC as a primary or secondary outcome

<table>
<thead>
<tr>
<th></th>
<th>2006-2010</th>
<th>2011-2016</th>
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<tbody>
<tr>
<td>PCPC</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>%</td>
<td>67%</td>
<td>62%</td>
</tr>
</tbody>
</table>
Goals: Use data from the NCRCPR database to:

- Describe the types of pediatric patients treated with E-CPR
- Report trends in the use of E-CPR, and to
- Determine factors associated with survival after E-CPR

Figure 1. Patient enrollment and outcomes.

CPA = cardiopulmonary arrest; CPB = cardiopulmonary bypass; DNAR = do not attempt resuscitation; ECMO = extracorporeal membrane oxygenation;
E-CPR = extracorporeal cardiopulmonary resuscitation; ROSC = return of spontaneous circulation.
Outcomes among neonates, infants, and children after extracorporeal cardiopulmonary resuscitation for refractory inhospital pediatric cardiac arrest: A report from the National Registry of Cardiopulmonary Resuscitation*

Tia T. Raymond, MD; Christopher B. Cunyngham, MD; Marita T. Thompson, MD; James A. Thomas, MD; Heidi J. Dalton, MD; Vinay M. Nadkarni, MD; for the American Heart Association National Registry of CPR Investigators

Figure 3. Duration of cardiopulmonary resuscitation (CPR) and the number of surviving patients managed with extracorporeal CPR. The duration of CPR was defined as the time from cardiac arrest until the extracorporeal membrane oxygenation pump was started. There was no association with the duration of CPR and survival based on time cut points ($p = .12$).

Figure 2. Trends in extracorporeal cardiopulmonary resuscitation (E-CPR) use and survival based on diagnostic groups from 2000 to 2001. There was no significant change in percent total E-CPR survival rate per year based on Cochran-Armitage trend test ($p = .62$).
• “…ECMO is increasingly used to provide blood flow and oxygenation to the patient when resuscitation is unsuccessful…”
  • “May contribute information supportive of the effectiveness in treating select pediatric patients with E-CPR”

• “The vast majority of survivors in this cohort with reported neurologic outcomes were favorable.”
• CPR beyond 20 minutes or with multiple epinephrine doses was considered futile

• Data indicate that some children survive with CPR of increased duration
  • This has not been rigorously evaluated

• Primary outcome: survival to hospital discharge

• Secondary measures
  • return of spontaneous circulation >20 minutes
  • 24-hour survival
  • survival to discharge with favorable neurological outcome (PCPC 1-3, and 1-2)
Duration of Cardiopulmonary Resuscitation and Illness Category Impact Survival and Neurologic Outcomes for In-hospital Pediatric Cardiac Arrests

Table 2. Continued

<table>
<thead>
<tr>
<th>Category of CPR duration, n (%)</th>
<th>General Surgical</th>
<th>Surgical Cardiac</th>
<th>Medical Cardiac</th>
<th>General Medical</th>
<th>Trauma</th>
<th>All Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–15 min</td>
<td>124 (46.3)</td>
<td>272 (38.3)</td>
<td>196 (34.3)</td>
<td>583 (39.5)</td>
<td>211 (54.0)</td>
<td>1386 (40.5)</td>
</tr>
<tr>
<td>16–35 min</td>
<td>74 (27.6)</td>
<td>172 (24.2)</td>
<td>196 (34.3)</td>
<td>480 (32.5)</td>
<td>115 (29.4)</td>
<td>1037 (30.3)</td>
</tr>
<tr>
<td>&gt;35 min</td>
<td>70 (26.1)</td>
<td>267 (37.6)</td>
<td>180 (31.5)</td>
<td>414 (28.0)</td>
<td>65 (16.6)</td>
<td>996 (29.1)</td>
</tr>
</tbody>
</table>

CPR, cardiopulmonary resuscitation.
• ...CPR duration was inversely associated with survival to hospital discharge and neurological outcome...

• “This study suggests that a proportion of children who would presumably die without CPR survive with a favorable neurological outcome even after prolonged CPR”
Survival Trends in Pediatric In-Hospital Cardiac Arrests
An Analysis From Get With The Guidelines–Resuscitation

Saket Girotra, MD, SM; John A. Spertus, MD, MPH; Yan Li, PhD; Robert A. Berg, MD;
Vinay M. Nadkami, MD; Paul S. Chua, MD, MSC; for the American Heart Association Get With the
Guidelines–Resuscitation Investigators*

2555 patients with index arrest due to asystole, PEA, VF and pulseless VT

2542 patients with complete non-missing data

1906 arrests located in a general inpatient ward, or ICU

836 arrests occurring outside of the ICUs and general inpatient wards excluded

1031 arrests from 12 hospitals included in the final study population

13 patients missing data on survival excluded

875 arrests excluded from 183 hospitals with < 3 years of data or low case volume (< 5/year)

Figure 2. Proportion of cardiac arrests attributable to asystole or pulseless electrical activity (PEA) and ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT) by calendar year. Over the past decade, the proportion of cardiac arrests treatable by defibrillation (VF and pulseless VT) has decreased (P for trend <0.001).


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Table 2. Observed (Unadjusted) Rates of Survival Outcomes and Neurological Disability by Calendar Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Survival to discharge, % (n)</th>
<th>Acute resuscitation survival, % (n)</th>
<th>Postresuscitation survival, % (n/survivors)</th>
<th>Significant neurological disability, % (n/survivors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>14.3 (4)</td>
<td>42.9 (12)</td>
<td>33.3 (4)</td>
<td>0 (0/3)</td>
</tr>
<tr>
<td>2001</td>
<td>24.3 (9)</td>
<td>62.2 (23)</td>
<td>39.1 (9)</td>
<td>0 (0/8)</td>
</tr>
<tr>
<td>2002</td>
<td>34.4 (22)</td>
<td>70.3 (45)</td>
<td>48.9 (22)</td>
<td>12.5 (2/16)</td>
</tr>
<tr>
<td>2003</td>
<td>30.3 (27)</td>
<td>55.1 (49)</td>
<td>55.1 (27)</td>
<td>17.4 (4/23)</td>
</tr>
<tr>
<td>2004</td>
<td>29.6 (29)</td>
<td>71.4 (70)</td>
<td>41.4 (29)</td>
<td>4.4 (1/23)</td>
</tr>
<tr>
<td>2005</td>
<td>23.5 (35)</td>
<td>62.4 (93)</td>
<td>37.6 (35)</td>
<td>12.0 (3/25)</td>
</tr>
<tr>
<td>2006</td>
<td>44.0 (55)</td>
<td>77.6 (97)</td>
<td>56.7 (55)</td>
<td>16.0 (8/50)</td>
</tr>
<tr>
<td>2007</td>
<td>41.6 (64)</td>
<td>74.7 (115)</td>
<td>55.7 (64)</td>
<td>13.2 (7/53)</td>
</tr>
<tr>
<td>2008</td>
<td>39.9 (77)</td>
<td>77.7 (150)</td>
<td>51.3 (77)</td>
<td>9.2 (6/65)</td>
</tr>
<tr>
<td>2009</td>
<td>39.4 (37)</td>
<td>77.7 (73)</td>
<td>50.7 (37)</td>
<td>21.9 (7/32)</td>
</tr>
</tbody>
</table>

P for trend <0.001

<table>
<thead>
<tr>
<th>Year</th>
<th>ed RR per 95% CI</th>
<th>P for Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>0.01–1.16</td>
<td>0.02</td>
</tr>
<tr>
<td>2001</td>
<td>0.01–1.07</td>
<td>0.006</td>
</tr>
<tr>
<td>2002</td>
<td>0.98–1.09</td>
<td>0.17</td>
</tr>
</tbody>
</table>

*Acute resuscitation survival was determined by the number of patients with return of spontaneous circulation for at least 20 minutes divided by the number of patients with cardiac arrest.

†Postresuscitation survival was determined by the number of patients with acute resuscitation survival who survived to hospital discharge divided by the number surviving the acute resuscitation.

‡Neurological disability in survivors. Neurological disability was defined as the proportion of patients surviving to hospital discharge with a pediatric cerebral performance category (PCPC) score of >3 (i.e., at least severe neurological disability). Discharge PCPC scores were missing in 17% of survivors.
“In conclusion, we found that overall survival in children with an in-hospital cardiac arrest has improved substantially over the past decade without higher rates of significant neurological disability.”

“Given the smaller sample size and **high rates of missing data (17%)**, we were able to examine only unadjusted trends in rates of neurological disability.

- Therefore, our findings on this secondary outcome should be interpreted with caution.”

Survival Trends in Pediatric In-Hospital Cardiac Arrests
An Analysis From Get With The Guidelines—Resuscitation

Saket Giroti, MD, SM; John A. Spertus, MD, MPH; Yan Li, PhD; Robert A. Berg, MD; Vinay M. Nadkarni, MD; Paul S. Chan, MD, MSC; for the American Heart Association Get With the Guidelines—Resuscitation Investigators*

CPC/PCPC in the literature

- Surrogate for long term survival
- Measure of therapeutic effectiveness
- Prognostic value
  - Pre arrest
  - Post arrest
- Hypothesis generation
- Changes in practice!
CPC/PCPC

- Most sites don’t chart this in the medical record
  - You need to “calculate” it!!
- It is easy to calculate!
  - Don’t check undocumented in the GWTG forms because it isn’t written in the medical record
  - Only score as not documented if there is no information in the chart to help you score it (which would be really, really, really, unusual)
- Even if there is not data on admit to score the CPC/PCPC, there will be some on discharge
  - There should always be a discharge CPC/PCPC!
Thank you!

Any questions?
Contact Us to Learn More

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Thank you for your active participation and contributions to GWTG-Resuscitation!