Design and Evaluation of a Single Family Room NICU

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Neonatal unit closer to term

Women & Infants Hospital celebrates topping off an addition that will expand its intensive care.

BY TIMOTHY C. SARMANN
Journal, Women's Warren

PROVIDENCE — Women & Infants Hospital moved a step closer to completing a $78.8-million addition yesterday when construction workers hoisted into place the structure's final steel beam.

Staff members, hospital officials, as well as youngsters who were treated as infants in the hospital's neonatal intensive-care unit, celebrated the occasion with a topping-off ceremony.

Four-day-old Gemmaro Cerci is about to be taken from his incubator in the neonatal intensive-care unit.


hospital building project since Hasbro Children's Hospital went up in 1994, is expected to be completed in the late spring of 2009.

The hospital has raised close to $20 million in charitable donations to help pay for part of the new addition, said Susan Howery, a spokeswoman for the hospital. The hospital will use cash and loans to pay for the balance.

Women & Infants broke ground on the project in May, allowing it to vastly expand its neonatal intensive-care unit, as well as to handle more births. The hospital was built in 1986 to accommodate 6,500 births a year; last year, almost 10,000 babies were born there.

In recent years, women have been urge.
Rationale

Infants in the NICU are affected by environmental factors

Single room NICU has potential to:

- Improve outcomes
- Sensitivity to developmental needs
- Family involvement in care
- Privacy
- Staff Satisfaction

Rationale

BUT….Urban Legend

Concerns:
- Infant safety
- More staff
- Isolation (staff and families)
- Families present during procedures
- Stress
- Logistics

Walsh et al. Advances in Neonatal Care. 2006;6:261-270
How to Study?

1. RCT: Ideal or is it?  
   Infants not representative of NICU  
   Bias in care

2. Observational Study in Hybrid NICU  
   Medical status of Infants in single room

3. Alternative: Observational Prospective  
   “Before and After” Study

Sites Selected:

- Vanderbilt University
  Children's Hospital
  Nashville, Tennessee

- Blank Children's Hospital
  Des Moines, Iowa

- Northside Hospital
  Atlanta, Georgia

- Scottish Rite Children’s Hospital
  Atlanta, Georgia

- Children's Hospitals – St. Paul
  St. Paul, Minnesota
Women & Infants Existing NICU

Floor 2 NICU

9,400 sq. ft.

70 rooms
Women & Infants Mock Up

175 sq. ft.
Specific Aim 1

Compare the medical and neurobehavioral status at discharge of infants in an Open Bay NICU with infants in a Single Room NICU
Specific Aim 2

Determine the role of potentially mediating factors in explaining differences in the medical and neurobehavioral status at discharge of infants in an Open Bay NICU with infants in a Single Room NICU

NICU Design and Infant Outcome
### Medical Outcomes

- Sepsis/nosocomial infection
- Length of stay
- Gestational age at discharge
- Weight at discharge
- Illness severity and resource utilization (NTISS)
- Gestational age enteral feeding
- Necrotizing enterocolitis

### Neurobehavioral Outcomes

- Neurobehavioral profiles (NNNS)
- Sleep state organization (behavior and cardiorespiratory)
- ECG
- Mother infant feeding interaction (NCAFS)
- Pain profile (PIPP)
Mediators: Family Centered Care

- Cochrane Collaboration Family Centered Care Clustered Rating Scale
  Administered to parents and staff

Mediators: Developmental Care

- Evaluating Your Practice According to Four Standards of Developmental Care
- Sound and light
- Elements of Developmental Care in NICU
Pilot Data

n=35, inter-rater reliability = .89

<table>
<thead>
<tr>
<th>Area of Caregiving</th>
<th>Mean</th>
<th>SD</th>
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<tbody>
<tr>
<td>Immediate Environment</td>
<td>4.383</td>
<td>0.644</td>
</tr>
<tr>
<td>Timing, Sequencing &amp; Pacing of Care</td>
<td>4.743</td>
<td>0.709</td>
</tr>
<tr>
<td>Aids to Self Regulation At Rest</td>
<td>3.662</td>
<td>0.211</td>
</tr>
<tr>
<td>Aids to Self Regulation During Care</td>
<td>3.647</td>
<td>0.915</td>
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<tr>
<td>Developmentally Appropriate Sensory Experiences</td>
<td>3.677</td>
<td>0.274</td>
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</tbody>
</table>
### Mediators: Parenting Factors

- Rates of parental visits, breastfeeding, massage, kangaroo care/skin to skin; parent care of infant
- Parent Stressor Scale. NICU
- Beck Depression Inventory-II
- Press Ganey NICU
- HowsYourBaby Survey

### Mediators: Staff Attitudes

- Expanded Nursing Stress Scale (ENSS)
- Maslasch Burnout Inventory (MBI)
- Professional Practice Environment Scale
- Number/percent of nurses who leave the NICU, Hospital, leaves of absence
Mediators: Changes in Medical Practice

- Pulmonary
- Cardiovascular
- Nutrition/GI
- Infectious disease
- CNS measures

Setting: Women and Infants

- Regional Perinatal Center
- 10th largest obstetrical service in U.S.
- 9,600 annual births
- 75% births in R.I.
- 1,300 in NICU (of which 175 transports)
Sample

Open Bay (n=880) vs Single Room (n=880)

- <2000 grams
- In NICU for at least 2 weeks
- Nipple feeding

Power

<table>
<thead>
<tr>
<th>Infant Outcomes</th>
<th>Full Sample (N = 1760)</th>
<th>Minimum Change</th>
<th>Effect size</th>
<th>Power</th>
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<tbody>
<tr>
<td>Late onset sepsis</td>
<td></td>
<td>6.8% decrease</td>
<td>&lt;.10</td>
<td>.820</td>
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<tr>
<td>Age at full enteral feed</td>
<td></td>
<td>14% decrease</td>
<td>.17</td>
<td>.843</td>
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<tr>
<td>NEC</td>
<td></td>
<td>5.6% decrease</td>
<td>&lt;.10</td>
<td>.813</td>
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<tr>
<td>Weight at 36w</td>
<td></td>
<td>4% increase</td>
<td>.16</td>
<td>.818</td>
</tr>
<tr>
<td>Length of Stay</td>
<td></td>
<td>12.8% decrease</td>
<td>.16</td>
<td>.811</td>
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<tr>
<td>Abnorm NNNS</td>
<td></td>
<td>9.2% decrease</td>
<td>.25</td>
<td>.808</td>
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### Timeline

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<tr>
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<th>2008-2009 (n=880)</th>
<th>2010-2011 (n=880)</th>
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<tbody>
<tr>
<td><strong>OPEN BAY NICU</strong></td>
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<td>Neurobehavioral outcomes</td>
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<td>X X X X</td>
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<tr>
<td>Parent/Family</td>
<td></td>
<td></td>
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<tr>
<td>Staff</td>
<td>X X X X</td>
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<tr>
<td>Medical practices</td>
<td>X X X X</td>
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### NICU Recruitment Database

- **RECRUITMENT REPORT**
  - Summarizes recruitment and completion data
- **STUDY PROCEDURE COMPLETION**
  - Staff record what instruments have been collected
- **ELIGIBILITY TRACKING**
  - Study staff add update information about recruitment status
- **SUBJECT IDENTIFICATION**
  - NICU Admissions with BW < 2000 grams
  - Demographic information for eligibility / recruitment

**CERNER**
- dob, birthweight etc.
- Daily Update
Report pulls current data and summarizes for up to date tracking as needed.

Data Analysis

- Traditional Statistics
  ANOVA, Logistic Regression

- Advanced Statistics
  Structural Equation Modeling (SEM) with latent factors
Figure 4. Example of Full SEM

Developmental Care

Pulmonary
Cardiovascular
Nutrition/GI
Infectious Dis
CNS

NICU

Medical Practice
Implement DevCare
Staff Behavior/Attitude
Parenting Behavior
Parent Stress
Maternal Concerns
Maternal Depression
Parent Satisfaction
Family Function

Parents
Nurse Educator

Infant Outcome

Parent/Infant Outcome

Parenting Behavior
Parent Stress
Maternal Concerns
Maternal Depression
Parent Satisfaction
Family Function

Figure 4. Structural Equation Model
Hypothetical: NICU Main Effect

\[
\beta = 0.70
\]

Hypothetical: NICU Reduced Effect

Comparative Fit Index >.95

\[
\beta = 0.21, 0.19, 0.24, 0.23, 0.20, 0.27
\]

\[
\beta = 0.50
\]
Hypothetical: NO NICU Effect

Comparative Fit Index >.95

Limitations

- "Before-After" design
- Secular changes
- Generalizability
- "Water"
- Long term follow-up
Summary

Single Room NICU

- Major response to improving care
- Face validity
- Evidenced based research to determine effects (+/-) on infant, family, staff
- Findings will have a substantial impact on NICU care of premature infant