A Program of Research: Improving Outcomes for Infants Born Preterm

Rita H. Pickler, PhD, RN, FAAN
The FloAnn Sours Easton Professor of Child and Adolescent Health
Director, PhD & MS in Nursing Science Programs
2016 International Nurse Researcher Hall of Fame Honoree
Objectives

• Explain how a program of research can be a blueprint to improve health outcomes.

• Explain how patterned caregiving experiences improve clinical and neurological outcomes for preterm infants.
A “Program of Research” Defined

• Term 1st used by philosopher of science Lakatos
  – Multiple programs coexist, each with theories immune to revision, surrounded by emerging theories
    • Extending a research program’s theories into new domains is theoretical progress
    • Experimentally corroborating theoretic reach is empirical progress

• Cohesive approach to sequencing a series of studies to efficiently and effectively build new knowledge
  – Broad enough to be cross cutting, narrow enough to be manageable, addresses a gap or gaps, and is fundable
Rita Pickler
Program of Research

NICU Practice
PNP Practice
NICU FU

Improving Outcomes for Infants Born Preterm

The effect of nonnutritive sucking on bottle feeding performance in preterm infants, ADW, VCU, 1994
The effect of nonnutritive sucking on measures of feeding performance, ANF, 1994

Premature infant-nurse caregiver interaction, 1990 Dissertation

Nonnutritive sucking effects on bottle feeding stress, VCU, 1992
Natural feeding histories of preterm infants, VCU, 1994
Feeding behavior development in growing preterm infants, VCU, 2002-2005

Predictors of length of stay of preterm infants, VCU, 1997

Mastery of stress in mothers of preterm infants, VCU GIA, 1991; Mothers of premature infants: A cross-case analysis of stress mastery, VCU, GIA1992

Feeding readiness in preterm infants, 2001-2011, R01, NIH

Relationship of feeding experience to feeding outcomes in preterm infants, VCU, 1999

P20 Center for Biobehavioral Research, NIH 2004-2009

Missed care, current, HTC PS2 (CCHMC), 2012-2014; R21 (2016-2018, NIH)

Optimizing Health Development Across Childhood, T32, OSU, 2013-2018

Brain Function and Connectivity following a Neuroprotective Intervention, CCTST

NICU to home transition for families of preterm infants, PLACE, CCHMC2014-2017

P30 Center for Biobehavioral Measurement of Fatigue, NIH, 2009-2011

Prematurity Research Center Ohio Collaborative, MOD, Muglia,, 2013-2023

Exome Sequencing for Rare Disorders and Parents' Experiences, Myers, CCTST, 2012-2014

Other Areas of Research Interest:
genetics (since 1993); children with chronic or life threatening illness (since 1988); family well-being (since 1981); Exome Sequencing for Rare Disorders and Parents' Experiences, Myers, CCTST, 2012-2014

Clinical Environment: NICU and Home

Needs of mothers of preterm infants, 1981 Thesis

Mastery of stress in mothers of preterm infants, VCU GIA. 1991; Mothers of premature infants: A cross-case analysis of stress mastery, VCU, GIA1992


Studies of maternal well-being during pregnancy and postpartum

Optimizing Health Development Across Childhood, T32, OSU, 2013-2018

Maternal responsiveness, 2002., Supplement to R01, NIH

Intensive nome visiting and at-risk preterm infants, Goyal, BIRCWH, 2012-2014

Improving post-discharge outcomes by facilitating family-centered transitions from hospital to home, PCORI, 2014-2017

Pregnancy stress management, Pending NIH

Missed care, current, HTC PS2 (CCHMC), 2012-2014; R21 (2016-2018, NIH)

Other Areas of Research Interest:
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Clinical Environment: NICU and Home
Benefits of a Program of Research

- Improved quality of care
- Increased chances of funding
- Increased contribution to nursing science
- Increased contribution to nursing practice
- Personal satisfaction
Getting There

- Experience
- Motivation
- Education
- Persistence
- Humility
- Passion
Experience → Motivation
Symbolic Interaction

- Behavior is a function of the meaning that it has for the person
- Meaning is derived from the interactions that one has with others
- Behaviors and their meanings are best understood by examination of the interactive process in which they occur and are developed
- Individuals possess unique behaviors and response that influence their interactions with others

(Blumer, 1939)
Interaction Purpose

Initiating
Transacting
Concluding

Deriving
Rationalizing

Mediators

Acting and Reacting (Pickler, 1993)
Synactive Theory of Development

(Als, 1981)
Nonnutritive Sucking Studies

- The effect of nonnutritive sucking on premature infants' weight gain, energy expenditure and feeding readiness.
- Nonnutritive sucking effects on bottle feeding stress.
- The effect of nonnutritive sucking on bottle feeding performance in preterm infants.
- The effect of nonnutritive sucking on measures of feeding performance.
- Nutritive and non-nutritive study analysis
Feeding Histories

• Natural feeding histories of preterm infants
• Descriptive study of feeding opportunities in preterm infants
• Recent opportunity to collaborate
  – R15 submitted to study feeding histories in infants born with congenital heart defects
Feeding Readiness

• Transition from gavage to oral feedings is a major challenge for preterm infants
• Competence at oral feeding is a criterion for hospital discharge
• Few evidence-based protocols to guide clinicians
• Potentially short and long-term effects to trial-and-error approaches to oral feeding for preterm infants
Funding: R01 NR005182, National Institute of Nursing Research, National Institutes of Health, 2001-2011
Feeding Outcomes

• Maturity and feeding experience interact making the relationship of these variables to feeding outcomes more complex
• Behavior state affects outcomes in ways not entirely expected
• Predicting feeding outcomes for the most ill infants is more complex
Clinical Outcomes

• As compared to infant receiving the least feeding experience, infants with the greatest feeding experience:
  – achieve full nipple feedings 16 days sooner and
  – are discharged home 13 days sooner.
Feeding Skill Development

• Feeding skill development for parents and infants continues after discharge
• Large gaps exist in preparing parents for home
• Inadequate systems are in place for assessing skill development in the post-discharge period
Persistence

“Life is like riding a bicycle. You don't fall off unless you stop pedaling.”

Claude Pepper
PRO2: Major Findings

- Later starting and more opportunities to “learn” resulted in faster transitions from the start of oral feeding to full oral feeding (8-12 days versus 17 days) and earlier discharge (14-17 days versus 24-26 days)

- Later starting and more opportunities also resulted in better oral feeding skills

- Each missed oral feeding opportunity resulted in a day increase in time to achieve full feeds and a prolongation of NICU hospitalization over a day
SSB and HR
Feeding and Neurodevelopment

- A preterm infant’s experience is not predictable
- Caregiving should be patterned to neurologic expectation
- SSB parameters and coordination are neurologically driven
- ANS maturation can be seen as feeding becomes more mature
Patterned Experience for Preterm Infants (PEPI)

Biobehavioral Variables in Preterm Infants (Perinatal, Fetal, Infant)
- Genetic Cofactors (ApoE)
- Immunologic Cofactors (Cytokines)

Patterned Feeding Experience
- Attended Gavage
- Maximum Oral

The NICU Experience

Neurobehavioral Organization (NAPI)
- Cognitive Function (BSID Cognitive Scale)
- Neurobehavioral Development (CNS and ANS function)
- Clinical Outcomes (Length of NICU Stay, Time to Full Oral Feeding)
Methods

- **RCT**
  - Infants randomly assigned to intervention or control
  - Intervention links a tactile component to every feeding opportunity

- **Serial neurobehavioral measures**
  - Behavior organization (assessed by oral feeding skill development)
  - Long-term development
Behavior Organization

Figure. Median days between 1st and full PO by % tactile during early gavage

Figure. Median days between 1st and full PO by % hold during transition
Models: 1\textsuperscript{st} PO to Full PO

<table>
<thead>
<tr>
<th>Predictor: % tactile early gavage</th>
<th>Hazard Ratio</th>
<th>95% CI</th>
<th>p value</th>
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<td>&gt;75</td>
<td>5.5</td>
<td>2.1, 14.7</td>
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<tr>
<td>50-74</td>
<td>4.1</td>
<td>1.6, 10.8</td>
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<td>25-49</td>
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<td>1.2, 4.2</td>
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<td>&lt;25</td>
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<table>
<thead>
<tr>
<th>Predictor: % hold transition</th>
<th>Hazard Ratio</th>
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<tr>
<td>50-74</td>
<td>0.31</td>
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<tr>
<td>25-49</td>
<td>0.23</td>
<td>0.11, 0.52</td>
<td>0.0004</td>
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<tr>
<td>&lt;25</td>
<td>0.62</td>
<td>0.28, 1.37</td>
<td>0.23</td>
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</tbody>
</table>

Controlling for intervention group status, NMI at transition, sex, GA
Survival curve of days between 1\textsuperscript{st} and full PO by % tactile during early gavage

Product-Limit Survival Estimates

Log-Rank p=0.004 differences in time to full PO
Survival curve of days between 1\textsuperscript{st} and full PO by % hold during transition

Log-Rank $p=0.0002$ differences in time to full PO
Immunomodulation and Neurobehavior

• Subsample 57
  – IL1ra, IL6, IL8, IL10, GCSF, GMCSF, MCP-1, TNFα
    • Drawn in the 1st week of life
  – Neurobehavioral Assessment of the Preterm Infant (NAPI)
    • 1st week of life, discharge, 2 months CA
  – Cytokines highly intercorrelated
    • ↑ IL8 higher baseline alert/orienting (AO) scores
    • ↓ IL1ra & IL10 lower AO scores at baseline
      – Continued lower AO scores with low IL10
Effects on Neural Connections

Intervention Group

Control Group

fcMRI Results: Default Mode
He who knows not and knows not that he knows not is a fool - shun him.
He who knows not and knows that he knows not is simple - teach him.
He who knows and knows not that he knows is asleep - wake him.
He who knows and knows that he knows is wise - follow him.

Ancient Proverb
BUILD A TEAM!
FOLLOW YOUR PASSION!
REMEMBER THE GOAL!