

# Effect of Oral Stimulation on Feeding Progression in Preterm Infants

*Brenda S. Lessen, PhD, RN*

NANN National Summit

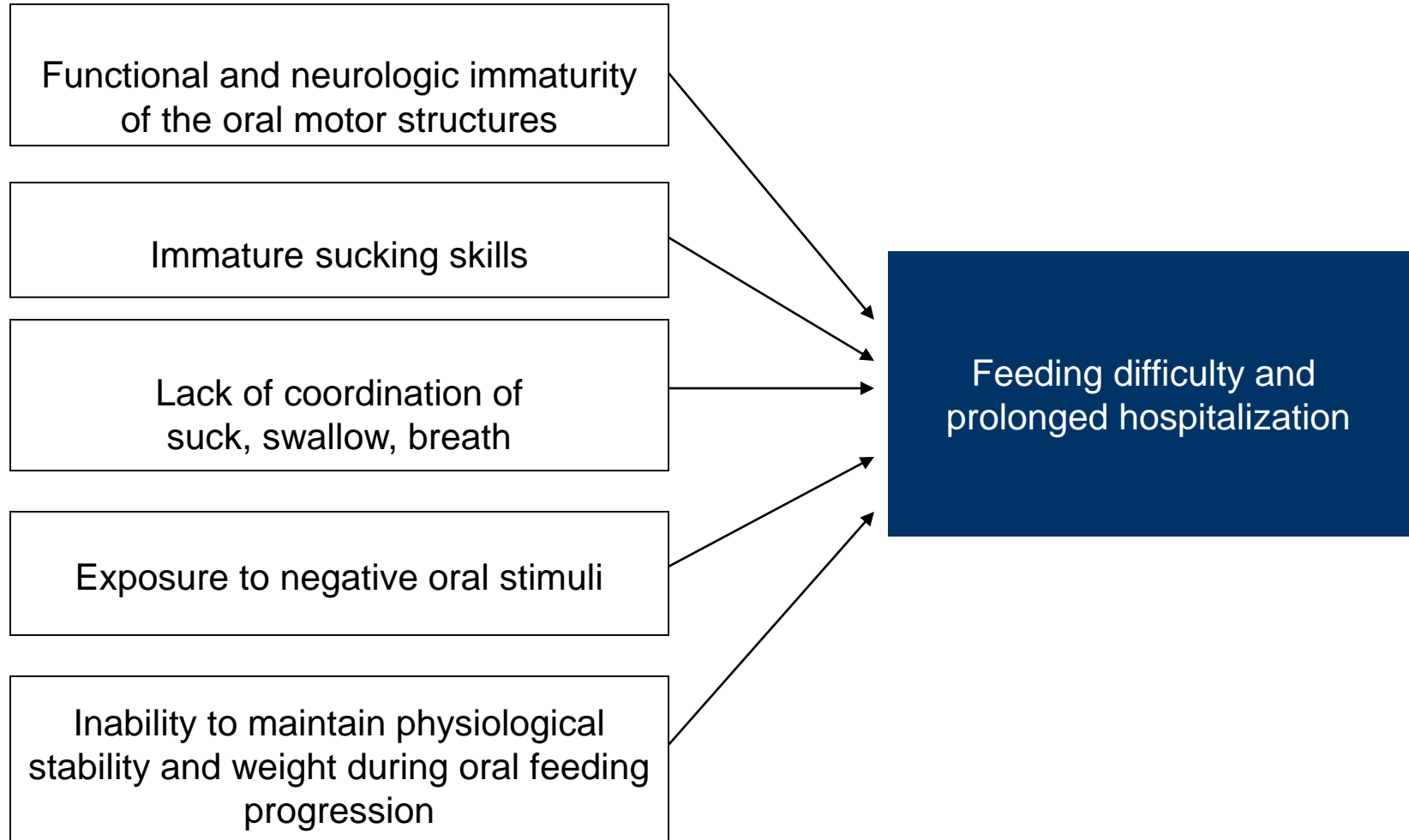
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Scottsdale, AZ

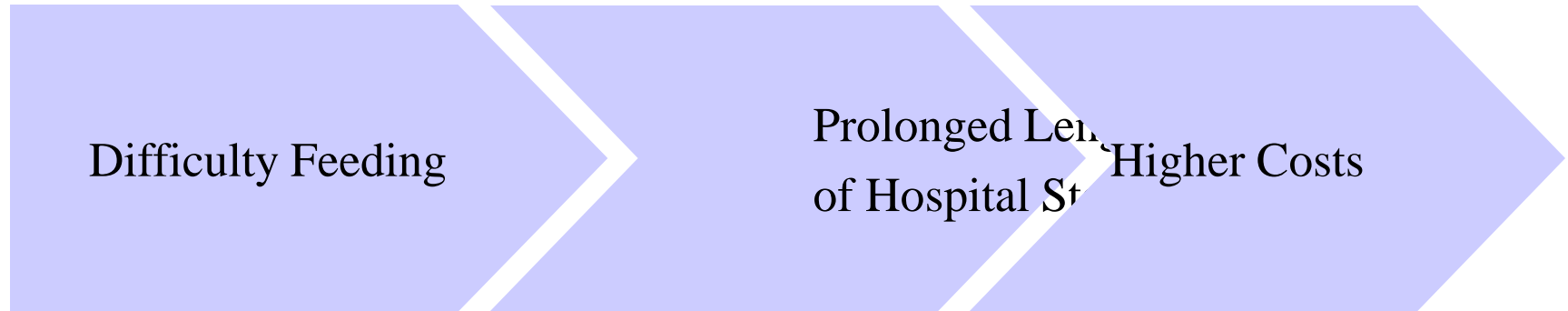
# Background

- Preterm birth rate still rising (↑ 21% since 1990)
- Double the HP2010 goal of 7.6%
- Over half million preterm infants born per year
- LBW infants hospital stay averages \$79,000 per infant
- Nationally- costs >\$20 billion annually

# Feeding Difficulties in Preterm Infants






# Clinical Problem



Need evidence-based interventions to facilitate successful feeding, thus shortening length of stay, & cutting cost of care.

# Interventions to Facilitate Feeding

- Sensorimotor input  
ATVV  Faster transition from gavage to oral feeds  
Decreased LOS
- Target oral structures  
peri-oral massage  
non-nutritive sucking  
cheek/chin support  
oral stimulation  ↑ Volume intake  
Faster transition from gavage to oral feeds  
↑ weight gain  
Decreased LOS
- Early feeding  
experience/practice  Faster transition to oral feeds  
Enhanced maturation of sucking patterns

# Oral Musculature

- Preterm infants have poor oral-motor control related to:
  - weaker muscle tone around mouth
  - less sensation
  - less tongue strength
- Decreased sucking strength and endurance



# Oral Stimulation

- Oral Stimulation = Stroking and/or pressure to structures in and around the mouth
- More complex, targeted intervention than non-nutritive sucking
- Supplemental oral stimulation → increase functional strength and control of movement for feeding

# Oral Stimulation on Preterm Infants

	PMA at Birth	PMA at Oral Stim	When Oral Stim rec'd	Fx/Duration of Oral Stim	PMA at 1 <sup>st</sup> Oral Fdg	Results
Fucile et al (2002) n = 32 <i>Canada</i>	26-29 weeks	?? After NCPAP (~31-32 wks)	Prior to gavage feedings	15 minutes Once daily 10 days	34.5 weeks	<ul style="list-style-type: none"> <li>▪ Transitioned to oral feedings 5 days sooner (<math>p &lt; .05</math>)</li> <li>▪ Discharged 5 days sooner</li> </ul>
Rocha, et al (2006) n = 98 <i>Brazil</i>	26-32 weeks	31-33	During gavage feedings	15 minutes (q 2h ???) 10 days	35.5 weeks	<ul style="list-style-type: none"> <li>▪ Attained oral feedings 8 days sooner (<math>p &lt; 0.001</math>)</li> <li>▪ Discharged 10 days sooner (<math>p &lt; 0.01</math>)</li> </ul>



# Oral Stimulation on Preterm Infants

The few studies re: oral stimulation are limited to preterm infants who rec'd oral stim when they were  $\geq 31$  weeks PMA

No studies where oral stim was done exclusively prior to the initiation of oral feeding (pre-feeding)

Early Feeding Protocol  
in my NICU (30wks)

“Prefeeding” me  
oral stim at  $<30$

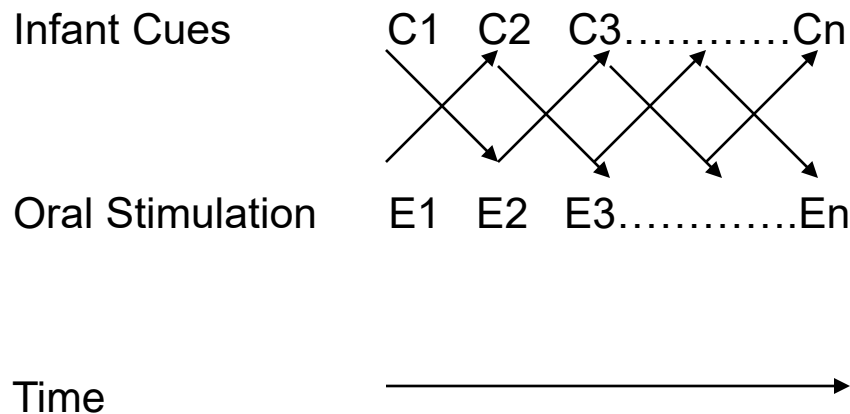
Younger PMA required  
an intervention of reduce  
length and frequency

# Purpose/Study Aim

To assess the effect of a prefeeding oral stimulation intervention on feeding progression and length of hospital stay on preterm infants < 30 weeks PMA.

# Conceptual Model

## Transactional Model



The transactional relationship between the preterm infant cues (C) and the oral stimulation as an aspect of the infant's environment (E), as the infant grows and develops over time (Sameroff & Chandler, 1975).

# Research Questions

1. Will the oral stimulation intervention given prior to a feeding once per day for 7 consecutive days result in a **faster transition from gavage to total oral feedings** when compared to controls who will receive routine NICU care?
2. Will the oral stimulation intervention given prior to a feeding once per day for 7 consecutive days result in a **shorter length of hospital stay** when compared to controls who will receive routine NICU care?

# Design

- Double blind, experimental design
- Short term longitudinal study
- Block randomized to experimental or control group
- Pilot study to test intervention methods, safety and efficacy on 29 week PMA infants

# Setting

- All subjects from one Level III NICU in a regional medical center in Peoria, IL
- Vermont-Oxford Network – rank top 3% nationally for NICU outcomes
- Review:
  - Peoria IRB
  - UIC IRB
  - Nursing Review Board
- Standard of Care
  - Developmental care protocols in place
    - » Nesting, swaddling
    - » Cycled lighting
    - » Decibel meters
    - » Rural rounding

# Sample

- Convenience sample
- Preterm infants born AGA between 26-29 weeks PMA
- Clinically stable
- Exclusion criteria:
  - Congenital anomalies
  - NEC
  - Brain Injury (including IVH > grade1)
  - Prenatal illicit drug exposure
  - Assisted ventilation (hi-flow nasal canula allowed)

# Control Condition

- PI/RA stands with hands inside Isolette, not touching infant, for 5 minutes
- Curtain is pulled for blinding



# Experimental Condition

- 5 min Oral Stimulation using Beckman\* (BOMI-PI)
- Once per day for 7 consecutive days
- Done 15-30 minutes prior to a gavage feeding
- Begins at 29 weeks PMA
- Continuous EKG/SaO<sub>2</sub> monitoring
- Done by PI and trained RA's
- Curtain pulled for blinding

\*Beckman Oral Motor Intervention-Premature Infant  
(BOMI-PI)

# Beckman Oral Motor Intervention- Premature Infant (BOMI-PI)

- Provides assisted movement to activate muscle contraction and provides movement against resistance to build strength.
- Focus is to increase functional response to pressure and movement, and control of movement for the lips, cheeks, jaw, and tongue.
- Cheeks, lips, gums, tongue and palate were stimulated per specific protocol with finger stroking for 3 minutes
- Ends with non-nutritive sucking for 2 minutes



# BOMI-PI



## Beckman Oral Motor

Structure	Purpose	Frequency	Duration
Cheek Stretch	Improve range of motion and strength of cheeks, and improve lip seal.	2x each cheek	30 sec
Lip Stretch	Improve lip range of motion and seal.	1X each lip	30 sec
Upper and Lower Lip Curl	Improve lip strength, range of motion, and seal.	1X each lip	30 sec
Gum Massage	Improve range of motion of tongue, stimulate swallow, and improve suck.	2X	30 sec
Lateral Borders of Tongue	Improve tongue range of motion and strength.	1X each	15 sec
Midblade of Tongue	Improve tongue range of motion and strength, stimulate swallow, and improve suck.	2X	30 sec
Elicit a Suck	Improve suck, and soft palate activation.	N/A	15 sec
Non-Nutritive Sucking	Improve suck, and soft palate activation.	N/A	2 min

# Outcome Measure: 1

- Feeding Progression

The day the first oral feeding was attempted to the day when “total oral feeding” was attained



# 6 Phases of Feeding Progression



Day/Phase 1	1 Nipple per day	When consumes >50% for 48 hours, progress
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Phase 2	Nipple BID	When consumes >50% for 48 hours, progress
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Phase 3	Nipple TID	When consumes >50% for 48 hours, progress
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Phase 4	Nipple QID	When consumes >50% for 48 hours, progress
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Phase 5	Nipple 6 per day	When consumes >50% for 48 hours, progress
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Phase 6	Nipple 8 per day (all)	When consumes >50% for 48 hours, progress
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# Outcome Measure: 2

- Length of Hospital Stay

Number of days from study entry at 29 weeks PMA to date of discharge

# Dependant Variables

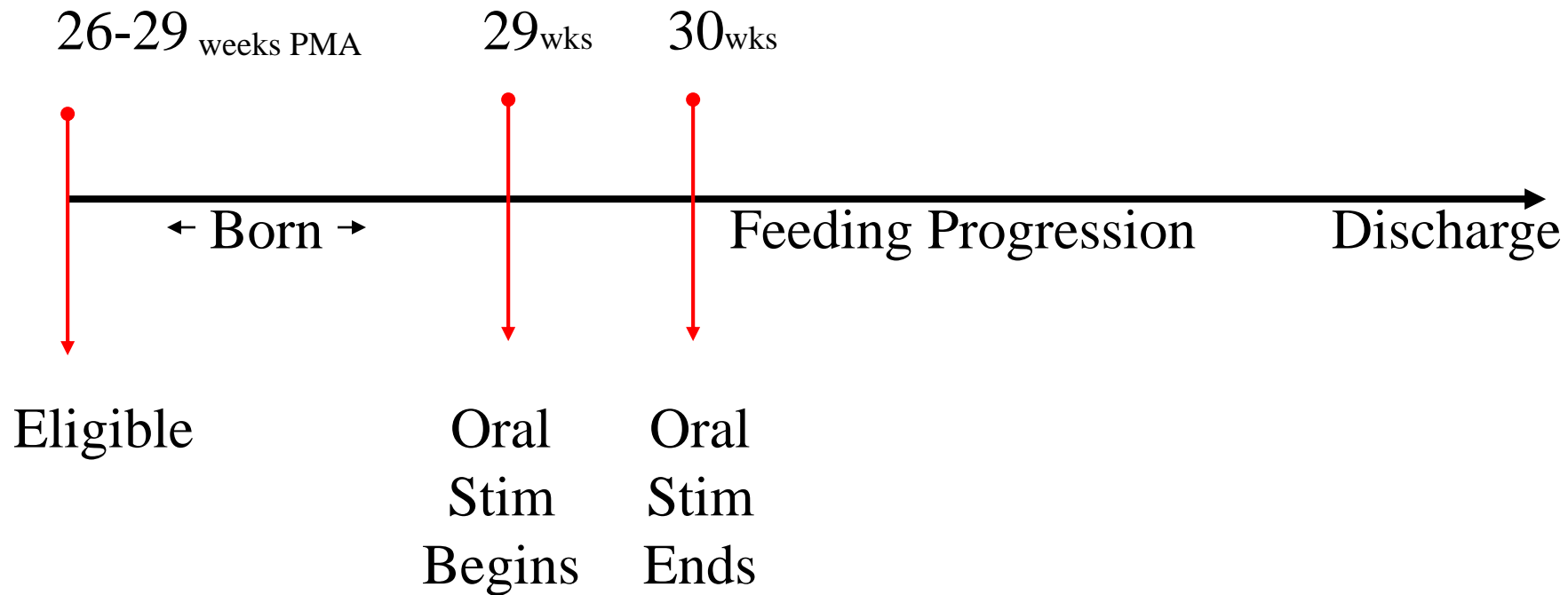
- Demographics
- Birth weight
- Weight at entry
- Illness severity at birth
- Illness severity at entry
- PMA at birth
- Parent feedings during fdg prog.
- Parent feedings after fdg. prog.
- PMA at first oral feeding
- PMA at total oral feedings
- # Days in each phase of 6-phase feeding progression

To test for  
homogeneity of  
groups

Identify any  
covariates

Of interest  
based on  
other studies

# Study Timeline





# Procedures

- Charge nurse notified PI of any 26-29 weekers born (I called almost daily)
- RA's determined eligibility with the inclusion/exclusion checklist
- If eligible, RA's requested permission from parents for PI to approach them
- PI got informed consent
- Laminated card taped to Isolette to mark study infants
  - Study infants could not have additional oral stim unless ordered by a physician
- Infants randomly assigned to group

# Procedures

- Intervention began the day the infant turned 29 weeks
- “Please Wait a Moment” note hung on the curtain so the blind would not be interrupted by staff
- Allowed a minimum of 9 hours and maximum of 36 hours between interventions (24 hours ideal)
- Clinical stability and eligibility rechecked prior to every intervention, and monitored throughout
- Any adverse physiologic or behavioral responses to the intervention were recorded on the study documentation form
- After intervention—followed chart for continued eligibility and measurement of feeding progression and length of stay

# Enrollment

- Subject Enrollment
  - 30 enrolled
- Attrition (33%)
  - 3 still intubated at 29 weeks
  - 4 NPO/enteral intolerance
  - 1 death
  - 2 transferred
  - 1 recalculated PMA/ineligible

Control Group      n = 9      →      n = 19  
Experimental Group      n = 11

# Characteristics of the Sample

	Experimental (n=10) M ± SD	Control (n=9) M ± SD	*P value
<b>PMA+ (weeks)</b>			
<u>At birth</u>	28.1 ±.6	28.0 ± .9	0.842
<b>PCS<sup>^</sup></b>			
<u>At birth</u>	4.4 ±.5	4.3 ± .7	0.968
<u>At entry</u>	3.8 ± .9	3.8 ± .7	0.968
<b>Weight (grams)</b>			
<u>At birth</u>	1017.3 ± 127.1	913.3 ± 87.8	0.028
<u>At entry</u>	991.0 ± 124.6	915.5 ± 145.2	0.079
<b>Parent feedings</b>			
<u>During feeding prog.</u>	3.2 ± 2.6	3.0 ± 3.2	0.661
<u>Total to discharge</u>	1.6 ± 1.2	2.2 ± 2.2	0.458

- + PMA = Post Menstrual Age
- ^ PCS =Postnatal Complications Score
- \* Mann-Whitney Test

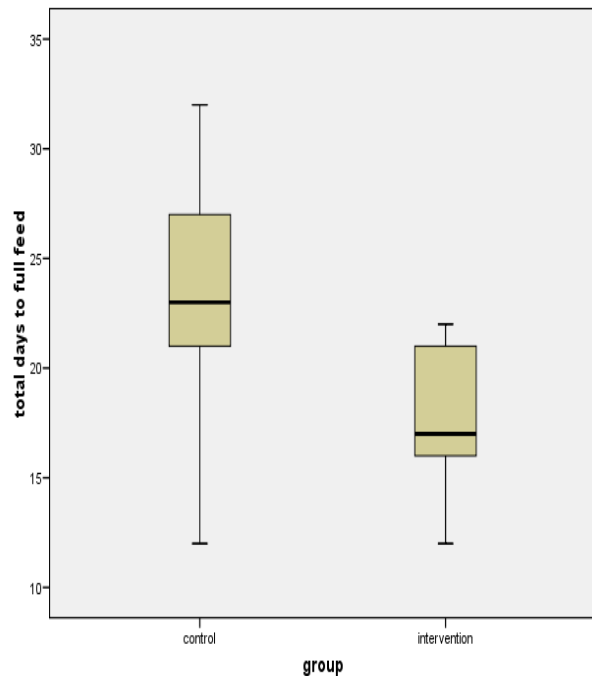


# Data Analysis

- SPSSPC 15.0
- Alpha's set at .05 (1-tailed)
- Group Differences
  - tested with chi-squares, Mann-Whitney-U tests, and independent t-tests
- Outcomes Variables (Feeding/LOS)
  - General Linear Models univariate for group differences while controlling for covariates

# Hypothesis 1 – Feeding Progression Results

- The oral stimulation intervention given prior to a feeding once per day for 7 consecutive days will result in a **faster transition from gavage to total oral feedings** when compared to controls who receive routine NICU care.



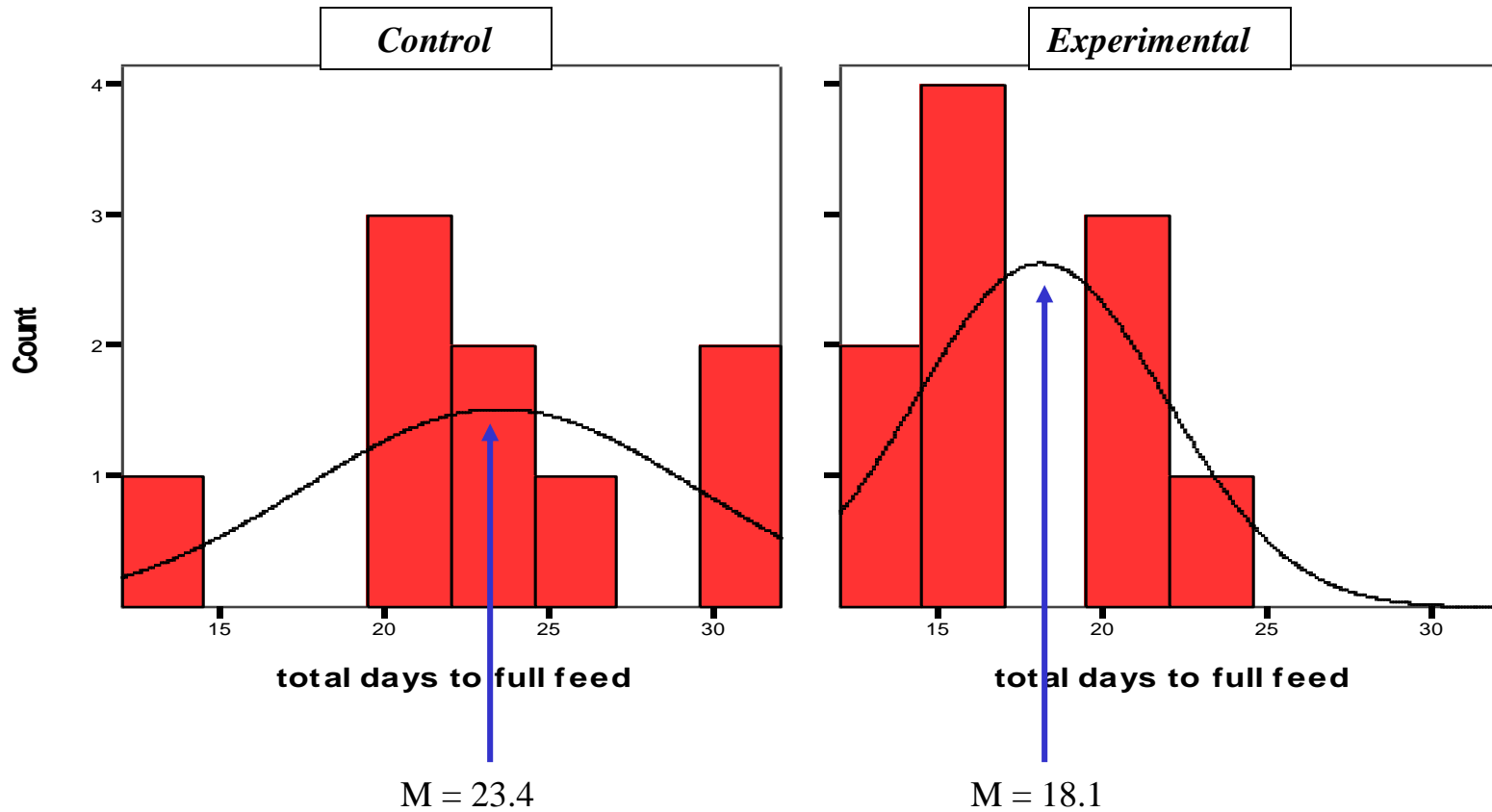
The oral stimulation group transitioned to total oral feedings **5 days sooner than controls**

( $p = 0.043$ )

With birth weight as a covariate:

( $p = 0.068$ )

# Total Days to Full Oral Feedings

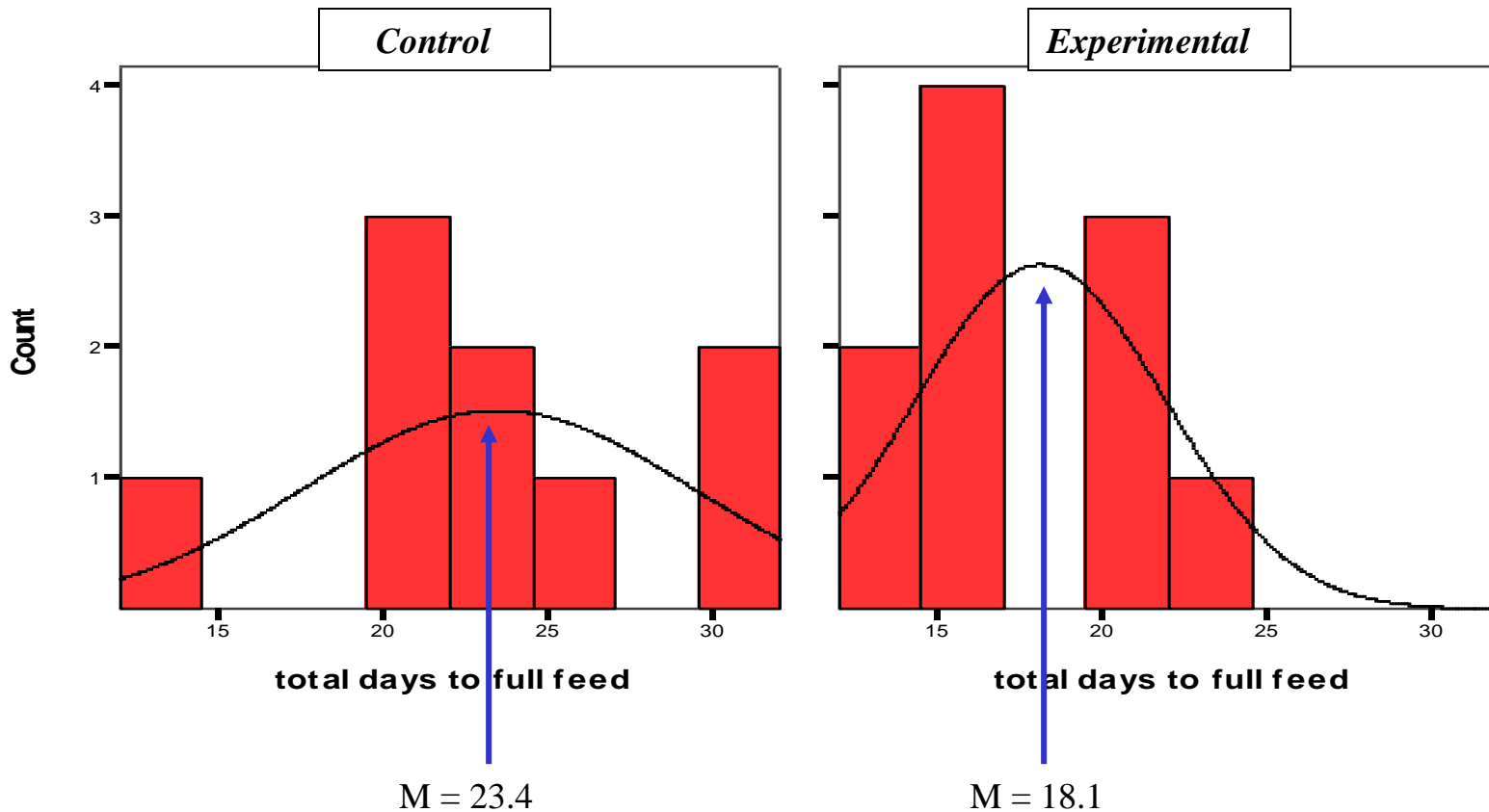


**5 day difference**

$p = .043$

(per Mann-Whitney U)

# Total Days to Full Oral Feedings - *with covariate*

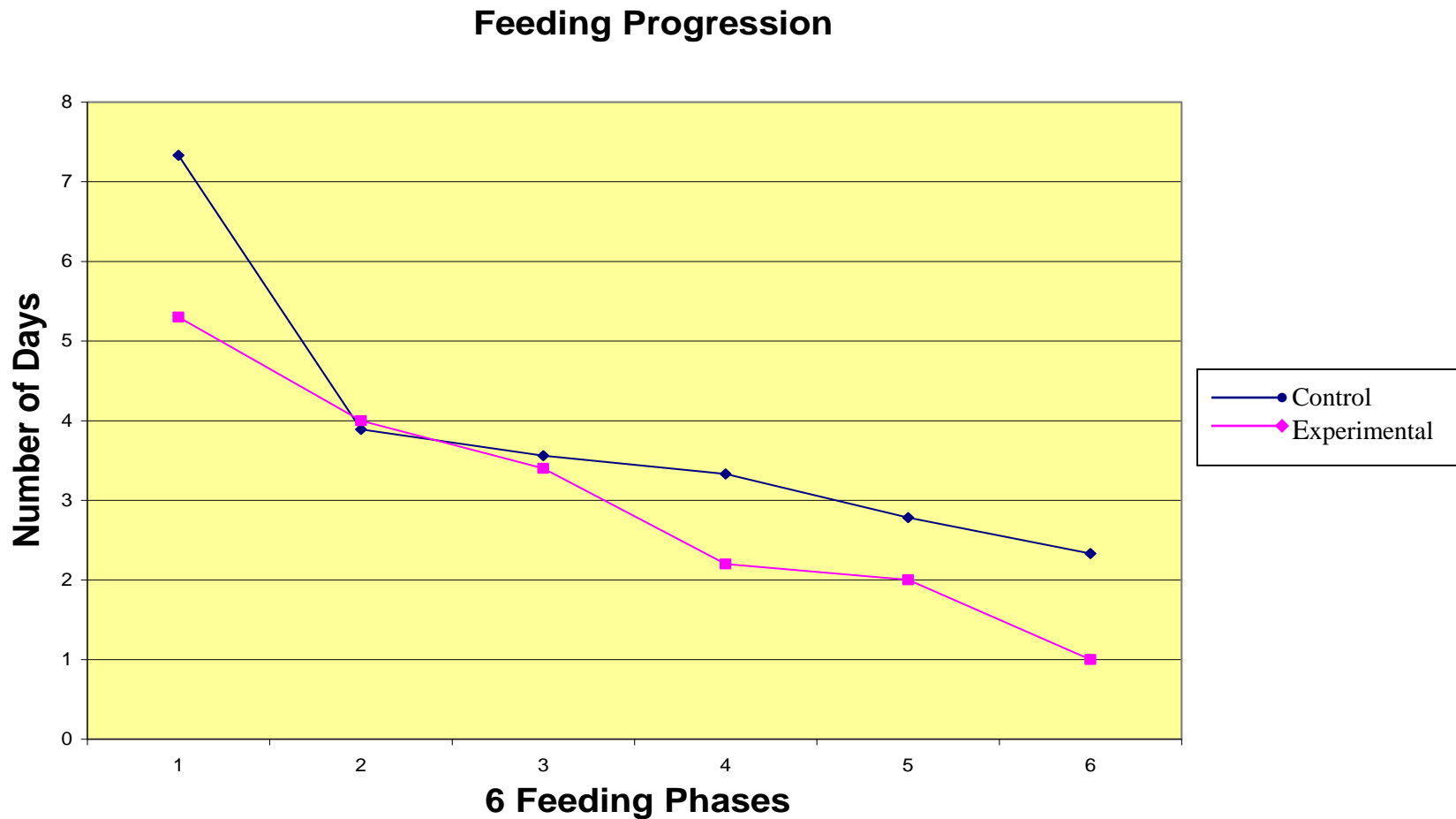


**5 day difference**

$p = .068$   
(per GLM)

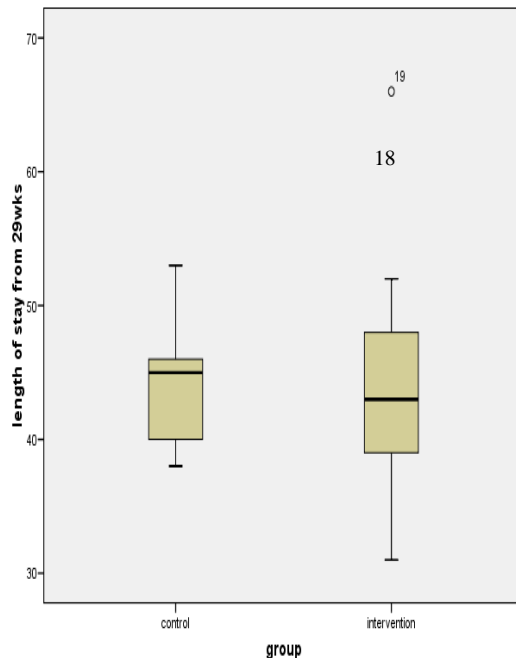


# Feeding Progression within the 6 phases



# Hypothesis 2 – Length of Stay Results

- The oral stimulation intervention given prior to a feeding once per day for 7 consecutive days will result in a **shorter length of hospital stay** when compared to controls who receive routine NICU care.



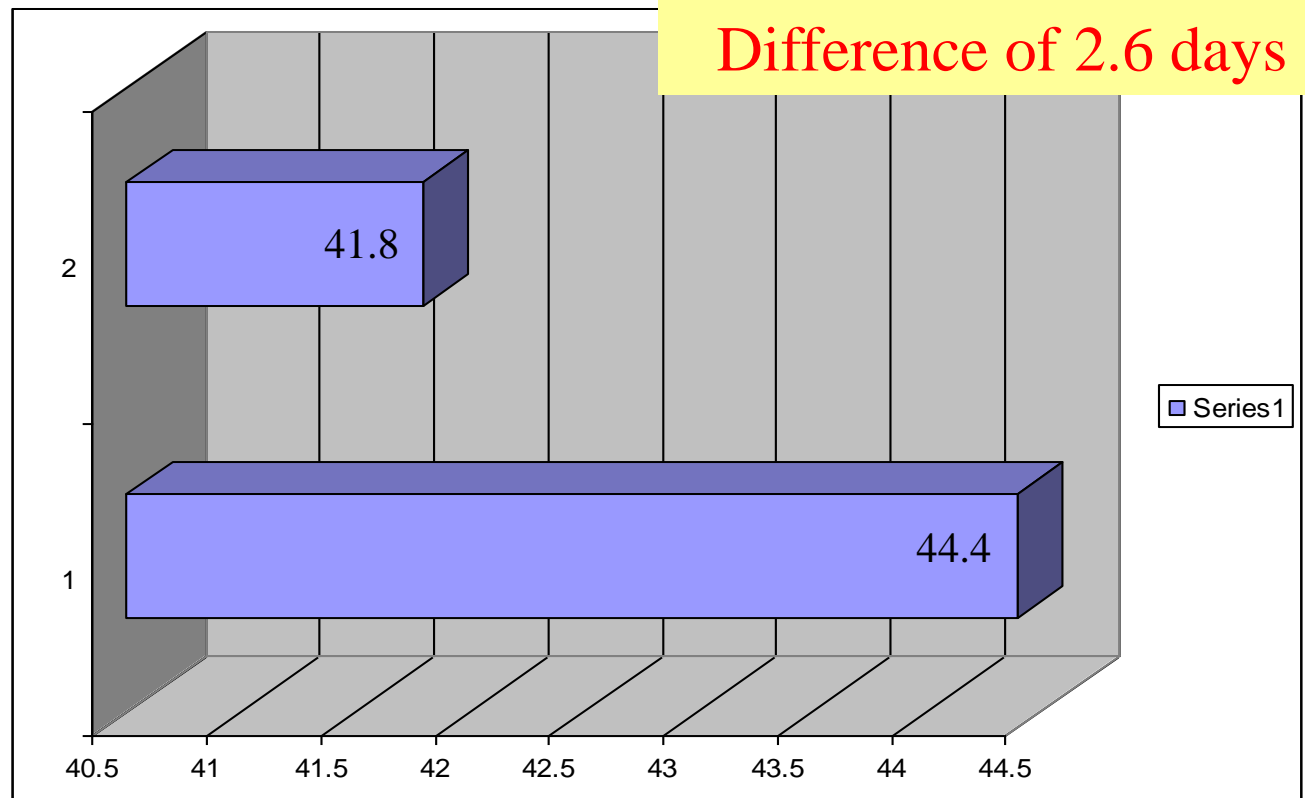
The oral stimulation group was discharged 2.6 days sooner than controls

$(p = .541)$

# Length of Stay (from 29 weeks PMA)

Experimental

Control

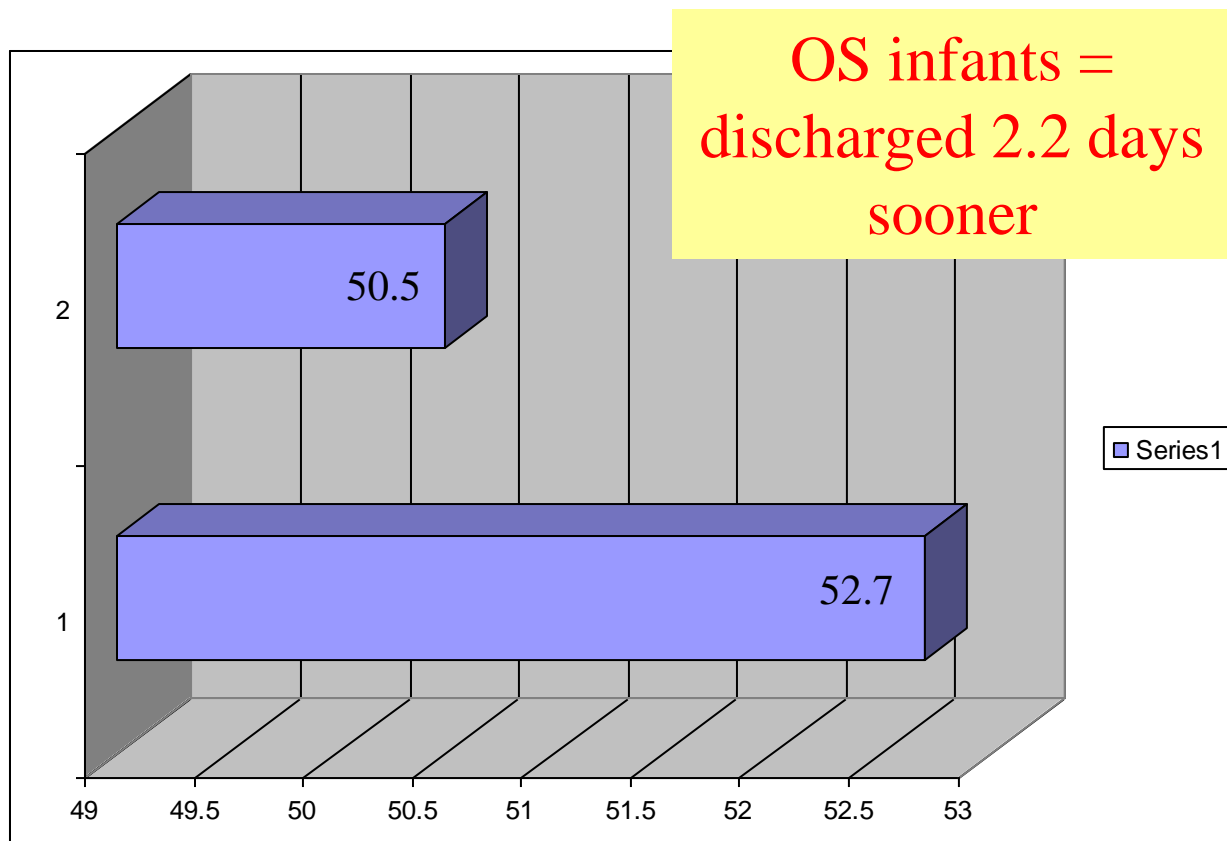


Days from 29 weeks PMA to Discharge

# *FYI SLIDE: Length of Stay (from Birth, rather than from 29 weeks PMA)*

Experimental

Control



Days from Birth to Discharge

# Limitations

- Small sample size (pilot)
- Breast milk and formula both used in bottle feedings
- Heterogeneity of Birth Weight
- No Measurement of Behavioral State



# Discussion

## ■ Feeding Progression

- Oral stimulation with the BOMI-PI done for 7 days starting at 29 weeks PMA did result in a 5-day faster transition from gavage to total oral feedings
- 29 week PMA infants tolerated the BOMI-PI. **Of the 182 times oral stim was done, it was never terminated due to an adverse response of the infant.** There were only 4 delays for apnea in which infant regained stability on his own, and oral stim was continued.
- Enteral intolerance, delayed gastric emptying, and decreased gastric motility can delay transition to oral feeding
  - This pilot excluded 4 infants who experienced enteral intolerance during feeding progression
  - Subjects may still have had slight delays in moving through the 6 phases due to gastric residuals, regurge, other early signs of stress (temp instability or apnea/bradycardia)
- The randomized design helped control for these variances

# Discussion

## ■ Staffing

- The feeding progression relies on the number of bottle feedings tolerated per day. A busy shift may force an RN to gavage, rather than bottle feed an infant, thus delaying the feeding progression.
- Staffing variances across the 8 months were not assessed, but both randomized groups were on the same unit

## ■ Parent Feeding

- In the early learning stages of oral feedings, the expertise of the feeder may impact how fast infants get through the feeding progression.
- **There was no difference between groups in number of parent feedings vs nurse feedings.**
- Both groups in this study had a mean of 3 parent feedings during feeding progression, and less than 3 subsequent parent feedings leading up to discharge. There was always one supervised feeding required as part of discharge planning.

# Discussion

- Initiation of Oral Feeding/Early Feeding Protocol
  - In my NICU, early feeding protocols allow the first attempted bottle feeding as early as 30 weeks, and determined safe in a 2004 report.
  - In this pilot, the mean PMA for the first feeding in both groups was 31 weeks. The earliest was 30 5/7 weeks.
  - The standard 32-34 “ready to feed” has been challenged in the literature. Early initiation of feedings has resulted in earlier attainment of total oral feedings (Simpson, et al 2002).
  - Simpson compared an early feeding group with a control group, but ALL infants in my pilot were early feeders. **It was initially questioned if the early feeding protocol would have already had the maximum benefit on feeding progression.**
  - **This pilot illustrates that even with both groups experiencing early feedings, the addition of oral stimulation still reduced the time to reach oral feedings by 5 days.**
  - Beckman supports the important distinction between sucking experience from early feedings and the more complex oral stimulation program of training the oral motor structures to respond functionally to pressure, movement, range, strength, and control for lips, cheeks, jaw and tongue.



# Discussion

## ■ Feeding Progression *Phases*

- There was no statistically significant differences between groups on how long infants took to progress through each of 6 individual phases.
- Phase 1 was clinically the most relevant, as the control group took 2 additional days to complete phase 1.
- The control groups also took a mean of 1 day longer to complete phases 4 and 6.
- 2 control infants took >5 days to progress out of phase 6, while all experimental infants took the minimum 48 hours.
- Fucile et al (2002) found similar results in meeting the same three feeding milestones.
- **Oral stimulation seems to have the greatest effect on the success of the first oral feeding attempts, oral feedings 4 times per day, and the infant's ability to handle all 8 oral feedings per day without relapse.**

# Discussion

- PMA at Total Oral Feeding
  - There was no statistically significant difference between groups at what PMA total oral feedings were attained.
  - **Clinically relevant; the oral stim group was 4 days younger than controls (34 1/7 vs 34 5/7)**
  - Because attaining total oral feeding is often the final requirement for discharge, this has the potential to result in an earlier discharge.

# Discussion

- **Illness Severity**
  - There was no difference between groups on illness severity either at birth, or at study entry.
  - The Postnatal Complications Score was not intended to be used other than within 12 after birth
  - It proved to be a reasonable assessment of illness severity at 29 weeks and also provided an additional prompt for assessment of eligibility prior to the first oral stimulation intervention.

# Discussion

- Length of Hospital Stay
  - The oral stimulation group was discharged 2.6 days sooner than controls.
  - A 3-day decrease in LOS would save our nation more than \$2 billion annually.
  - These findings are consistent with the 2 other studies that used the Beckman Oral Stim Intervention, with discharges between 5 and 10 days sooner than controls.
  - There was already considerable evidence in the literature that oral stimulation given *during* feeding progression to preterm infants >31 weeks decreases LOS
  - **Now this pilot reveals promise for oral stim done *prior to* the first oral feeding, *and* on preterm infants as young as 29 weeks, to also decrease length of stay**

# Future Research

- Larger study/larger sample size
- Dose-response studies
  - More times per day
  - Longer period of days (to discharge?)
    - Right before each gavage or during gavage?
    - Decrease attrition by delaying start of oral stim by 1 week (30 weeks PMA)- if not *prefeeding* anymore
- Nurse/Parent responses to the BOMI-PI
- Measure Infant Behavioral State

*Thank You*

*Contact Info: [blessen@iwu.edu](mailto:blessen@iwu.edu)  
309-212-0544 (cell)  
Illinois Wesleyan University  
School of Nursing  
Bloomington, IL*