Effect of Oral Stimulation on Feeding Progression in Preterm Infants

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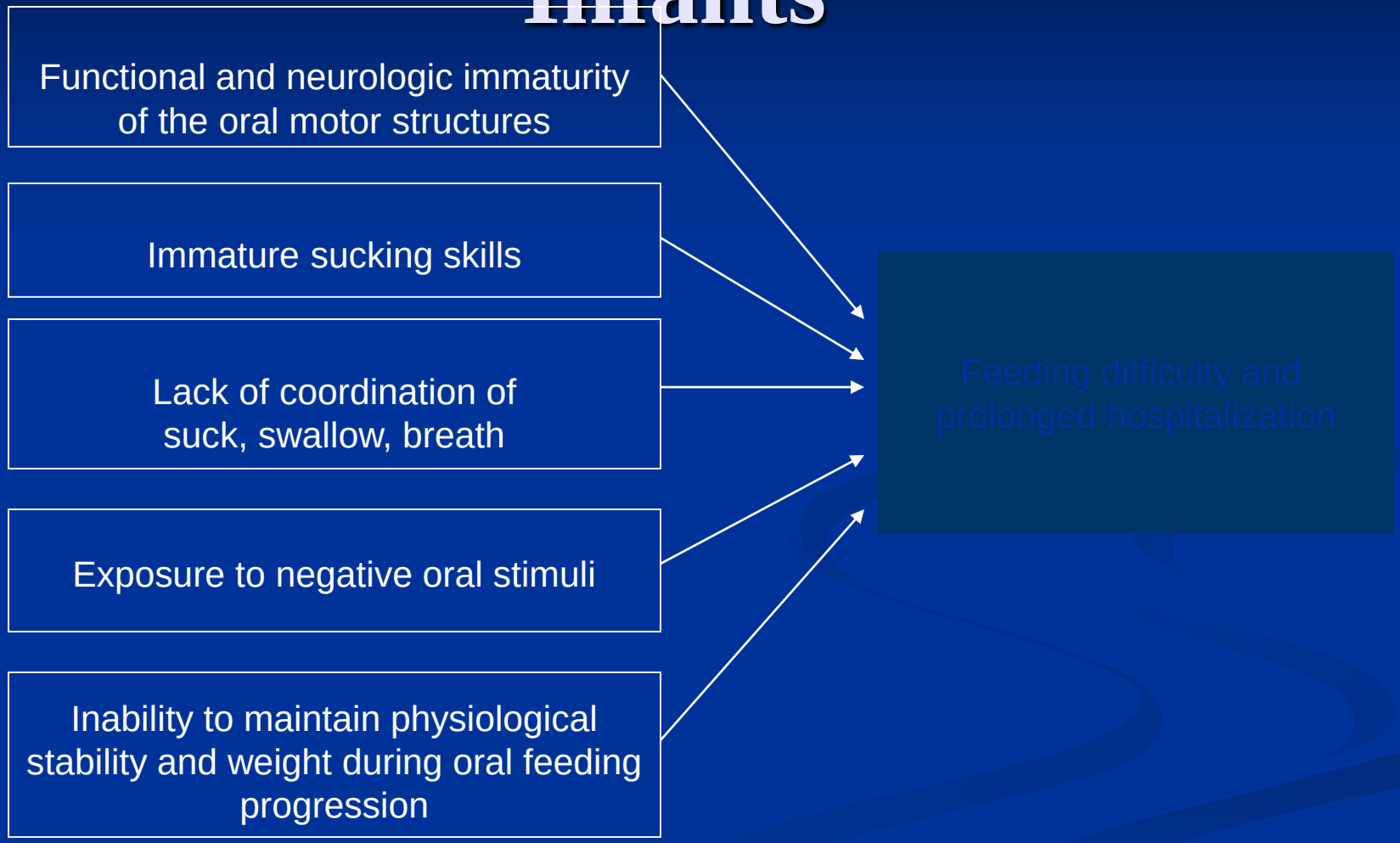
Future Milestone Project

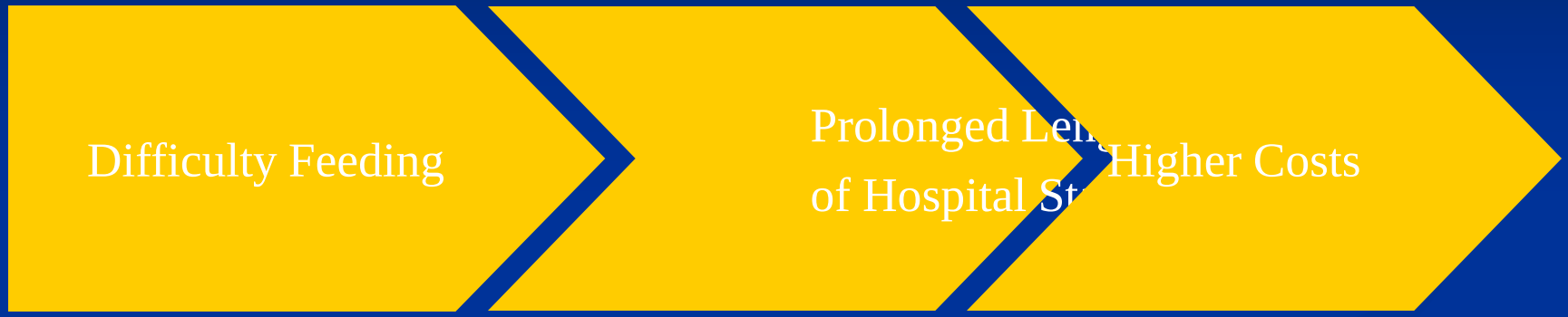
Background

- 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 1st Oral Fdg	Results
Fucile et al (2002) n = 32 *Canada*	26-29 weeks	?? After NCPAP (~31-32 wks)	Prior to gavage feedings	15 minutes Once daily 10 days	34.5 weeks	•Transitioned to oral feedings 5 days sooner ($p<.05$) •Discharged 5 days sooner
Rocha, et al (2006) n = 98 *Brazil*	26-32 weeks	31-33	During gavage feedings	15 minutes (q 2h ???) 10 days	35.5 weeks	•Attained oral feedings 8 days sooner ($p<0.001$) •Discharged 10 days sooner ($p<0.01$)

Both used the 15 minute Beckman Oral Motor Intervention

Oral Stimulation on Preterm Infants

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

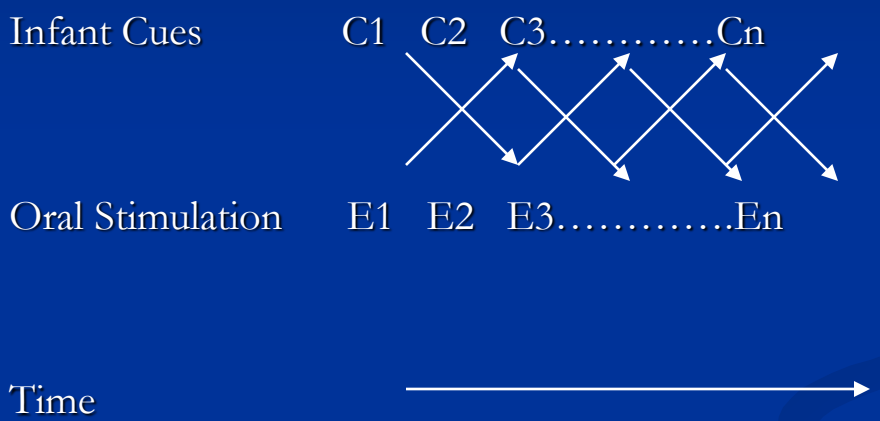
No studies where oral stim was done exclusively prior to the initiation of oral feeding (pre-feeding)

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/SaO2 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

BOMH-TT

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 Pro

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

Outcome Measure: 2

- Length of Hospital Stay

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

Dependant Variables

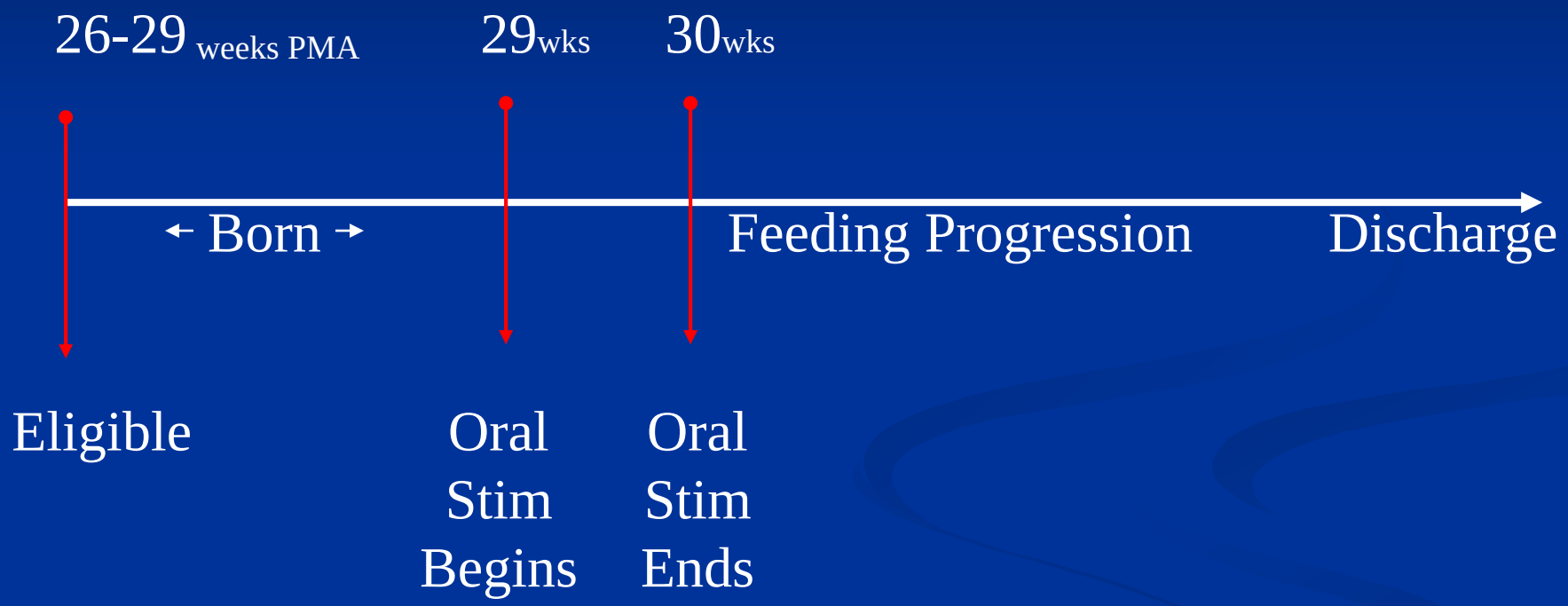
- Demographics
- Birth weight
- Weight at entry
- Illness severity at birth
- Illness severity at entry
- PMA at birth
- Parent feedings during fdg prog.
- Parent feedings after fdg. prog.
- PMA at first oral feeding
- PMA at total oral feedings
- # Days in each phase of 6-phase feeding progression

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

Experimental Group n = 11

→ n = 19

Characteristics of the Sample

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

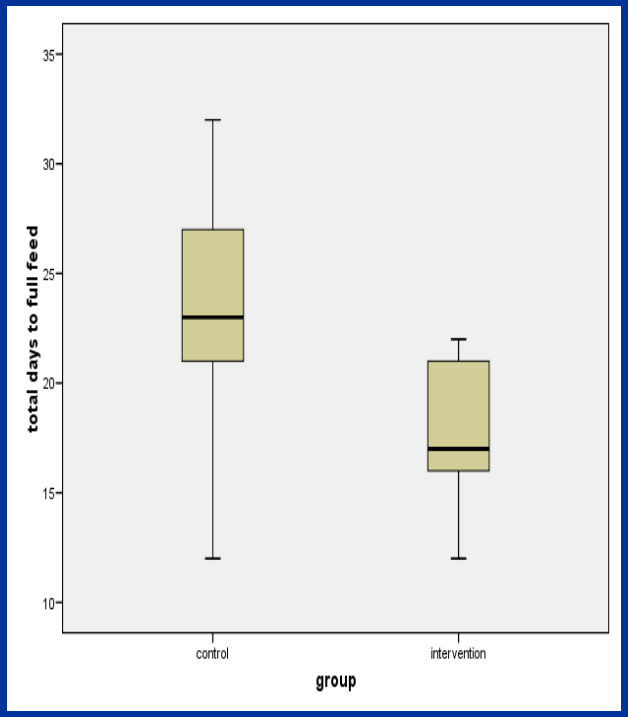
+ PMA = Post Menstrual Age
^ PCS =Postnatal Complications Score
* Mann-Whitney Test

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

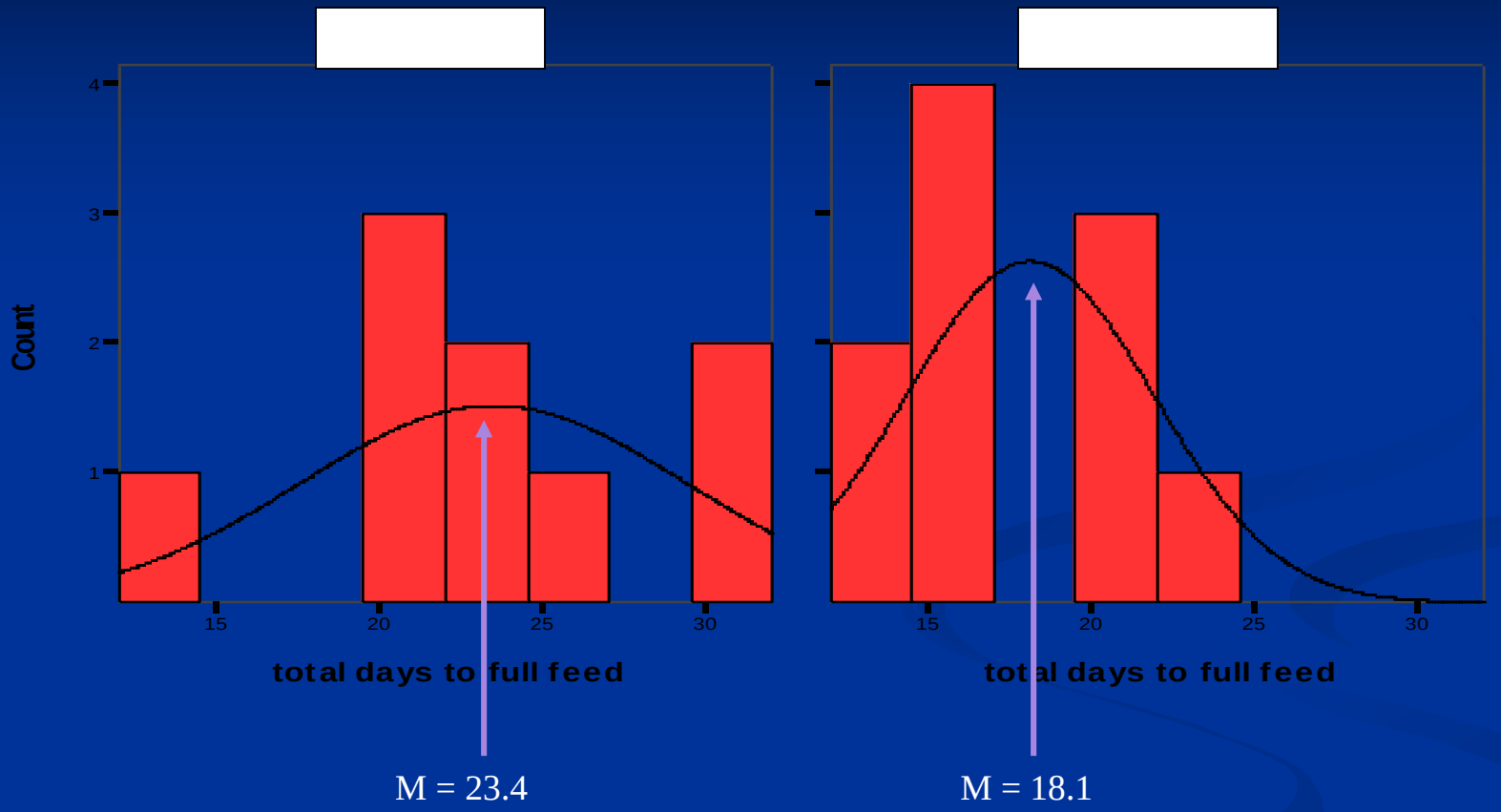
- The oral stimulation intervention given prior to a feeding once per day for 7 consecutive days will result in a **faster transition from gavage to total oral feedings** when compared to controls who receive routine NICU care.



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

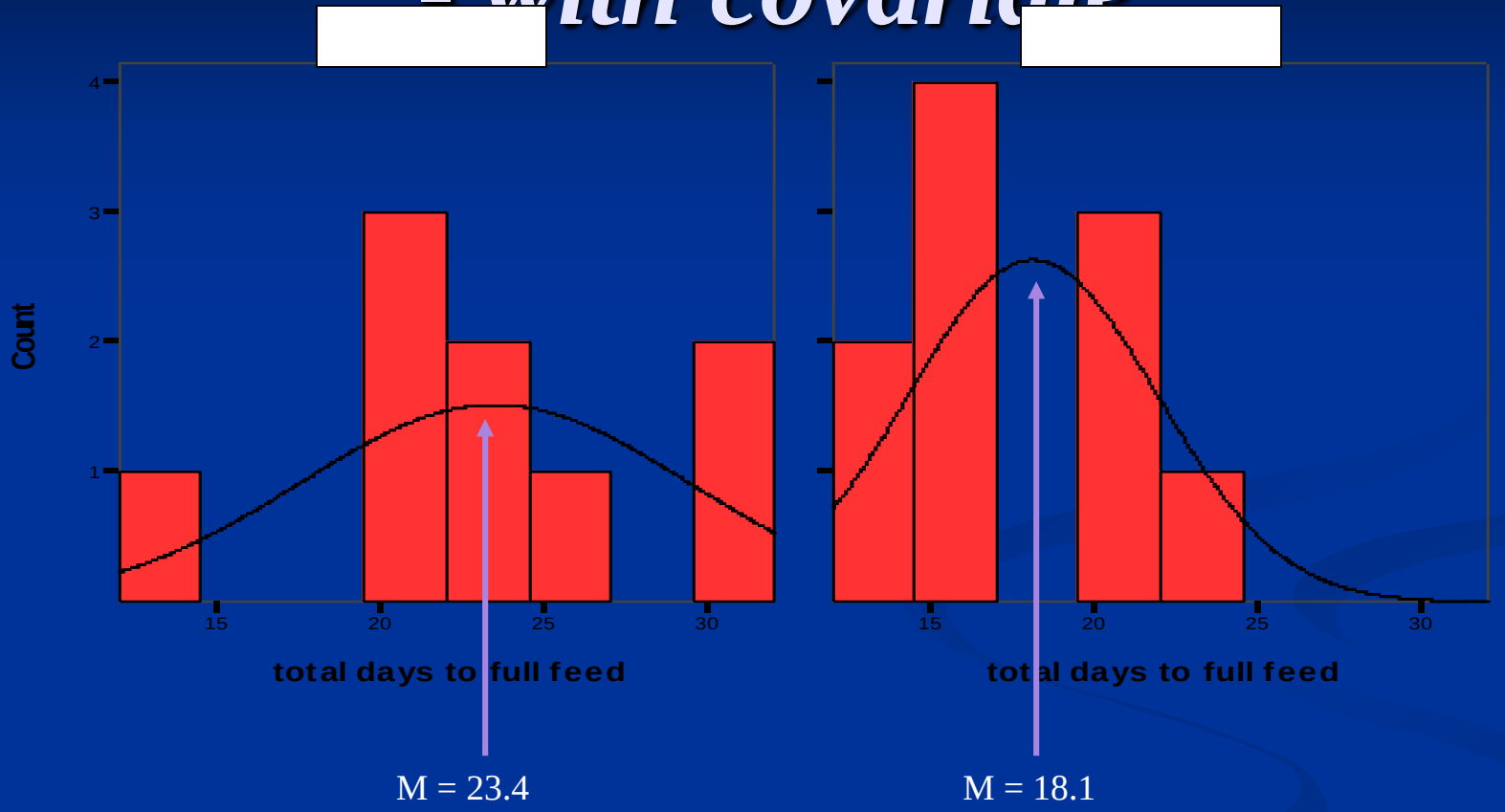


5 day difference

p = .043

(per Mann-Whitney U)

Total Days to Full Oral Feedings - *with covariate*



M = 23.4

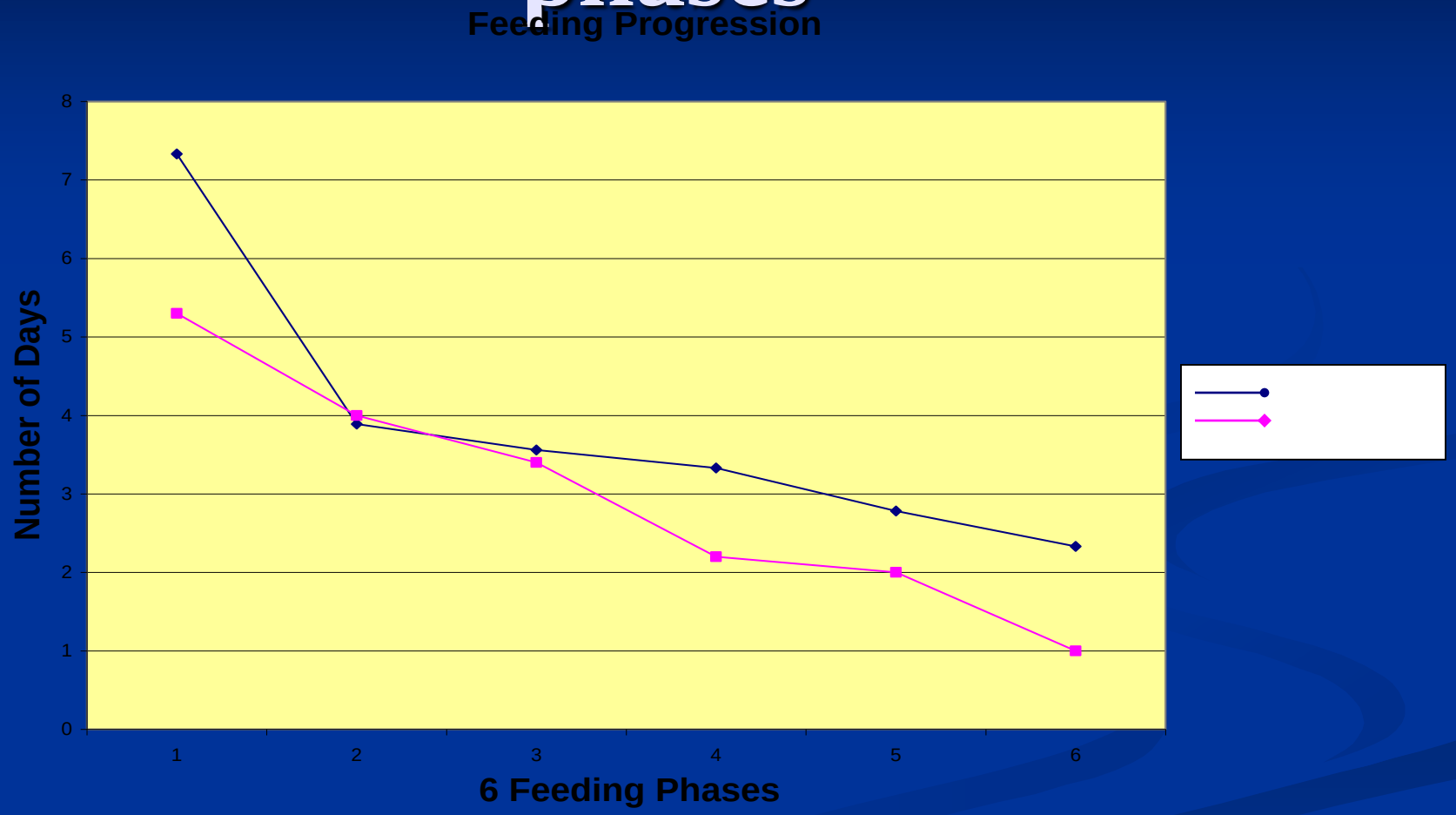
M = 18.1

5 day difference

p = .068

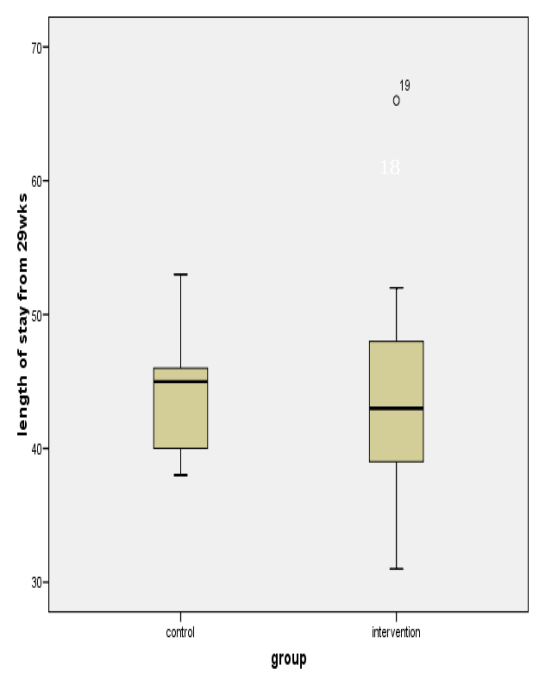
(per GLM)

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.



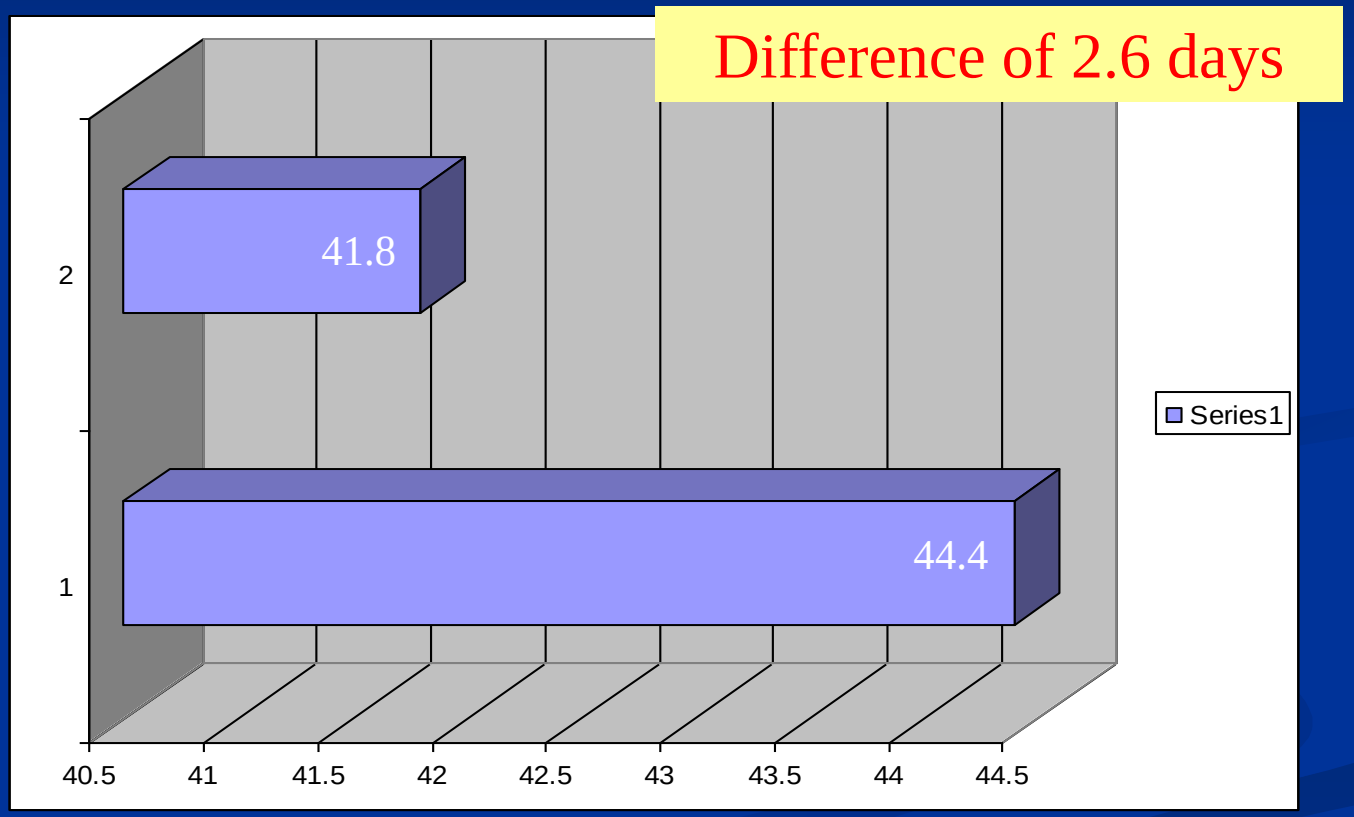
The oral stimulation group was discharged 2.6 days sooner than controls

(p = .541)

Length of Stay (from 29 weeks PMA)

Experimental

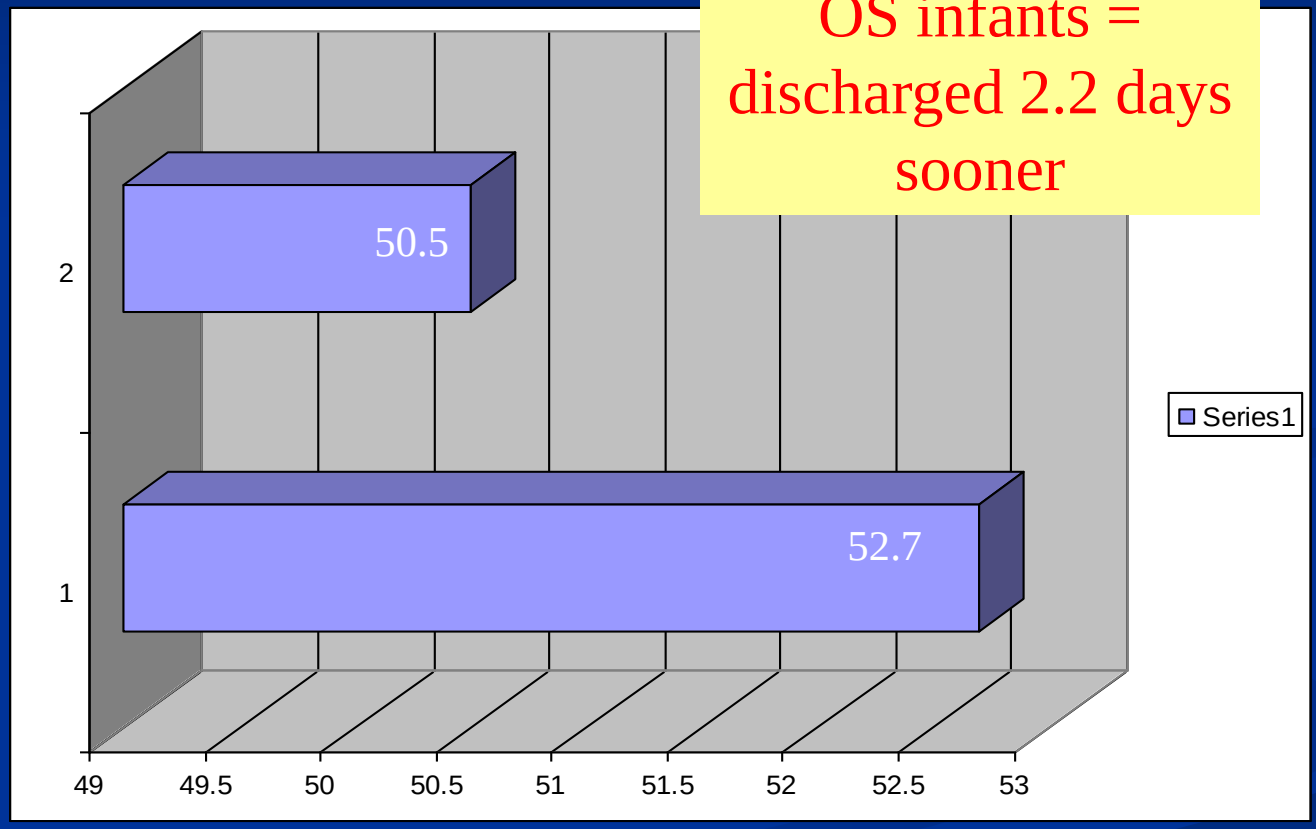
Control



Days from 29 weeks PMA to Discharge

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

OS infants = discharged 2.2 days sooner



Limitations

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

Discussion

- PIOMI Well Tolerated
  - 29 week PMA infants tolerated the BOMI-PI. **Of the182 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.

Discussion

- **Excluded Infants NPO**
  - Enteral intolerance, delayed gastric emptying, and decreased gastric motility can delay transition to oral feeding
    - This pilot excluded 4 infants who experienced enteral intolerance (thus became NPO) 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
  - **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*
  - **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
  - 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**
  - A 3-day decrease in LOS would save our nation more than $2 billion annually.

Future Research

- Larger study/larger sample size
- Dose-response studies
  - More times per day
  - Longer period of days (to discharge?)
  - During gavage vs Prior to gavage
- Nurse/Parent responses to the PIOMI
- Measure Infant Behavioral State (?)
- Home follow-up on feeding
- Study PIOMI on high risk infants

Thank You

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