Effect on Infant-Driven Cue-Based Feeding in the NICU

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Abstract

A delay in achieving the ability to oral feed is one of the major reasons for the delay in hospital discharges and the increase in financial cost for otherwise physiological stable infants. Oral feeding starts at around 33 to 35 weeks of gestation and infants stay in the Neonatal Intensive Care Unit (NICU) until all required feedings can be nippled before discharged to home. The project question is "Will a change in the cue-based feeding protocol directed at utilizing a tool that will grade the readiness of the infant to feed at a NICU by its nursing staff increase the identification of the infant to feed?"

An Infant-Driven feeding scale and protocol was developed to guide the nurses on when to initiate oral feedings in premature infants. The scale is from 1 to 5 with a score of 1 or 2 signifying readiness to oral feed. The infant can start oral feeding if the infant consistently scores a 1 or 2, at least three times. 30 charts were reviewed to compare the pre- and post-implementation of the cue-based feeding protocol. As a result, the use of infant-driven scale tool by nurses contributed to the decreased length of stay of premature infants in the NICU.

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Introduction

Despite the improved survival rates of preterm infants and major changes in their care, many common caregiving issues remain, including when to initiate the oral feeding methods required and how to advance their progress in a timely manner. The transition from gavage to oral feeding remains a clinical challenge for both the infants and their caretakers. A delay in achieving the ability to oral feed is one of the major reasons for delay in hospital discharge and increase in financial cost for otherwise physiologically stable infants (Shaker, 2013a). Initiation of enteral feeding is a challenge particularly with many related factors to consider that may warrant withholding. Likewise, after successful initiation and advancement, transitioning from tube feeding to oral feeding may also be an issue because of the infant's lack of oromotor skills. Extreme premature in itself, is a major risk factor for the premature infant's later feeding problems. Some of these preemies may be sufficient feeders but not necessarily have effective nipple quality that may still be evident even at the time of discharge. The lack of consistency and inability to adapt to changing environmental conditions may predispose these infants to later exhibit negative feeding behaviors at home and have slow growth velocity (Shaker, 2013a).

Historically, oral feedings start at around 33 to 35 weeks of gestation and infants stay in the Neonatal Intensive Care Unit (NICU) until they can nipple all the required volume. But recent studies have shown that oral feeding can be started at 32 weeks' gestation based on the infant's feeding cues and abilities (Pickler, Reyna, Griffin, Lewis, & Thompson, 2012). Achieving successful feeding is the main goal and is required before these premature infants can be discharged to home. It is of extreme difficulty to achieve these goals and this may increase the length of the infants' hospital stay, increasing the medical cost, and leading to maternal stress

which may affect mother-infant bonding (Shaker, 2012). Both short and long-term feeding-related impairments may also be of concern. Oral feeding skill is a learned behavior, developed by the premature infant. Therefore, it is the responsibility of the primary nurse, lactation consultants, and occupational therapists to ensure that these high- risk preemies develop effective and successful feeding skills (Shaker, 2012).

Problem Statement

Premature infants' inability to complete their feedings safely due to fatigue and physiological instability results in the lack of progression to independent oral feedings (Crowe, Chang, & Wallace, 2012). The focus on nursing care during the final weeks of hospitalization, is for the successful transition to occur. Persistence of these problems may have major health impact and detrimental consequences for the infants and their families (Shaker, 2012).

Due to the lack of a Cue-based feeding protocol, there was a slow progression in the decrease of long hospitalization of stable premature infants in the NICU. Before the start of the cue-based feeding practice a year ago, the starting rate of the delayed discharge of infants due to poor feeding was 85 percent in a 60-bed unit. This was measured by using the cue-based feeding at the 32 weeks of gestation until discharge for three months. Six months after the start of the cue-based feeding practice, the rate of delayed discharge of stable infants was down to 70 percent. At present, the rate stayed at 60 percent delayed discharge. The target rate of the delay of discharge is 10 to 0 percent for the next six months. The current practice was still cue-based feeding but the nurses were not consistent in using the cue-based feeding due to lack of cue-based feeding protocol. The stakeholders that started the cue-based feeding practice wanted to put a protocol in place to restart the study and re-evaluate the practice. According to The

American Academy of Pediatrics (2015), one of the requirement for the infants to be discharge is a full feeding that is safe and healthy.

According to the interviews done with several of the nurses and caregivers, four out of ten nurses are still using the traditional feeding practice which was feeding infants according to the age of the infant and an empty-bottle (Shaker, 2012). It was considered a successful feeding regardless of the cues of the infant. Some of the nurses stated, that they don't know about cue-based feeding because they were new to the NICU and some nurses choose not to follow the practice. The protocol was not developed at the start of the implementation because the stakeholders wanted to know if this practice was going to be successful (Dr. Cruz, M,, 12/6/2016).

In a profit community hospital, there is an increasing number of recovering premature infants in the NICU that has feeding difficulties with subsequent increased hospitalization stays. DNP student can meet these challenges by using and evaluating the new practice guidelines that emphasize individual infant cues and abilities at an earlier age of 32 weeks and consider if this approach will lead to a more effective feeding program that can facilitate early discharge**.**

Purpose Statement

The purpose of this project is to assess the effectiveness of the infant-driven feeding (IDF) protocol to all babies less than or equal to 32 weeks' gestation. Literature-based research has shown that cue-based feeding protocols have improved post premature infants' feeding outcomes, primarily by decreasing the stress of oral feeding and decreasing the amount of time needed for oral feeding achievement (Pickler, Reyna, Griffin, Lewis, & Thompson, 2012). This project was done in coordination with the NICU team that includes occupational therapists, neonatologists, and nurses. The following outcomes will be noted:

1. Compliance and ease of using a feeding scale. This was done by chart review noting date and age of start of oral feeding. Random interviews with bedside nurses was done to get their feedbacks on using the scale as well as problems encountered. Twenty interviews were the goal. Prepared questionnaires were given to each nurse.
2. Findings of the data to look at the length of stay (LOS) of premature infants before and after the implementation of the program.

Reducing the time needed to obtain oral feeding competency, decreasing the length of stay, and the length of mother-infant separation are the ultimate goals. This project was formulated to include both protocol implementation and evaluation, to establish if implementing a developmentally supportive method for feeding premature infants would lead to improved feeding outcomes.

Project Objectives

The project was conducted to meet the following objectives:

1) To facilitate the transition of oral feeding practices in the NICU from traditional gestational-age driven criteria or, volume-based feeding progression, to infant-driven, cue-based feeding
2) To determine if the providers' (Neonatologist (MD) and Nurse Practitioner (NNP) involvement to start ordering infant driven feeding (IDF) at 32 weeks PCA was met.
3) Improve the nursing staff ability to identify the premature infants' readiness to feed.
4) Determine if the tracking tool that was founded on evidence-based research was effective in increasing the identification of the infant to feed.

Project Questions

The project question is: Will a change in the cue-based feeding protocol directed at

utilizing a tool that will grade the readiness of the infant to feed at a NICU unit by its nursing staff increase the identification of the infant to feed?

Literature Review

The search engines that were used in the literature reviews were CINHAL, PubMed Touro, and Scholar Google. The search terms that were used were “Cue-based feeding”, “Neonatal infant-driven feeding”, and Beginning of feeds in the NICU”. The limitations of the research were the last ten years of publication and in English language. The search yielded 52 literatures.

Multiple theoretical framework are vital aspects to this project, including 1) the needs of the premature infant developmentally, 2) improving nurse performance outcomes 3) growing nurse advocacy role, and 4) collaboration of the practice change through various educational methods (Chickering & Gamson, 1987). Historically, the use of multiple theories into a single project frame reflects the influences from multiple combinations of theories to optimize patient outcome and the quality of their care. According to Shaker (2012, 2013a, 2013b), 40,000 infants are born less than 28 weeks and their survival rates have improved over the years. However, there is an increase in deaths with the increase in survival rates during the stages of motor and sensory development. Because of their small size, underdeveloped body systems, lack of immune protection, and inability to self-regulate physiologically, they are incapable of handling their unfamiliar environment (Pickler, Reyna, Griffin, Lewis, & Thompson, 2012). They are forced to associate with a foreign environment early.

Picker, Reyna, Griffin, Lewis, & Thompson (2012), stated that the development of the neurological subsystems that includes autonomic, motor, behavioral, and attentional, advances through the constant balance between environmental stimulation and avoidance of stimulation

that would hinder the child from developing in a timely manner. This is the Synactive Theory of Development which has been the main theory in family-centered care, developmental care, and cue-based feeding studies for several years. Therefore, the caregivers influence the pathway of the premature infant's development through their caregiving practices, by either supporting or impeding the ability of the infant to self-regulate (Pickler, Reyna, Griffin, Lewis, & Thompson, 2012).

A study by Bertoncelli et al. (2012), stated that the very low birth weight infants have more risk from their medical and developmental issues related to their prematurity. The balance of the physiological development systems explains how the growing infant handles their internal physiologic stresses while balancing the input from the outside environment (Bertoncelli, 2012). With the traditional feeding regimen of the physicians and clinicians, there was an increase of delay in the discharges in the NICU due to the poor feeding. Achieving successful oral feeding is the goal and required before the premature infants can be discharged. The extreme difficulty to achieve these goals may increase the length of their hospital stay, increase medical costs, and leads to maternal stress affecting mother-infant bonding. It is the responsibility of the primary nurse, lactation consultants and occupational therapist to ensure that these high- risk preemies develop effective and successful feeding skills (Bertoncelli et al., 2012)

Theoretical Model

The theoretical model used for this project is the Diffusion of Innovation Theory by Rogers (1995). The Diffusion of Innovation of Theory evaluates how the ideas are distributed among groups of people. A new protocol is an innovation and defined as an idea, project or practice that is improved for positive patient outcome. Diffusion of Innovation framework requires a strong connection of the strength of research evidence that supports a specific

innovation for the compliance of clinicians, such as bedside nurses to the new adopted recommendation (Rogers, 1995). This theory describes a dynamic method for transfer of knowledge from the resource to the user system. The innovation occurs through the efficient communication channels, main program is accepted by the users, presentation of the program, and the proficiency of the target users, and upkeep of the innovation in practice. It comprises a partnership between people recommending the program and the possible users (Kaminski, 2011).

The infant-driven cue-based feeding protocol brings information to the feeding practice and practices to be adopted by the stakeholders, nurses, therapist, physicians and parents. As specified in the Diffusion of Innovation Theory, the method of cue-based feeding adoption in the NICU is going to be supported by the gradual delivery of information through a variety of low and high technology devices that includes educational, staging, and initiation process of the project. The education of the staff will be given through articles, online modules, poster demonstrations, leadership meetings, bedside instructions, and written guidelines that allows staff to learn the information gradually, and increase their awareness in the practice-change process (Kaminski, 2011).

Mitchell (2012) specified that in leadership, effective communication and teamwork are the important basis for a planned practice change. A leader should be working as member of the team players with the same goals as the rest of the team.

The focus of the innovative methods that support the DNP project is the continuous decrease in the percentage of delayed discharges in the NICU. With this conceptual framework, the infant-driven cue-based feeding which is an evidence-based practice for many years and being used by different hospital is going to use to support the DNP project one. Feeding practices are propelling to infant-driven where infants are showing their readiness to start oral feeding

through their behavior (Shaker, 2013a) Studies shows that increasing alertness before and during the feeding positively influence the feeding capability of an infant (Bertoncelli et al, 2012)

Caregiving is still the main issue on when to start and how to advance further in oral feeding. Making the switch from gavage feedings to oral feedings involves an infant to synchronize suck-swallow-breathe and sustain the autonomic nervous system organization (Pickler, Reyna, Griffin, Lewis, & Thompson, 2015) The start of oral feedings begins at 34 weeks gestational age due to the full alertness of the premature infants at this age. It shows that cue-based feeding speeds up the changes to oral feeding and early hospital discharge regardless of the volume taken orally (Picker, Reyna, Griffin, Lewis, & Thompson, 2015).

Study shows that attentively watching the infant to feed is closely associated to the capability of the caregiver to skillfully understand and response to the physiology and behavioral communication of the infant (Shakers, 2013a). All caregivers must be educated on the feeding cues of an infant to deliver a successful cue-based feeding. It is important for the caregiver to have the knowledge and skills to identify the cue signs of an infant and intercede properly (Shaker, 2013b).

According to Kirk, Alder & King (2007), Shaker (2012, 2013a), & Pickler, Reyna, Griffin, Lewis, & Thompson (2012), full oral feeding can be achieved at earlier gestational ages by initiating oral feeding and/or by employing infant-determined schedules, they focused of “well” preterm infants. The exclusion criteria of initiating cue-based feeding is the low birth weight infants, significant oxygen needs of the infant, history of intraventricular hemorrhage, infants with surgical anomalies, and genetic syndromes. The inclusion criteria to start oral feeds are premature infants that no longer required positive airway pressures or manifested respiratory

distress, and infants greater than 32 weeks that are showing signs of infant cue readiness such as rooting and sucking on fingers (Kirk, Alder, & King, 2007; Shaker, 2012, 2013).

Project Design

The infant's inability to feed well is closely related to the caregiver's ability to recognize and respond to the physiology and behavioral communication of the infant (Shaker, 2013). The caregiver's actions strongly influence the feeding experience of the premature infant. This will either support the infant's individual routine and pace of acquiring their feeding skills, or impede their feeding skills development.

With the new cue-based feeding protocol, an "infant-driven scale" was developed to guide the cue-based feeding protocol. The scale is from 1-5 with a score of 1 or 2 signifying readiness to oral feed (Pickler, Reyna, Griffin, Lewis, & Thompson, 2012). The infant can start oral feeding if the infant consistently scores 1 or 2, three times. With a new protocol in, education and continuous re-education of the staff, especially bedside nurses, was done on a regular basis in order to assure that everyone was up to speed on the latest protocols.

The purpose of this project was to evaluate patient outcomes of the use of cue-based feedings based on the development of a revised protocol which was implemented on the neonatal care unit (NICU). The use of the infant-driven protocol was based on the following:

1. The providers' (Neonatologist (MD) and Nurse practitioner (NNP) involvement to start ordering infant driven feeding (IDF) at 32 weeks PCA.
2. The bedside NICU nurse's compliance to score the infant once IDF is ordered
3. The bedside NICU nurse's compliance to start bottle-feeding the infant based on the accepted scores in the protocol.

The project design for the protocol implementation was as follows:

A) Electronic records were gathered and analyzed to assess compliance:

1.) If MD/NNP order to start IDF at 32 weeks

2.) Scoring started at 32 weeks

3.) oral feeding started when scores are met.

B) 30 patient charts were reviewed, and includes information from the start of feeding till discharge. Compliance rates from the above 3 factors in (A) were analyzed.

B) The duration of hospital stay was compared between those who follow the protocol and those who did not follow the protocol. The one-way ANOVA and Multiple Linear Regression was used for these parametric variables (Pallant, 2016).

C) The findings were presented to the stakeholders.

Population of Interest and Stakeholders

The stakeholders were made up of multiple disciplines in the NICU including neonatologists, nurse practitioners, and speech and physical therapists that were also involved in feeding the infants. The populations of interest were the bedside NICU nurses at a local hospital in Southern Nevada. Even though the infants were not considered a population of interest in this DNP project, the cue-based feeding protocol was implemented in the NICU and the premature infants born less than 34 weeks were instrumental to the outcomes of the practice change in this project.

The inclusion criteria were as follows: a) infants who were admitted between 24-37 weeks of gestation, b) infants who had reached 32 weeks of postmenstrual age (PMA), c) infants that were classified as “feeders/ growers” that includes showing signs of oral feeding, d) infants not receiving advanced respiratory/ventilation support via mechanical ventilator and continuous positive airway pressure (Crowe, Chang, & Wallace, 2012).

The exclusion criteria were as follows: a) infants who were born more than 34 weeks gestational age (GA) and those who did not achieved at least 32 weeks PMA, b) infants who required critical care like advanced respiratory support from CPAP to ventilators that preclude oral feeding, and c) infants with congenital malformation, medical syndrome or severe neurological problems that had an impact on feeding abilities (Crowe, Chang, & Wallace, 2012).

Recruitment Methods

All stakeholders and the population of interest was informed by the DNP student of the DNP project. The participants were notified at the staff meetings and huddles of the implementation and education of the cue-based feeding protocol. In addition, other recruitment methods that was used are: 1) bedside personal communication to each nurse regarding the cue-based feeding education during their scheduled shifts and: 2) communication through staff emails with the authorization and coordination of the nurse manager. All staff nurses in the NICU was asked to participate in this project during staff meetings and huddles. Due to the DNP project design and ability to collect data anonymously, individual patients were not involved in this project and was not recruited.

Tools and Data Collection

A tool was developed and used per patient for review that contained the following information on the checklist:

1. Provider's compliance to order IDF at 32 weeks (Y/N)
2. Bedside nurse scoring at 32 weeks until end of scoring (can nipple at all scheduled times) (Y/N)
3. Bedside nurse feeding based on accepted scores (Y/N)

All data was gathered from the electronic charting every week. The Statistical Package for the Social Sciences (SPSS) program was used for statistical analysis of One-way ANOVA and Multiple Linear Regression for the length of hospital stay. After the protocol was implemented, 30 chart reviews were conducted. The age of gestation from 32 weeks up and born less than 34 weeks were the identifier to locate charts. An audit tool was developed to measure the results of the implementation of the cue-based feeding protocol and to collect data. An infant feeding skills tool was also developed to determine the readiness of the infant to nipple. A questionnaire was also developed for the nurses regarding the protocol. An approval from the nurse manager was obtained before the implementation of the DNP project.

Objective documentation process was important. Both negative and positive experiences was included. This created the evidence to support previous subjective recurrences and encourage learning process from this documentation. The set protocols were reviewed regularly to compare what occurred in the new standard practice from the originally planned procedure, to make any necessary adjustments. Collection and documentation of accurately recorded and saved results were essential (Melnyk & Cole, 2011).

The collection of data of the DNP project was obtained from the computerized charting every week and auditing the data collected was done every month. All data sheets were recorded and kept in the medical office for safe- keeping and protection of patients' identities (World Health Organization, 2016).

Intervention and Project Timeline

The implementation of this DNP project was based on the development and revision of a prior policy on cue-based feeding for infants. The stakeholders have provided permission to developed and revised this policy and implement this DNP project as a way to improve patient

outcomes on a nursing unit, specifically a NICU. The timeline was 3 months from the start of the recruitment of staff members to the end of the implementation.

The DNP student advertised and informed the nursing staff of the DNP project by attending day and night shift staff meetings and team huddles. In addition, the staff was informed about the project in emails and letters. All pertinent information regarding the revised protocol was distributed to the stakeholders and staff members of the unit. After informing the stakeholders and staff members, the following intervention was implemented:

A) Educational sessions were scheduled to review the protocol and retrain nurses on how to use the infant feeding readiness tool that was developed going for the project.
B) Pre- and post- questionnaires were distributed to staff nurses to determine their level of engagement and knowledge about cue-based feeding practice.
C) Chart review was done every week.

Ethics and Human Subjects Protection

It is important to consider the ethical aspects of a DNP project at the initial stage of project planning. The ethics review process is essential to ensure that the DNP project will protect the dignity, rights, safety, and well-being of any participants (Resnik, 2015). Therefore, before initiating the DNP project, a written approval of the project proposal, collecting data anonymously, and defined recruitment procedures were required.

The Belmont report (1979) stated that research must respect the autonomy of the participants, must be fair in both conception and implementation, and must maximize potential benefits while minimizing possible harms (“National Bioethics Advisory Commission, 2001). This report allows protection of participants in trials and research studies.

Protecting the anonymity and confidentiality of participants is another practical component of ethical considerations. Protecting those aspects is a DNP student's duty. During the data collection process, the participant should be provided as much privacy possible to ensure that the information being provided is not tampered with or shared with others (Resnik, 2015). There is a duty to protect the rights of people in the DNP project as well as their privacy and sensitivity.

The DNP project was conducted at an acute care hospital and took place on a NICU unit. The hospital is in Southern Nevada which is a non-profit facility. The participants of this project were the staff nurses working in the NICU unit. Privacy for participants were maintained and no identifying criteria were collected. Even though individual patient data was collected for statistical analysis based on a chart review, the patient was not a participant but this data was part of the findings and outcome of the practice changes for this project. This information was anonymized utilizing a number and no identifiable personal information. Data was collected only by the DNP student. There was a minimal risk involved to the participants of this project. The acute care facility granted permission and IRB approval for the project. Per IRB guidelines, the project meets exempt status because the activity involves no more than a minimal risk to the participants as the nursing staff were voluntarily participating in the DNP project. There was no compensation for the participants volunteering to participate in this project.

Plans for Analysis and Evaluation

The plan for analysis was to use the SPSS program that includes the chart review of data collection in the pre and post-protocol intervention to where the findings were compared to determine if there was a practice change following the implementation of the revised cue-based feeding policy (Pallant, 2016). The evaluation was based off the data collected following

implementation of the revised policy. Data was collected from the chart review to determine if there was a practice change by nursing staff in the use of cue-based feeding policy. The final evaluation included the findings and a determination whether nursing staff require additional training on the policy or if a protocol revision was needed. Concerns and common issues were addressed by the DNP student in the form of bedside resources, and questions was answered regarding the policy and the project.

Analysis of Results

Many neonatal units are adopting developmentally appropriate feeding practices such as cue-based or infant-driven feeding (IDF). A quality improvement plan was initiated and introduced. The quality improvement plan included an IDF tool and protocol for premature infants greater than 32 week's gestational age. Implementation of the tool measured if the time to discharge was decreased. Chart data were obtained to determine whether time to full feeds and time to discharge would be decreased using an infant-driven tool and protocol. The chart review was divided into three sub-groups, < 28 weeks, 28 to 31.6 weeks, and 32 to 34 weeks' gestational age.

The following chart data were retrieved during the pre-implementation phase from the month of June and the post-implementation phase included from the month of July 15 to August 15, 2017. The data included the gestational age, birth weight, sex, if the physicians had ordered start of feeds at 32 weeks, the nursing staff use of the tool, days to full oral feeds, and length of stay. The analysis was performed by using Statistical Package for the Social Science (SPSS). A one-way ANOVA was used for the analysis and interpretation of the results. A repeated measures analysis of variance is used when measuring the same data under different conditions (Pallant, 2016). In this analysis of the result, the pre-implementation and post-implementation of

the DNP project was measured. A correction for potential confounder was used and performed using variable linear regression analysis in which the relationship between one continuous dependent variable and several independent variables or predictors are explored (Pallant, 2016). All results were presented as a mean significant difference.

The following were the analysis results taken from the 30 chart reviews for the pre- and post- implementation:

Table 1:

		df	F	Sig.
GA (weeks)	Between Groups	1	.410	.525
	Within Groups	58		
	Total	59		
Weight (g)	Between Groups	1	.500	.482
	Within Groups	58		
	Total	59		
Sex	Between Groups	1	.000	1.000
	Within Groups	58		
	Total	59		
MD ordered IDF Scores @ 32 week	Between Groups	1	104.400	.000
	Within Groups	58		
	Total	59		
IDF Score by Nurses	Between Groups	1	42.731	.000
	Within Groups	58		
	Total	59		
Days to all PO from 32wks	Between Groups	1	169.107	.000
	Within Groups	58		
	Total	59		
LOS (days)	Between Groups	1	23.873	.000
	Within Groups	58		
	Total	59		

There was a minimal significance in gestational age, birth weight, and sex from the pre- and post-implementation chart data. The significant difference from the results was more than 0.05. The significant value was less than or equal to 0.05 (Pallant, 2016).

There is a large significant difference in the MD ordered IDF scores at 32 weeks, the IDF scores by the nurse, days to all PO from 32 weeks, and length of stay (LOS)(days).

The significant value was less than or equal to 0.05 (Pallant, 2016).

Table 2:

Correlations

		Chart	MD orderd IDF Scores @ 32 week	IDF Score by Nurses
Pearson Correlation	Chart	1.000	.802	.651
	MD ordered IDF Scores @ 32 week	.802	1.000	.843
	IDF Score by Nurses	.651	.843	1.000
Sig. (1-tailed)	Chart	.	.000	.000
	MD ordered IDF Scores @ 32 week	.000	.	.000
	IDF Score by Nurses	.000	.000	.

Multiple linear regression was conducted to determine if the physician ordered IDF Scores at 32 weeks and if the IDF Scores used by nursing staff could predict LOS.

There was a significant difference in the correlation between the MD ordered IDF scores at 32 weeks' gestation and the IDF score by nurses. It clearly indicates this predicts the LOS.

The significant value was less than 0.7 (Pallant, 2016).

Table 3:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.803[a]	.645	.632	.30568

A) Predictors: (Constant), IDF Score by Nurses, MD ordered IDF scores at 32 weeks.

The value of the R Square is .645 and when expressed in percentage it is 64.5%. This indicated that the IDF ordered by the physicians and the IDF scores used by the nursing staff explains 64.5% of the variance of the predicted LOS.

Table 4:

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.087	.064		17.053	.000
	MD ordered IDF Scores at 32 week	.875	.147	.873	5.953	.000
	IDF Score by Nurses	-.087	.151	-.085	-.577	.567

a) Dependent Variable: Chart

The largest Beta value was .873 which indicates that the variable makes the strongest contribution to the dependent variable. This makes it a statistically significant contribution to the independent variables. The second variable, the IDF scores by nurses, is -.085 was lower than the

first variable, MD ordered IDF scores at 32 weeks. This indicated that it made less unique contribution. The significant result was significant=.000 (p=.0005).

The significant value was less than .05 (p=0.05) (Pallant, 2016).

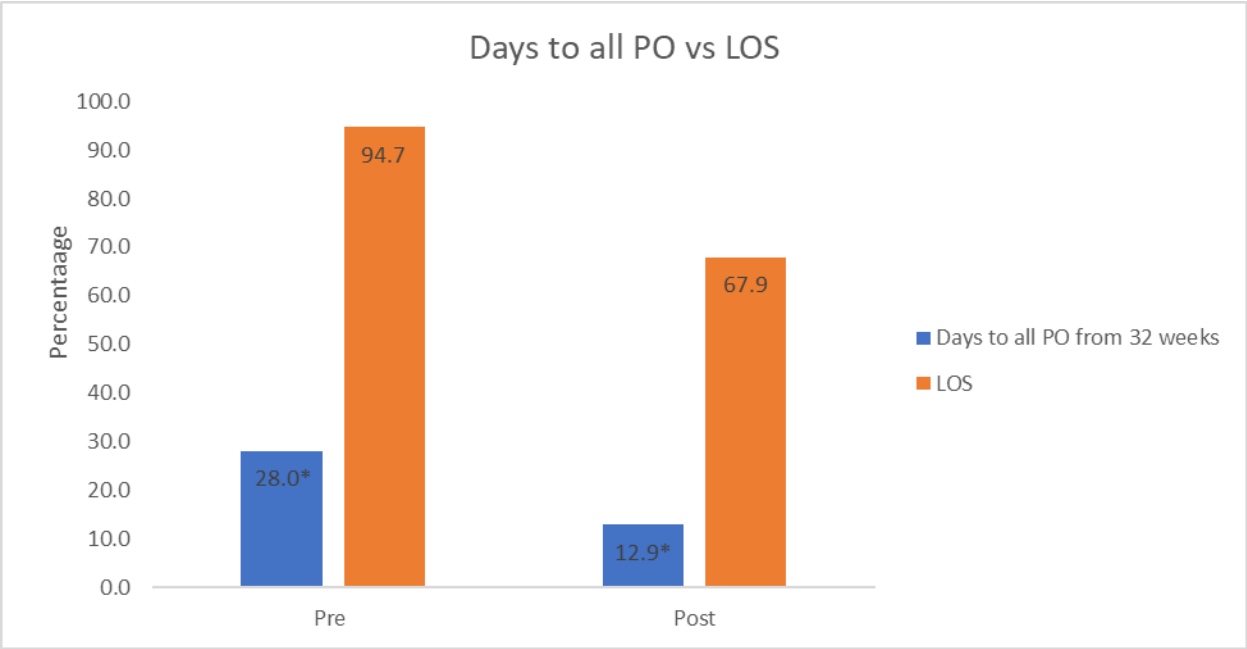

Figure 1: Days to PO from 32 Weeks vs LOS

This graph indicated a significant difference between the pre-implementation where the scoring tool was not used and the use of a scoring tool during post-implementation phase of the DNP project.

Discussion of the Findings

The achievement of full nipple feeding is often one of the last milestone reached by a premature infant before discharge. The DNP project leads to determined that the use of an IDF plan would result in earlier capability of full feeds and earlier discharge. According to Newland, L'Huillier, & Petrey (2013) an IDF plan allows NICU staff to quickly document behaviors and interventions so that all caregivers involved in supporting the infant's oral feeding development can have a full picture of the infant's behaviors which will lead to the infant's achievement of

full feeds and early discharge. An IDF plan was introduced to the nursing staff of the NICU as a process to determine cue-based feedings of premature infants less than or equal to 32 weeks GA. The IDF plan was to determine whether using infant-driven scoring tools would help to the identification of the premature infant's feeding readiness, including improving quality of feedings, and increasing consistency of feeds among providers in which time to full nipple feeds would be shortened and lead to an earlier discharge of the infant.

The results of the analyzed 30 charts after exclusion were obtained by SPSS program using a one-way ANOVA and multiple linear regression. This was a quality improvement plan. The subgroup categories were as follows: Less than 28 weeks' gestational age, 28 to 31. 6 weeks' gestational age, 32 to 34 weeks' gestational age from the pre- and post-implementation chart data. For the pre- and post- implementation analysis result, there is a minimal significant difference in gestation, which is (0.525), birth wt. .428, and sex 1.000 (as seen in table 1) This indicated that there was significant difference between the pre- and post- implementation. There was a large significant difference in MD ordered IDF scores at .32 weeks, which is 104.4 IDF scores by nurses which is 42.73, days to all PO from 32 weeks which is 169.107, and length of stay (LOS) which is 23.873 (as seen in table 1). The significant value is $p=<0.05$ (Pallant, 2016). This indicated that the MD ordered ID scores at 32 weeks, IDF scores by nurses contributed to the decrease of length of stay in the NICU.

Controlling for Confounders

Multiple linear recession analyses of the results were conducted to assess the significance of the correlation between the physician that ordered the IDF scores at 32 weeks and the IDF scores used by nursing staff that could predict LOS (as seen on table 2, 3 and 4). There was a

large significant difference (P = 0.000) associated with earlier discharge of preterm infants. The significant value is P = 0.05 (Pallant, 2016).

Figure 1 Graph

In the graph (Figure 1), it indicates a significant count difference between the pre-and post- implementation. In the pre-implementation, the IDF scoring tool and IDF was not used, therefore the LOS was longer. The use of the IDF scoring tool and protocol in the post-implementation phase indicated that the LOS was decreased when nurses used the IDF scoring tool and protocol to determine the feeding readiness of a preterm infant.

The result of these analysis corresponded to the project question if "a change in the cue-based feeding protocol directed at utilizing a tool that will grade the readiness of the infant to feed at a NICU unit by the nursing staff increase the identification of the infant to feed". According to the results of the analysis, the infant-driven feeding that was ordered by the physician at 32 weeks' gestation which is followed by the use of the scoring tool and protocol by the nursing staff, can decrease the LOS of the preterm infant.

The objective of the DNP project was met by changing the traditional feeding practice to IDF practice by using a scoring tool and protocol of the nursing staff and by the physician's order to start IDF at 32 weeks' gestation. The tracking tool was used by the nurses to identify the preterm infant's readiness to feed, thereby decreasing their LOS.

Significance/Implications for Nursing

A cue-based feeding protocol focuses on the physical mechanics of feeding, and airway protection by incorporating behavioral assessment of feeding readiness of the infant. Most neonatal clinicians turn toward cue-based feeding models to provide premature infants with a safe, physiologically-driven method for acquiring oral feeding competence. It is a key factor in

how the preterm infant's experiences feeding, how parents acquire their knowledge of the cue-based feeding relationship with their infants, and how the nurses communicate about, and attempts to support feeding skills needed for discharge to home (Shaker, 2013).

Improvement in nursing capability will occur with the use of cue-based feeding methods, as it will focus on individually catering to the needs of the patients. This will promote safety, and effective guidance for infants to develop and achieve the best feeding experience. The cultural foundation which represent the culture of feeding in the NICU can affect caregiving both negatively and positively, and therefore, the occurrence of safe and successful feeding and swallowing (Shaker, 2013).

This DNP project demonstrated that the implementation of the use of an IDF tool and protocol was associated with the earlier discharge in premature infants. The ability to achieve full nipple feeding readiness sooner in IDF likely reflects that its use guides nurses to identify the infant feeding cues for the initiation and progression of feeds (Shaker, 2013). It may also be due to the increased opportunities to participate in positive feeding experiences, as infants were not limited in the frequency or amount of daily cue-based attempts.

An IDF approach was associated with an earlier attainment of full nipple feeding and as a result, earlier discharge. This was achieved using a standardized approach, which provided a more objective, consistent, and infant-guided assessment of readiness for nipple feeding (Shaker, 2013). The cultural change in feeding practice required time, education and an interdisciplinary approach to achieve success. The benefits included increased provider and parent satisfaction as well as potential for reduced hospital cost.

Limitations and Dissemination

Although the IDF method was implemented successfully, there were many challenges to implementing such a cultural change in the NICU. There was an initial resistance among both nurses and physicians in using the IDF tools. Many nurses considered the IDF scoring tool unnecessary to assess an infant's readiness and felt that it was time consuming to observe and score the preterm infant, while physician's questioned whether premature infants could reliably provide feeding cues at an early age such as 32 weeks' gestational age.

Another limitation of this DNP project was the data taken from the chart reviews. The data might not be accurate because some of the nurses' charting may not be complete, such as nurses not using the IDF scoring tool. There was also the possibility that some uncontrolled differences between the subgroups, such as changes in practice overtime, may have influenced the feeding ability of the preterm infant. Another limitation was the different gestational age within subgroups. Infant born at < 28 weeks' gestation were limited in numbers because of the exclusion criteria.

The dissemination process of the DNP project was done in standardized approach which provided a more objective, consistent, and infant-guided assessment of readiness for IDF. The introduction to the implementation of the IDF plan was announced through the huddles on every shift and staff meetings every month. Bedside in-services were done to review the use of IDF scoring tool before and after feeding of an infant. Information about feeding cues were distributed to all nurses in the NICU so they are aware of what to observe from the infants. Consistent monitoring was done to continuously monitor the implementation of the DNP project.

Conclusion

The improvement of the caregiving issues must be led by sensitivity during observation to identify and value the complex communication patterns of the infant to have a greater impact on the prospective decrease in delayed discharge.

As a DNP leader, the development of a protocol for the infant-driven cue-based feeding practice will guide the staff in the continuance of the practice to increase the rate of early discharge among the stable premature infants. The continuation of the practice is of utmost importance, but its impact on hospital stay, maternal-bonding, and bedside nurse's ease of using and understanding the infant-driven scale needs constant monitoring and data evaluation to thoroughly assess the significance of the practice.

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Appendix A

Infant-Driven Feeding Scale

Infant-Driven Feeding Scale- Readiness Score-

1 Alert or fussy prior to care. (rooting, good tone)

2 Alert once handled (some rooting, adequate tone)

3 Briefly alert with care (no hunger cues, no change tone)

4 Sleeps throughout care (no hunger cues, no change tone)

5 Change in heart rate, respiratory rate, oxygen, or WOB outside safe parameters

Infant-driven feeding scale- Quality Score-

1 Nipples with strong coordinated suck, swallow, and breath (SSB) throughout feeds

2 Strong coordinated SSB but fatigues with progression

3 Difficulty coordinating SSB despite consistent suck

4 Nipples with a weak/inconsistent SSB (little/no rhythm)

5 Unable to coordinate SSB. (significant changes in heart rate, respiratory rate, oxygen, WOB)

Infant-Driven feeding scale- Caregiver Score-

1. Modified side-lying (modified position infant in inclined side-lying position with head in midline to assist with bolus management).
2. External pacing (trip bottle downwards/break seal at breast to remove or decrease the Flow of liquid to facilitate SSB pattern).
3. Specialty nipple (use nipple other than standard for specific purpose, ie. Nipple shield, Slow flow nipple, Habermann Bottle).
4. Cheek support (provide gentle unilateral support to improve intra oral pressure)
5. Frequent burping (burp infant based on behavioral cues not on time or volume

completed).

6. Chin support (provide gentle forward pressure on mandible to ensure effective latch/tongue stripping if small chin or wide jaw excursion).

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Appendix B

Effect of Infant-Driven Cue-based feeding in the NICU

Infant feeding Data Collection Form

Chart #_____ Gestational age on admission: _____

Total Days of Stay/ Length of stay (calculated in days): _____

Feeding Method:

Volume-Driven (current Practice) ☐

Cue-based feeding (Infant-driven feeding practice) ☐

Post-Menstrual Age enteral feeds initiated: ____

Post-Menstrual Age full enteral feeds achieved: _____

Post-Menstrual Age for oral feeding initiated: _____

Post Menstrual Age for achievement of full oral feeds maintained: _____
(no longer needing gavage feeds).

Post-Menstrual Age when advanced supplemental oxygen support was discontinued: _____
(Nasal Cannula @ greater than 2 liters/minute)

Number of incidents that disrupt oral feedings (daily totals):

Apnea: ____ Bradycardia: ___ Choking: ____ Desaturation: ____

Gagging:____

Weight at discharge: _____ Post-Menstrual Age: _____

Appendix C

Post Questionnaire

Questions	Strongly Disagree	Disagree	Agree	Strongly Agree
	1-5	1-5	1-5	1-5
Cue-based feeding is important for premature infant for a success oral feeding				
Cue-based feeding practice will help preterm infants to have an early discharge				
Infant- Driven protocol guides nurses on how to assess the start of oral feeding				
The educational part of the infant-driven protocol is clear and concise				
The Infant-Driven protocol improves the nursing staff ability to identify the preterm infants' readiness to feed				
The communication between the bedside nurses and innovators are sufficient for the success of the implementation				
The Infant-Driven Feeding scale is an appropriate tool for the Infant-driven feeding Protocol				
The infant-Driven feeding protocol is clear, concise and easy to follow				
The infant-driven protocol can help providers decide when to start preterm oral feeding				
The Infant-feeding scale is an appropriate communication between nurses and providers to start preterm oral feeding				