Implementation of Dextrose gel for Asymptomatic Hypoglycemia in Newborns

Anjana Solaiman

Under Supervision of

Barbara Wise, PhD, RN, CPNP-AC/PC

Second Reader

Renee Franquiz, DNP, RN, CNE

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Abstract

Problem & Purpose

Neonatal asymptomatic hypoglycemia is a common problem that may contribute to poor health outcomes. Firstline treatment includes formula feeding, and/or transfer to the Neonatal Intensive Care Unit (NICU) for intravenous glucose. Both of these treatment options are sub-optimal because breastfeeding/bonding are disrupted, and costs may be increased due to NICU care. The purpose of this quality improvement (QI) project was to implement 40% buccal dextrose gel as the first line treatment of asymptomatic hypoglycemia in newborns at an academic medical center in the mid-Atlantic region to improve glycemic outcomes.

Methods

This QI project was implemented during a 12-week period in the Fall of 2019. The target population included infants admitted to the newborn nursery who were less than 24 hours of life (HOL) with an identified risk factor for hypoglycemia (birthweight >3800 grams or <2500 grams, gestational age <37 weeks, LGA or SGA, or is an infant of diabetic mother), with asymptomatic hypoglycemia (blood glucose levels between 20- 40mg/dl). The QI project involved modifying the hospitals current neonatal hypoglycemia clinical practice guideline (CPG), to implement 40% dextrose gel as initial therapy in conjunction with feeding, developing an order set, creating documentation in the electronic health record, training personnel and collaborating with pharmacy to stock the gel.

Results and Conclusions

During the implementation 16 newborns received glucose gel (N=16). Treatment success, defined as blood glucose levels >40mg/dL following the first and/or second administration of gel, was achieved in 87.5% of newborns. Newborns who did not respond favorably to glucose

gel had an initial blood glucose level of <20mg/dL, a deviation from the modified CPG. Fifty five percent of newborns who were exclusively breastfeeding (N=9) received medically indicated formula supplementation. Five patients were transferred (N=5) to the NICU, 2 patients had achieved treatment success, but were unable to maintain adequate glycemic levels. Future QI cycles should include exploration of treatment failure with modifications to improve CPG adherence, consideration for increasing doses for responsive newborns as well widening the gestational age criteria. Overall the outcomes of this QI project demonstrated that glucose gel as the initial treatment for infants with asymptomatic hypoglycemia is effective.

Keywords: dextrose gel, newborn hypoglycemia, breastfeeding, quality improvement project

Implementation of Dextrose gel for Asymptomatic Hypoglycemia in Newborns

Introduction

Neonatal hypoglycemia is a common problem affecting approximately 15 out of every 100 term newborns (Hegarty, Harding, Crowther, Brown, & Alsweiler, 2017). In neonates, hypoglycemia contributes to apnea, cardiorespiratory instability, hypothermia and seizures, which can lead to morbidity and mortality if left untreated (Thompson-Branch & Havranek, 2017). The first line treatment for asymptomatic hypoglycemic term infants is supplemental feeding with formula which interrupts breastfeeding (Harris et al., 2013). While this readily available option is attractive, the importance of exclusive breastfeeding should not be unheeded. The American Academy of Pediatrics (AAP) endorses the recommendation of exclusive breastfeeding for the first six months of life due to medical benefits (Spatz & Edwards, 2016).

If management with formula supplementation fails, a transfer of care to the Neonatal Intensive Care Unit (NICU) for enteral and parenteral support often occurs. This transfer results in separation that disrupts the maternal-newborn dyad which is detrimental to the establishment of breastfeeding (Glasgow, Harding, & Edlin, 2018; Harris et al., 2013; Makker et al., 2018; Newnam, Bunch, & Gephart 2017). In addition to interrupted breastfeeding, NICU transfer is problematic due to invasive treatments and increased hospital expenditures (Glasgow et al., 2018; Newnam et al., 2017).

The utilization of 40% buccal dextrose gel is an effective therapy for the management of neonatal hypoglycemia which does not violate The Joint Commission Perinatal Care measure for exclusive breastfeeding (Bennett, Fagan, Chaharbakhshi, Zamfirova, & Flicker, 2016; Harris et al., 2013; The Joint Commission, 2016; Rawat et al., 2016; Stewart, Sage & Reynolds, 2016; Ter, Halibullah, Leung & Jacobs 2017; Weston et al., 2016). In addition, guidelines from the AAP

support the use of buccal dextrose gel as an alternative therapy for infants with mild hypoglycemia (Adamkin, 2011). The purpose of this DNP project was to implement and evaluate the use of buccal dextrose gel in a newborn nursery at a tertiary care university affiliated hospital center in the United States.

Literature Review

The effectiveness of 40% dextrose gel for the management of neonatal hypoglycemia was the focus of the findings in this literature review (Table 1). Findings from Harris et al. (2013), established the efficacy of 40% dextrose gel in the management of neonatal hypoglycemia. Harris et al. (2013) performed a randomized control trial (RCT), in a New Zealand tertiary care center, to compare the effectiveness of 40% dextrose gel to placebo gel for the treatment of hypoglycemia in at-risk neonates. Participants received either the proposed treatment, 200 mg/kg 40% dextrose gel (n = 118), or the control treatment, placebo gel (n = 119), for pre-prandial hypoglycemia and were then encouraged to beast feed. Neonates in the dextrose gel treatment arm were less likely to have sustained hypoglycemia (p = .04), receive other sources of dextrose (p = .01) and formula supplementation (p = .04), or require NICU admission (p = .03). Also, the dextrose gel cohort were more likely to exclusively breastfeed at 2 weeks of age (p=.03). The principally New Zealand European and Maori population utilized in this study may limit external validity of results but the randomization, double blind treatment groups and adequate sample size (80% power) strengthen the validity of results.

Two other international studies focusing on the use of 40% dextrose gel for newborn hypoglycemia were included in this literature review. Both studies utilized a quasi-experimental time series design to compare the efficacy of 40% dextrose gel to supplementary feeds (expressed breast milk or formula) for hypoglycemia management (Stewart et al., 2016; Ter et

al., 2016). In the pre-implementation phase (n=28), Stewart et al. (2016) reported a 96% formula supplementation rate in breastfed infants with hypoglycemia at a hospital located in the United Kingdom. The existing neonatal hypoglycemia protocol was adjusted to include 40% dextrose gel as first-line treatment for infants with serum glucose between 36 and 46 mg/dL (Stewart et al., 2016). Post-implementation (n=24) findings indicated a decline of formula supplementation in breastfed infants to 52% after the hypoglycemia protocol was modified to include dextrose gel (Stewart et al., 2016). In addition, NICU admissions decreased from 10.8% pre-implementation to 3.2% post implementation (Stewart et al., 2016). This study was limited by small sample size and non-random assignment and therefore may not be generalizable to other populations.

The primary aim of the other international study included in this review was to evaluate if dextrose gel utilization could decrease NICU admissions in an Australian hospital. Ter et al. (2016) found that NICU admissions for the treatment of hypoglycemia were reduced significantly post-implementation (29%) vs. (14%), ($P = 0.01$). Ter et al. (2016) utilized a lower serum glucose threshold (27-45mg/dL) for dextrose gel utilization as compared to Stewart et al. (2016). This may have contributed to the hypoglycemia recurrence findings which were higher in the post-implementation group (31%) vs. (49%), ($P = 0.02$) (Ter et al., 2016).

Three additional quasi-experimental studies included in this review were conducted at hospitals in the United States. The studies shared the same primary goal, which was to explore the effect of 40% dextrose gel utilization on NICU admissions for neonatal hypoglycemia and breastfeeding (Bennett et al., 2016; Makker et al. 2018; Rawat et al., 2016). Bennett et al. (2016) noted a decline in NICU admissions for hypoglycemia from 10.6% to 2.9% after the implementation of dextrose gel. Pre- implementation all newborns experiencing hypoglycemia were supplemented with formula (Bennett et al., 2016). Comparatively, 49% of newborns

experiencing hypoglycemia post-implementation were exclusively breastfed (Bennett et al., 2016). Similar findings for NICU admission rates and breastfeeding were reported by Makker et al. (2018). Makker et al. (2018) found that NICU transfers for the management of hypoglycemia fell from 8.1% to 3.7% ($p = 0.01$) in one year following the utilization of dextrose gel as an adjunct therapy to an existing protocol. In addition, the rate of exclusive breastfeeding increased from 6% to 19% ($p < 0.001$) (Makker et al., 2018). In line with the other studies reviewed that were conducted in the United States, Rawat et al. (2016) reported that the incorporation of dextrose gel into the current newborn hypoglycemic protocol reduced NICU admissions ($p < .01$) and increased exclusive breastfeeding at discharge ($p = .03$). In addition, cost savings as a result of the protocol modification were assessed at $2,593 USD per patient (Rawat et al., 2016). Outcomes of these studies are strengthened by large sample sizes: 1,959, 804 and 498 neonates, respectively (Bennett et al., 2016; Makker et al., 2018; Rawat et al., 2016). However, lack of a random design, and inability to control for maternal breastmilk production, breastfeeding support or choice of feeding (breastmilk or formula) threatens the internal validity of results.

Evidence supports that 40% buccal dextrose gel is an effective treatment for neonatal hypoglycemia that prevents newborns from requiring formula supplementation and can increase the duration of exclusive breastfeeding (Bennett et al., 2016; Harris et al., 2013; Makker et al., 2018; Rawat et al., 2016; Stewart et al., 2016). This important finding of increased exclusive breastfeeding, which was found in five studies, points to the potential beneficial effects of dextrose gel on infant health outcomes that dextrose gel can contribute to. The use of oral dextrose gel was also linked to reduced transfer of newborns to the NICU for IV dextrose administration (Bennett et al., 2016; Harris et al., 2013; Makker et al., 2018; Rawat et al., 2016; Stewart et al., 2016; Ter et al., 2017). This key outcome, which was examined in all six studies

likely contributes to a significant cost savings and also the maternal newborn dyad (Makker et al., 2018; Rawat et al., 2016).

Theoretical Framework

Kurt Lewin's change theory was used as an organizational framework to structure the development and implementation of this project. Lewin's theory suggests that change occurs in three stages: unfreezing, moving and refreezing (Butts & Rich, 2015; Lewin, 1951). Unfreezing is described as the act of destabilizing old behaviors (Butts et al., 2015). During this unfreezing phase old practices that are sub optimal are exposed, unlearned and discarded as standard practice (Lewin, 1951). Once this step is accomplished the moving phase occurs to motivate individuals to adopt a new perspective that enables them to perceive that the current situation can be improved (Butts et al., 2015). Lastly refreezing involves reinforcing new patterns of behavior that the practice change encourages (Butts et al., 2015).

In using Lewin's change theory to guide this project, the first step was to expose the current practice of newborn hypoglycemia management as suboptimal. A meeting with the key stakeholders within the organization occurred and evidence to support the use of buccal dextrose gel was presented. Following a commitment from the primary stakeholders, further unfreezing took place with the clinicians directly affected by the practice change (physicians in the FTN and registered nurses [RNs] in the Mother-Baby Unit). During the moving phase the use of buccal dextrose gel was promoted and change agents who embraced the concept were recruited and supported as facilitators for the modification of the existing hypoglycemia clinical practice guideline (CPG) (see Appendix A for current CPG and Appendix B for modified CPG). Refreezing involved reinforcing buccal dextrose gel administration using in person demonstrations with question and answer sessions.

Methods

This evidence-based quality improvement (QI) project took place at a 1500 births per year, tertiary care university affiliated medical center located in an urban city in the Mid-Atlantic region of the United States. This project was assessed and approved by the University of Maryland Baltimore (UMB) Institutional Review Board (IRB) through CICERO for Non-Human Subjects Research (NHSR). The population included infants admitted to the newborn nursery who were less than 24 hours of age, had an identified risk factor for hypoglycemia per hospital protocol (birthweight of > 3800 grams or < 2500 grams, gestational age < 37 weeks, LGA or SGA that was determined by MD based on growth chart, or was an infant of diabetic mother based on maternal history), and developed asymptomatic hypoglycemia with the exception of isolated jitteriness. Infants with congenital malformations or symptomatic hypoglycemia were excluded from the sample.

This QI project was conducted over a 12-week period in the Fall of 2019 which was preceded by a preparation phase that established the necessary framework for the practice change. During the preparation phase, the project leader collaborated with key stakeholders (Pediatric Attending Physician, Neonatology Attending Physician, NP Administrators for NICU, Lactation Consultants) to adapt 40% dextrose gel to the hospital's established CPG and created education materials to disseminate the updated changes. Additionally, the project leader worked in tandem with the Director of Pharmacy Clinical Services to obtain hospital supply of 40% dextrose gel and collaborated with the information technology department to develop an order set for the intervention.

Prior to implementation, the RN staff and Newborn Nursery Resident Physicians received the introductory presentation via the hospital's online education system and competency was

validated by an embedded knowledge assessment (Appendix C). On-site training (see Appendix D for an outline of the training) of buccal dextrose administration for RN staff was provided through five Mother Baby Unit huddles prior to implementation. An additional two were added after the implementation had started due to some hesitancy expressed by the RNs related to a lack of experience with the buccal route of medication administration.

Perceived feasibility of the adoption of 40% dextrose gel to current practice was assessed at the RN huddles with a survey developed by the project leader. The implementation survey used a 5-point Likert response scale to assess item agreement (Appendix E). Of the 34 respondents, 41% had prior knowledge of the intervention. The maximum possible total score of agreement, which correlates to higher perceived feasibility, was 25 and the actual mean for respondents was 21(Table 2). A post implementation survey was planned, to compare the pre-implementation survey findings and pinpoint variances in the perception of the dextrose gel intervention but was not utilized based on staff availability.

Champions were identified throughout the preparation phase and during the initial weeks of the implementation. They served as valuable unit experts and were given resource binders which were eventually made available for all staff in the Newborn Nursery. Additional laminated modified CPG algorithms (Appendix F) were placed next to medication pyxis', at nurses' stations, and in the workspaces of the Newborn Nursery Resident Physicians.

The modified CPG using 40% dextrose gel was piloted for 12 weeks. At-risk infants were monitored for hypoglycemia by obtaining serial capillary blood glucoses according to existing hospital protocol. Registered nurses notified the Newborn Nursery Resident Physician of asymptomatic hypoglycemia and, when indicated, the Physician initiated the order set for 40% dextrose gel. Once the order populated on the patient's electronic medication administration

record (eMAR), the RN obtained dextrose gel from the unit's medication supply pyxis and administered the weight-based dose according to the steps outlined in the modified CPG. Administration of dextrose gel was documented in the eMAR and serum glucose levels were monitored per usual practice. If the infant had recurrent hypoglycemia the RN could obtain a second order set for dextrose gel, for a maximum of two doses in the first 24 HOL.

Weekly chart audits of all newborns admitted to the Newborn Nursery were used to identify newborns who were hypoglycemic during a 16-week period. The first four weeks of chart audits prior to the intervention was intended as baseline data collection. The project leader manually audited the EMR and recorded deidentified subject demographic and outcome data onto an Excel spreadsheet (see Appendix G for a sample spreadsheet) of all newborns who met the project inclusion criteria. From week four onward treatment success during the twelve-week pilot was tracked and coded as a dichotomous (yes/no) variable and was defined as a capillary blood glucose above the threshold designated in the modified CPG (>40 mg/dL) following administration of dextrose gel.

Results

Prior to implementation, RNs and Newborn Nursery Resident Physicians (N=128) were assigned the online educational training which included a post-test assessment for understanding. Of the RNs and Newborn Nursery Resident Physicians assigned the module 79% successfully completed the education. For further breakdown of online education completion see Figure 1.

The pre-implementation data collected for four weeks included 6 newborns who would have been eligible for gel based on the modified CPG. Of these six newborns one was transferred to the NICU for a sepsis evaluation and the rest remained in the Newborn Nursery. In addition, one newborn who was breastfeeding was given formula supplementation. The data gathered

during this pre-implementation period was not sufficient to draw any significant comparisons with postimplementation figures.

During the twelve-week pilot of the modified CPG, 40% dextrose gel was utilized in the management of 16 patients. The gestational age of newborns ranged from 36.5 - 40.2 (38.1) weeks with birth weights ranging from 2330-4390 (3187) grams. See Table 3 for a summary of the demographic data. Treatment success was achieved in 87.5% of newborns. Treatment failure occurred in the remaining 12.5% newborns; however, these patients did not meet the CPG inclusion criteria (with initial blood glucose levels of <20mg/dl) but still received gel management. Half of the infants (N=8) received two doses of gel. Complete outcome data of the sample is presented in Table 4 and Figure 2.

Secondary outcome measures included NICU admission for receipt of IV dextrose and formula supplementation for breastfed infants. Five infants in the sample required NICU admission (31%) and four of those infants required IV dextrose (25%); however, three of these infants were initially responsive to dextrose gel (achieving a blood glucose level >40mg/dl). Nine infants in the sample had a documented breastfeeding preference. Of the newborns with a documented breastfeeding preference, 55% (N=5) were treated with formula supplementation in addition to dextrose gel; however, one of these infants was born to a mother with prior breast reduction surgery and milk production was in question. Of the remaining four breastfeeding infants who received gel and formula, three had initial blood glucose levels of <20mg/dl.

Discussion

The implementation of the modified CPG utilizing 40% dextrose gel in conjunction with feeding as first line management for infants with asymptomatic hypoglycemia demonstrated an 87.5% success rate in the primary outcome of improving blood glucose values to a level

>40mg/dl. This outcome is similar to the 86% success rate achieved in the literature (Harris et al., 2013). It is important to acknowledge that the treatment failures experienced during this project were in newborns whose initial blood glucose levels were <20mg/dl. Dextrose gel was not indicated for these infants per the modified CPG recommendation of immediate transfer to the NICU for IV glucose administration. For these newborns' dextrose gel was not helpful which further supports the need for prompt transfer and escalation of care with levels of <20mg/dl.

Data from this QI project did not reflect low formula supplementation rates and decreased NICU transfers that were observed in the literature. However, previous literature supports the implementation of dextrose gel with those aforementioned benefits (Harris et al., 2013; Rawat et al., 2016; Stewart et al., 2016). The short implementation period may not have been an adequate time frame to demonstrate those outcomes. Furthermore, a potential explanation for the increased use of formula supplementation at this organization for newborns who were exclusively breastfeeding could be related to increased maternal and newborn acuity. The patient population in this organization is high risk and chart audits indicated that the formula supplementation was medically necessary. In addition, the NICU transfer rate may have been influenced by the 2-dose limit of dextrose gel that was outlined in the modified CPG. The literature reviewed for this QI project suggest that more doses of gel may be beneficial and safe. Bennett et al. (2016) and Rawat et al. (2016) provided up to 3 doses of gel for hypoglycemia in the first 24 HOL. Furthermore, Makker et al. (2018) provided up to four doses of gel and Ter et al. (2017) administered up to 6 doses of gel in the first 48 HOL.

A strength of this QI project was its alignment with the existing organizational breastfeeding goals to achieve the Baby Friendly Designation. Therefore, the culture in the hospital was already primed to support the use of dextrose gel based on the perceived benefits to

breastfeeding and preservation of the maternal-newborn dyad. The timing of the project enhanced the relevance of the intervention and quickly gained acceptance from the key stakeholders which facilitated the swift practice change.

The lack of comparable pre-implementation patient data and short post-implementation data collection time period were the primary limitations of this QI project. A small sample of pre-implementation patient data was collected during the first four weeks of chart audits, but this data was not sufficient to draw any conclusions about the potential post-implementation data. Data mining for low serum glucose levels in the EMR of newborns admitted to the Newborn Nursery was proposed as an alternate way to capture a larger sample which may improve the ability to recognize comparative outcomes pre and post implementation. Unfortunately, this process of data mining was not available during the implementation phase.

Conclusion

The utilization of dextrose gel was an effective therapy for the management of asymptomatic hypoglycemia in at-risk infants. A CPG modification with glucose gel implementation can be successful with organizational buy-in and collaboration with unit champions and the multidisciplinary leadership team. This modified CPG, as well as the supporting structures and processes established by this project, will remain in place for the continued management of this population.

Opportunities for improvement include exploration regarding the modified CPG non-adherence, specifically the utilization of dextrose gel with newborns whose blood sugars were <20mg/dl should be further investigated. Future considerations for expansion of this intervention include the provision of more than 2 doses of dextrose gel in the first 24 hours of life. In

addition, subsequent QI cycles of this project should examine the expanded use of dextrose gel to infants who are 35 -37 weeks.

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Table 1

Author(s), year		Objective	Design	Population (n)	Outcomes	Results	Evidence Strength & Quality Rating JHNEBP
Bennett et al. (2016)		Evaluate the effectiveness of 40% oral dextrose gel compared to IV dextrose or formula for the treatment of neonatal hypoglycemia, NICU admissions, maternal-infant attachment, and uninterrupted breastfeeding rates.	Quasi-experimental Pre test - IV dextrose or formula Post test - 40% oral dextrose gel 200 mg/kg QI Project	Pre (n=870) and post (n=1,089) intervention (n=1,959). IDM, LGA, SGA, Late preterm (34-36.9 weeks).	NICU admission incidence for hypoglycemia. Number of oral glucose gel doses, reaction to several doses, and exclusive breastfeeding rates.	NICU admissions decreased from 10.6% to 2.9% post-implementation. Pre-implementation all newborns experiencing hypoglycemia were supplemented with formula. Pre-implementation exclusive breastfeeding rate was not assed but thought to be close to 0%. Post-implementation exclusive	II B

						breastfeeding rate was 49%.	
Harris et al. (2013)		Compare 40% dextrose gel to placebo gel for the reversal of NH in at risk populations.	Randomized, double-blind, placebo-controlled trial 40% dextrose gel 200 mg/kg or placebo gel	35-42 weeks' gestation, younger than 48-h-old, and at risk of hypoglycemia. 514 enrolled babies, 242 (47%) became hypoglycemic and were randomized. Five babies were randomized in error, leaving n= 237 for analysis	Primary outcome was treatment failure, defined as a blood glucose concentration of less than 2.6 mmol/L after two treatment attempts. Secondary outcomes include admission to NICU, use of IV dextrose, feeding method at 2-week follow-up, receipt of supplemental feeds, including expressed breastmilk or formula	Dextrose gel reduced the frequency of treatment failure compared with placebo; relative risk 0.57, 95% CI 0.33-0.98; (p=0.04), less likely to receive other sources of dextrose (p=.01), fewer formula feeds (p=.04) and fewer NICU admissions (p=.03). Dextrose gel cohort were more likely to exclusively breastfeed at 2 weeks of age (p=.03).	I A
Makker et al. (2018)		Introduction of a protocol that prescribed oral	Quasi-experimental	>35 weeks GA, >2000 gm at birth.	NICU transfer for hypoglycemia,	NICU transfer for management of	II B

		glucose gel 40% as an adjunctive therapy in infants at risk for hypoglycemia admitted to the newborn nursery	Pretest-standard protocol, formula/IV dextrose Posttest - Oral glucose gel 40% 200 mg/kg as an adjunct therapy to current protocol Retrospective QI project	Study population included late preterm, small and large for gestational age infants, and infants of diabetic mothers. (n= 804)	breastfeeding rate and hospital cost.	hypoglycemia fell from 8.1% in Year 1 to 3.7% in Year 2 ($p = 0.01$). Rate of exclusive breastfeeding increased from 6% in Year 1 to 19% in Year 2 ($p < 0.001$). Hospital charges for the study population decreased from 801,276 USD to 387,688 USD in Year 1 and Year 2, respectively.	
Rawat et al. (2016)		To determine the effect of 40% dextrose gel in decreasing NICU transfer for IV dextrose, increased uninterrupted breastfeeding,	Quasi-experimental Pretest – formula/IV dextrose Posttest - 40% dextrose oral gel 200 mg/kg	Neonates < 48 hours old, >35 weeks GA, with asymptomatic hypoglycemia (n=498). Pretest comparison group (n=248).	NICU transfer and IV dextrose utilization. Uninterrupted breastfeeding at discharge and cost reduction.	Fewer infants were transferred to the NICU for IV dextrose in the posttest group ($p<.01$). Increased exclusive uninterrupted breastfeeding at discharge in the	II B

		and reduction of cost.		Posttest intervention group (n=250).		posttest group (p=.03). Cost savings assessed at $2,593 USD per patient.	
Stewart et al. (2016)		To assess the effectiveness of a newborn hypoglycemic management pathway using 40% dextrose gel versus formula supplementation or expressed breast milk as first line treatment	Quasi-experimental Pre-intervention - formula supplementation or expressed breast milk Post intervention - 40% dextrose gel 200mg/kg	Neonates with hypoglycemia pre-intervention (n=28) and post intervention (n=24) intervention (n=52).	Formula supplementation rate, breastfeeding duration and NICU admission.	Pre-implementation 96% of breastfed infants were supplemented with formula, compared to 52% post-implementation. 63% of infants in treatment arm were breastfed at 3 months, compared to 29% in pre-implementation group. NICU admission decreased from 10.8% to 3.2% post implementation.	II C
Ter et al. (2017)		The aim of this study was to	Quasi-experimental	Neonates ≥ 36 weeks	NICU admission,	NICU admission for	II B

		evaluate dextrose gel in the management of neonatal hypoglycemia in the postnatal wards at an Australian tertiary level perinatal center.	Pre-intervention formula supplementation Post-intervention formula supplementation and 40% dextrose oral gel 200 mg/kg	gestation with asymptomatic hypoglycemia (n=200). Pre intervention group (n=100). Post intervention group (n=100).	normoglycemia, hypoglycemia recurrence	treatment of hypoglycemia reduced significantly post-implementation (29%) vs. (14%), P = 0.01). No significant difference was seen in the proportion of neonates achieving normoglycemia (71%) vs. (75%), P = 0.52), but hypoglycemia recurrence was higher in the post-implementation group (31%) vs. (49%), P = 0.02).	

Table 2

Pre-Implementation Survey Results

	Mean	**SD**	**95% CI**
Registered Nurses (n = 34)			
Q1. Ease of Administration	4.35	0.6	4.42 – 4.28
Q2. No Increase in Workload	3.84	0.82	3.94 – 3.75
Q3. Parents are Receptive	4.12	0.69	4.20 – 4.04
Q4. Compatible with Practice	4.21	0.75	4.30 – 4.13
Q5. Improves Patient Outcomes	4.48	0.61	4.56 – 4.41
Total	21	3.47	

Table 3

Demographic Data for At-Risk Infants with Asymptomatic Hypoglycemia (n = 16)

Gestational Age (weeks)	
Range (Mean)	36.5 – 40.2 (38.1)
Birth Weight (grams)	
Range (Mean)	2330 – 4390 (3187)
Gender	*n* (%)
Male	10 (62.5%)
Female	6 (37.5%)
Risk Factor	
DM	7 (43.7%)
LGA	3 (18.7%)
SGA	4 (25%)
More than 1	2 (12.5%)
Feeding Intent	
Breastmilk	9 (56.2%)
Both/Formula	7 (43.7%)

Table 4

Patient ID	Gender	GA	BW	Risk(s)	Intent	IV Dextrose	NICU	Formula	BG Pre	BG Post	BG Pre 2	BG Post 2	Tx Success
1	2	39.1	3820		Formula	yes	yes		36	46	27	44	YES
2	1	40.1	3825	LGA	Breast	no	no	no	33	49			YES
3	1	37.3	4390	LGA/T1DM	Breast	yes	yes	yes	17	41			YES
4	1	36.5	2340		Breast	yes	yes	yes	<20	21	22	38	NO
5	1	39.3	4120	LGA/GDM	Breast	no	no	no	35	52			YES
6	2	38.1	2600	SGA	Formula	no	no		22	47			YES
7	1	38.1	3170	GDM/Insulin	Breast	no	no	no	26	30	30	41	YES
8	1	37.3	2410	SGA	Breast	no	yes	no	34	55	39	94	YES
9	1	40.2	2930	GDMA1	Both	no	no		26	43	43	53	YES
10	2	37.1	2330	SGA	Both	no	no		35	50	32	43	YES
11	2	37	2990	AGA/T2DM	Breast	no	no	yes	34	46			YES
12	2	38	3600	AGA/GDMA2	Both	no	no		37	53			YES
13	2	37.6	2380	SGA	Both	no	no		38	64			YES
14	1	37.4	3050		Both	no	no		34	61			YES
15	1	38	3530	T2DM/Insulin	Breast	no	no	yes	34	45	40	57	YES
16	1	38.3	2800	AGA	Breast	yes	yes	yes	<20	32	32	37	NO

Note. Gestational age is weeks and days reported as a decimal. Birth weight is reported in grams. Intent represents the caregivers' intended infant feeding method (*breast milk*, *formula*, or *both*) identified on hospital admission. IV dextrose reflects both bolus and continuous infusions. NICU denotes admission to the NICU for hypoglycemia management. Formula represents the use of formula supplementation for infants whose intended feeding method was identified as *breast milk*. Blood glucose before administration of 40% buccal dextrose gel is represented by *BG Pre*; and *BG Post* signifies blood glucose after dextrose gel and feeding. Blood glucose before administration of a second dose of 40% buccal dextrose gel is represented by *BG Pre2*; and *BG Post2* signifies blood glucose after the second dose of dextrose gel and feeding. Treatment (Tx) success signifies a blood glucose above the threshold identified in the CPG following the administration of 40% dextrose gel.

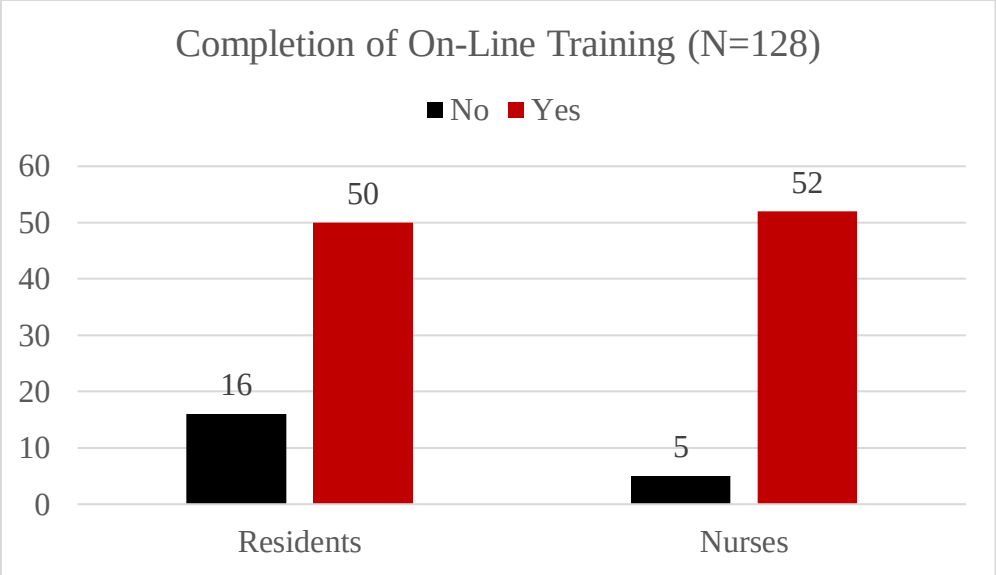
Completion of On-Line Training (N=128)
No
Yes
60
50
40
30
20
10
0
16
50
5
52
Residents
Nurses

Figure 1

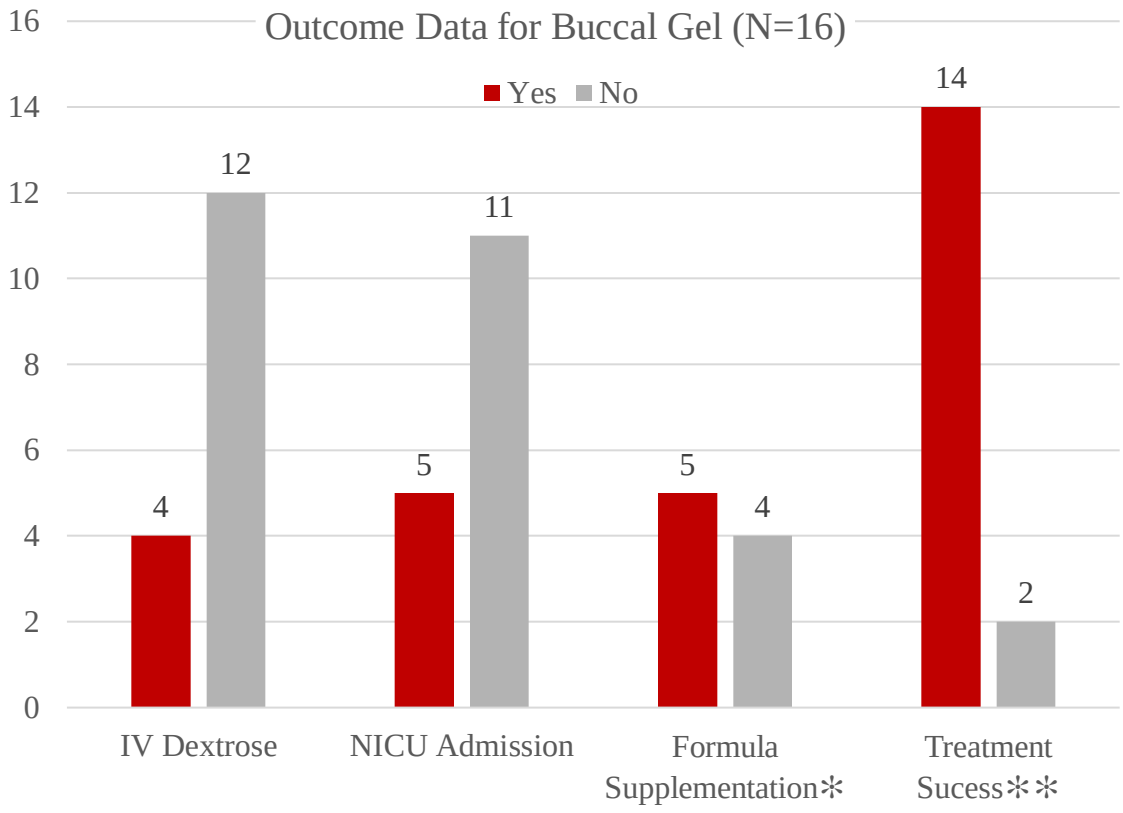

Figure 2

✻IV Dextrose reflects both bolus and continuous infusions.

✻✻Formula Supplementation signifies administration of formula to an infant with documented *"Breast"* preference in their EHR.

✻✻✻Treatment Success signifies a blood glucose above the threshold identified in the CPG following the first and/or second administration of 40% dextrose gel (>40mg/dL for infants less than 24 HOL)

Appendix A

Department of Nursing
Division of Women's and Children's Health – Newborn Nursery
Subject: Guidelines for Evaluation for Hypoglycemia in the Newborn Nursery

1.0 Policy: The following guidelines will be followed to ensure early identification and safe management of hypoglycemia in at risk babies admitted to the Newborn Nursery.
2.0 Purpose: To describe the process for monitoring blood glucose levels in the newborn and the management of an infant experiencing signs of hypoglycemia or at risk for developing hypoglycemia.
3.0 Responsibility: All nursing and medical personnel
4.0 Definition: For the Newborn Nursery, hypoglycemia is defined as a heelstick blood glucose of less than 40 mg/dl.
5.0 Process – For all babies admitted to the Newborn Nursery, assess the newborn for indication for glucose screening. Complete a heelstick blood glucose within 1 hour for any of the following indications:

- 5.1 Birthweight - > 3800 grams or < 2500 grams
- 5.2 Gestational age < 37 weeks
- 5.3 LGA or SGA – determined by MD based on growth chart
- 5.4 Infant of Diabetic Mother based on maternal history
- 5.5 Symptomatic newborn
  - 5.5.1 Low APGARs
  - 5.5.2 Signs of sepsis
  - 5.5.3 Jittery
  - 5.5.4 Lethargic
  - 5.5.5 Decreased or Absent Tone/Floppy
  - 5.5.6 Apnea
  - 5.5.7 Poor Feeder
  - 5.5.8 Seizure activity
  - 5.5.9 Repeated hypothermia – less than 36.4 C, temperature instability (If baby is initially cold in L&D or Newborn Nursery – DO NOT check the blood glucose unless the baby is symptomatic or has any of the stated risk factors). Take appropriate measures to establish thermoregulation – skin to skin, mom covered with warm blankets. Recheck temperature in 30 minutes.
  - 5.5.10 Known inborn error in metabolism (diagnosed prenatally)

6.0 Protocol:

- 6.1 A heelstick blood glucose will be done within 1 hour of identification of risk factors or presentation of symptoms.
- 6.2 If baby meets the listed criteria, the baby should be placed on the following Blood Glucose testing protocol
  - 6.2.1 Initial blood glucose check
  - 6.2.2 Repeat every hour X 3
  - 6.2.3 Then repeat blood glucose checks before the next 3 feeds, at 12 hours, 24 hours and 36 hours of life.

7.0 If heelstick BG is less than 40 mg/dl, repeat the test to confirm, then notify MD and obtain an order for a confirmatory serum glucose. If not contraindicated, feed by preferred method.

7.1 If breastfeeding and mother is able to feed, put the baby to breast and support and monitor for effective feeding session. Repeat BG in 30 minutes. If mother is unable to breastfeed, supplement 3-5 ml/kg of expressed breast milk or infant formula and recheck BG in 30 minutes. If expressed breast milk is not available, obtain permission from mom and an order from the covering MD to feed 3-5 ml of infant formula.

7.2 If bottle feeding formula, give 10-15 ml of formula and recheck BG in 30 minutes

7.3 If PO feeding is contraindicated

7.3.1.1 initiate an IV start –Contact NICU Charge Nurse if assistance is needed

7.3.1.2 Obtain order for further management while awaiting NICU transfer

7.4 If BG is less than 20 mg/dl, repeat the test to confirm and notify covering MD and obtain order for a stat serum glucose. Refer to flow chart while arranging transfer to NICU.

7.4.1 Contact NICU Charge Nurse if assistance is needed for initiation of NG/OG feed of infant formula and or IV start for further management.

7.4.2 Obtain order for further management while awaiting NICU transfer

8.0 Contraindications to PO Feeding

8.1 Significant Respiratory Distress

8.2 Respiratory rate >80

8.3 Respiratory distress requiring supplemental oxygen

8.4 Signs of GI obstruction – bilious emesis, abdominal distention, or tenderness

8.5 Lethargy – hard to wake for feeds

9.0 Document all assessments and interventions and the baby's response in baby's chart.

10.0 Parent education Instruct the parents to recognize the symptoms of hypoglycemia and when to notify the nurse; the importance of neutral thermal environment and how to assist the infant to maintain thermoregulation; the importance of adequate nutritional intake and methods of feeding

Appendix B

Guidelines for Evaluation of Hypoglycemia in the Newborn Nursery

Department of Nursing
Division of Women's and Children's Health – Newborn Nursery

POLICY:
The following guideline will be followed to ensure early identification and safe management of hypoglycemia in at-risk babies admitted to the Newborn Nursery during the first 24 hours of life. If hypoglycemia occurs after the 24th hour of life, notify the provider.

PURPOSE:
To describe the process for monitoring blood glucose levels in the newborn and the management of an infant experiencing signs of hypoglycemia or those infants at risk for developing hypoglycemia.

RESPONSIBILITY:
All nursing and medical personnel will be responsible for following this guideline.

DEFINITION:
For the Newborn Nursery, **hypoglycemia** is defined as a heel stick blood glucose of **less than 40 mg/dl**.

PROCESS:
For all babies admitted to the Newborn Nursery, assess the newborn for an indication for glucose screening. Complete a heel stick blood glucose within 1 hour for any of the following indications:

- Birth Weight >3800 grams or <2500 grams
- Gestational age <37 weeks
- Large for gestational age (LGA) or small for gestational age (SGA) – determined by provider based on growth chart
- Infant of diabetic mother based on maternal history
- Symptomatic newborn
    - Low APGARs
    - Signs of sepsis
    - Jittery
    - Lethargic
    - Decreased or absent tone/floppy
    - Apnea
    - Poor feeder
    - Seizure activity
    - Repeated hypothermia – temperature less than 36.4 C and/or temperature instability. If baby is initially cold in Labor & Delivery or Newborn Nursery, DO

NOT check the blood glucose unless the baby is symptomatic or has any of the stated risk factors. Take appropriate measures to establish thermoregulation (i.e. skin to skin, mom covered with warm blankets) and recheck temperature in 30 minutes.

- Known inborn error in metabolism (diagnosed prenatally)

PROTOCOL:

- A heel stick blood glucose will be done within 1 hour of identification of risk factors or presentation of symptoms.
- If baby meets the listed criteria, the baby should be placed on the following blood glucose testing protocol:
  - Initial blood glucose check
  - Repeat every hour x 3
  - Then repeat blood glucose checks before the next 3 feeds, at 12 hours, 24 hours and 36 hours of life
- **If heel stick blood glucose is less than 20 mg/dL**, repeat the test to confirm, notify covering provider and obtain an order for stat serum glucose. Refer to flow chart while arranging transfer to NICU.
  - Contact NICU charge nurse if assistance is needed for initiation of NG/OG feed of infant formula and/or IV start for further management
  - Obtain order for further management while awaiting NICU transfer
- **If heel stick blood glucose is less than 40 mg/dl**, repeat the test to confirm.
  - If the baby is less than **24 hours** old and is asymptomatic with the exception of isolated jitteriness, counsel the parents on the hypoglycemia guideline and then notify the provider to obtain an order for a confirmatory serum glucose and 40% dextrose gel 200 mg/kg (0.5 mL/kg). If not contraindicated, feed by preferred method and monitor closely for signs and symptoms of hypoglycemia. For contraindications to feeding see below.
    - If breastfeeding and mother is able to feed, administer 40% dextrose gel 200 mg/kg (0.5 ml/kg) to buccal mucosa. Then place the baby to breast and support and monitor for effective feeding session. If dextrose gel is not immediately available, support baby at the breast while another nurse obtains the dextrose gel. When dextrose gel is brought to the bedside, interrupt breastfeeding and administer gel, then continue to support and monitor the baby at the breast. Repeat blood glucose in thirty minutes after feeding is complete.
    - If mother is unable to breastfeed, administer 40% dextrose gel 200 mg/kg (0.5 ml/kg) to buccal mucosa. Then supplement 3-5 ml/kg of expressed breast milk and recheck blood glucose thirty minutes after feeding is complete. If expressed breast milk is not available, administer 40% dextrose gel 200 mg/kg (0.5 ml/kg) to buccal mucosa and recheck blood glucose after thirty minutes.
    - If bottle feeding formula, administer 40% dextrose gel 200 mg/kg (0.5 ml/kg) to buccal mucosa. Then give 10-15 ml of formula and recheck blood glucose thirty minutes after feeding is complete.

        - If blood glucose levels remain less than 40 mg/dl on repeat screen, notify provider. If ordered, administer 40% dextrose gel 200 mg/kg (0.5 ml/kg) to buccal mucosa, then refeed (breastfeed, expressed breastmilk or formula) and recheck blood glucose 30 minutes after feeding is complete. Monitor closely for signs and symptoms of hypoglycemia. **Dextrose gel administration is not to exceed two doses in the first 24 hours of life.**
    - If PO feeding is contraindicated
        - Initiate an IV start – Contact NICU charge nurse if assistance is needed
        - Obtain order for further management while awaiting NICU transfer
        - Contraindications to PO feeding
            - Significant respiratory distress
            - Respiratory rate >70
            - Respiratory distress requiring supplemental oxygen
            - Signs of GI obstruction – bilious emesis, abdominal distension or tenderness
            - Lethargy – hard to wake for feeds
- **Documentation:** Document all assessments and interventions along with the baby's response in the baby's chart.
- **Parent education**: Educate the parents on how to recognize the symptoms of hypoglycemia, when to notify the nurse, the importance of neutral thermal environment (and how to assist the infant to maintain thermoregulation), the importance of adequate nutritional intake and methods of feeding.

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Created and reviewed by: Anjana Solaiman, Jennifer Fitzgerald, Colleen Driscoll, Maria Martino-Gomez, Jessica Biggs
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Approved by: Peds P&T (August 2019), P&T (August 2019)

Appendix C

Online Assessment

1. What is the appropriate dose of 40% buccal dextrose gel to treat asymptomatic neonatal hypoglycemia?

    a. 400mg/kg (1ml/kg)
    b. 300mg/kg (0.75mg/kg)
    c. 200mg/kg (0.5ml/kg)
    d. 100mg/kg (0.25ml/kg)

2. What is the most appropriate method for administering 40% buccal dextrose gel?

    a. Dry the infant's cheek with 2x2 gauze, dispense 0.5ml of dose onto gloved finger and massage into buccal mucosa. Repeat, and alternate cheeks, until the entire dose is administered.
    b. Dry the infant's cheek with 2x2 gauze and use the syringe to administer dextrose gel orally.
    c. Dispense 0.5ml of dose onto gloved finger and massage into buccal mucosa. Repeat until the entire dose is administered.
    d. Dry the infant's cheek with 2x2 gauze, use the syringe to administer 0.5ml of dose into the infant's cheek. Repeat, and alternate cheeks, until the entire dose is administered.

3. Once the provider initiates an order set for 40% buccal dextrose gel, where will the nurse obtain the dose?

    a. Pharmacy
    b. NP office in Newborn Nursery
    c. Medication Pyxis
    d. Patient's Room

Case Scenario 1

4. Baby Girl J was delivered vaginally at 39 weeks gestation to a mother with Type 2 Diabetes Mellitus. Her birth weight was 4300 grams and she breastfeed at 1 hour of life. Baby Girl J's blood glucose 30 minutes after the first feed is 20mg/dL and she is asymptomatic. What is your next step in caring for this infant?

a. Start an IV and prepare for transfer to the NICU for IV dextrose
b. Notify the provider to obtain an order set for 200mg/kg (0.5ml/kg) of 40% buccal dextrose gel
c. Obtain 40% dextrose gel from the medication pyxis and administer 200mg/kg (0.5ml/kg)
d. No treatment is needed since she is asymptomatic

5. You administered 200mg/kg (0.5ml/kg) of 40% dextrose gel based on the Neonatal Hypoglycemia Protocol and encourage Baby Girl J to breastfeed. Thirty minutes after re-feeding, Baby Girl J's blood glucose is 46mg/dL. She is currently 3 hours old and is not symptomatic. What is your next step in caring for this infant?

a. Administer a second dose of 200mg/kg (0.5ml/kg) of 40% buccal dextrose gel
b. Provide 10-15ml of formula supplementation
c. Transfer the newborn to the NICU for further care
d. Encourage the mother to breastfeed 10-12 times/24 hours and re-check blood glucose before the next feed

6. Baby Girl J is now 8 hours old, her blood glucose prior to breastfeeding is 33mg/dL and she is asymptomatic. What is your next step?

a. Obtain 40% dextrose gel from the medication pyxis and administer 200mg/kg (0.5ml/kg)
b. Start an IV and prepare for transfer to the NICU for IV dextrose
c. Notify the provider to obtain a second order for 200mg/kg (0.5ml/kg) of 40% buccal dextrose gel
d. Give 10-15ml of formula supplementation

7. You administered a second dose of 200mg/kg (0.5ml/kg) of 40% dextrose gel based on the Neonatal Hypoglycemia Protocol and encourage Baby Girl J to breastfeed. Thirty minutes after re-feeding, Baby Girl J's blood glucose is 30mg/dL. She is currently 9 HOL and is not symptomatic. What is your next step in caring for this infant?

a. Notify the provider to obtain an order set for 200mg/kg (0.5ml/kg) of 40% buccal dextrose gel
b. Notify the provider, send STAT serum glucose, and prepare for administration of IV dextrose
c. Give 10-15ml of formula supplementation

d. Administer a third dose of 200mg/kg (0.5ml/kg) of 40% buccal dextrose gel

Case Scenario 2

8. Baby Boy X was born via C-section at 36 weeks gestation and his birth weight was 2100 grams. Baby Boy X breastfed at 1 hour of life and his blood glucose 30 minutes after feeding was 42mg/dL Baby Boy X is now 12 hours old, his mother is ready to breastfeed, his pre-prandial blood glucose is 25mg/dL, and he is asymptomatic. Which of the following treatments is the most appropriate?

    a. Administer 200mg/kg (0.5ml/kg) of 40% buccal dextrose gel and feed 10-15ml of formula
    b. Administer 200mg/kg (0.5ml/kg) of 40% buccal dextrose gel and allow him to breastfeed
    c. Administer 400mg/kg (1ml/kg) of 40% buccal dextrose gel and feed 10-15ml of formula
    d. Administer 400mg/kg (1ml/kg) of 40% buccal dextrose gel and allow him to breastfeed

9. You administered 200mg/kg (0.5ml/kg) of 40% buccal dextrose gel and allowed Baby Boy X to breastfeed based on the Neonatal Hypoglycemia Protocol. One hour after breastfeeding you re-check his blood glucose and it is 37mg/dL. Baby Boy X is 13 hours old and is asymptomatic. Which of the following treatments is the most appropriate?

    a. Administer 200mg/kg (0.5ml/kg) of 40% buccal dextrose gel and encourage him to breastfeed again
    b. Administer 200mg/kg (0.5ml/kg) of 40% buccal dextrose gel and feed 15-20ml of formula
    c. Send STAT serum glucose and prepare for IV administration of dextrose
    d. Re-feed, but do not administer 40% dextrose gel since the patient has exceeded maximum number of doses in 24 hours

Case Scenario 3

10. Baby Boy F was delivered via repeat C-section at 39 weeks gestation with a birth weight of 3810 grams. The mother plans to breast and bottle feed her newborn. At thirty two hours of life you see that the baby has isolated jitteriness, but no other signs of hypoglycemia and you check the blood glucose, it is 25mg/dl. Which of the following treatments is the most appropriate?

a. **Notify the NBN provider to obtain orders since this newborn is more than twenty four hours old.**
b. Send STAT serum glucose and prepare for IV administration of dextrose
c. Administer 200mg/kg (0.5ml/kg) of 40% buccal dextrose gel and then give him 30mls of infant formula
d. Notify the NBN provider and give him formula, but do not administer 40% dextrose gel since the patient is bottle feeding

Appendix D

Registered Nurse In-Service Training Outline

Objectives	Content Outline	Method of Instruction	Time	Evaluation
After completion of the training the RN will be able to: 1. Identify the benefits of 40% buccal dextrose gel for neonatal hypoglycemia. 2. Identify negative effects of formula supplementation and Joint Commission guidelines. 3. Describe the role of the Newborn Nursery Resident Physician and RN within the framework of the CPG. 4. Demonstrate proficiency in following guideline recommendations. 5. Demonstrate appropriate administration of dextrose gel.	• Dextrose gel: formulation, dosing, administration, and benefits. • Formula supplementation: negative effects, Healthy People 2020 goals, and Joint Commission core measures. • Modified CPG: changes to current practice, roles of the Newborn Nursery Resident Physician and RN, and case scenarios. • Review step-by-step procedures and administration of dextrose gel.	Poster presentation, case scenarios, demonstration, and discussion of questions or concerns.	Approximately 15 minutes.	1. Discussion of case scenarios. 2. Verbalization of appropriate dextrose gel administration. 3. Completion of the pre-implementation survey.

Appendix E

Pre-Implementation Survey

40% Dextrose Gel Pre-Implementation Survey

Please complete this survey after the education session. All surveys will be collected anonymously, and participation is voluntary. Results of the survey will be presented in aggregate data and will be used to improve the implementation of 40% dextrose gel for neonatal hypoglycemia.

What is your role? RN ☐ MD ☐

Did you have any knowledge of 40% buccal dextrose gel for the treatment of neonatal hypoglycemia prior to the HealthStream module and/or In-service? YES ☐ NO ☐

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Buccal dextrose gel seems easy to administer.	1	2	3	4	5
2. Administration of buccal dextrose gel will **not** substantially increase my workload.	1	2	3	4	5
3. Patient's parents or caregivers will be receptive to the use of buccal dextrose gel.	1	2	3	4	5
4. Using buccal dextrose gel is compatible with current practice.	1	2	3	4	5
5. Buccal dextrose gel will help improve patient outcomes.	1	2	3	4	5

Additional comments:

Appendix F

Evaluation and Management of Neonatal Hypoglycemia in the First 24 hours

(for the normal, term newborn without any dysmorphic features or altered mental status)

Note: If hypothermia due to exposure, provide warmth. If hypothermia persists despite provision of appropriate warmth or hypothermia with other symptoms, then check chem. strip

If chem strip <20mg/dL, then draw venous or heel stick for stat blood glucose and notify medical provider (pediatric resident or full term nursery attending during the day, or neonatology fellow at night).

Term, feeding, and asymptomatic

No or high risk** — Transfer to NICU

Yes — Continue feeding while processing transfer to NICU

Give IV bolus 2ml/kg of D10W

Begin continuous infusion of D10W @ 4-6mg/kg/min

Repeat blood glucose (chem strip and/or venous or heel stick for blood glucose) 15 minutes after bolus

Consider repeat bolus if needed, but be cautious of rebound hypoglycemia, especially in hyperinsulinemic infants

If infant of diabetic mother, begin D10W @ 6-10mg/kg/min

If chem strip 20-40mg/dL, then draw venous or heel stick for stat blood glucose and notify medical provider (pediatric resident or full term nursery attending during the day, or neonatology fellow at night).

Term, feeding, and asymptomatic

No — Draw venous or heel stick for stat blood glucose. Is repeat chem strip is 20-40mg/dL?

Yes — Continue to feed/breast feed, monitor chem strips

No — Continue feeding while processing transfer to NICU

Yes — Give 40% dextrose gel 200 mg/kg (0.5 mL/kg) and then feed by the preferred method. Recheck chem strip after 30 minutes.

Is repeat chem strip >40mg/dL?

No

Yes — **GLUCOSE GEL NOT TO EXCEED 2 DOSES**.

Give 40% dextrose gel 200 mg/kg (0.5 mL/kg). After gel administration, breastfeed or feed 3-5ml/kg expressed BM. If bottle feeding formula give 10-15 mL. Repeat chem strip 30 minutes after feeding.

Is repeat chem strip >40mg/dL?

No

Yes

****Note:** High risk infants include: Preterm babies, infants of diabetic mothers, small or large for gestational age babies, infants with micro- or macrocephaly or dysmorphic features. For any chem strip <40, ALWAYS send a serum glucose – venous or heel stick

Symptoms of hypoglycemia include: persistant jitteriness, irritability, lethargy, seizures, apnea, inability to oral feed &/or grunting.

Appendix G

Sample Data

Patient ID	Gender	GA	BW	Risk(s)	Intent	IV Dextrose	NICU	Formula	BG Pre	BG Post	BG Pre 2	BG Post 2	Tx Success
1	2	38.1	3420		Formula	yes	yes		27	46	27	44	YES
2	1	40.1	3725	LGA	Breast	no	no	no	33	67			YES