Implementation of Carbohydrate-Based Liquid Nutrition in Labor

by

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Abstract

Problem and Purpose: At a large community hospital in the mid-Atlantic region, with over 2,400 deliveries yearly, all women were kept fasting during labor. This outdated practice can lead to increased stress, pain and dissatisfaction with the labor experience. The primary purpose of this quality improvement project was to implement an evidence-based policy for oral carbohydrate-based liquid nutrition in laboring women at low risk of operative delivery.

Methods: An evidence-based tool was developed to assess risk of operative delivery. Women at low risk were cleared to receive a carbohydrate-based clear liquid diet. The unit personnel were educated on the new policy, assessment tool, and orders prior to implementation. Implementation tactics included staff specific policy verbal and email reminders. Inpatient charts were reviewed to track and evaluate the number of high and low risk patients, diet orders and frequency of high-risk characteristics. Data analysis included the use of descriptive statistics and a run chart with daily staff compliance rates.

Results: A total of 235 women had vaginal deliveries (58% high-risk, 42% low risk) during the nine-week project implementation. Following staff education, diet order compliance rates in both high and low risk groups was 61%, increasing to 75% by the end of implementation. The initial compliance for low risk patients was only 38% following education but increased to 55% by the end of the implementation. In contrast, the compliance rate for high-risk women was 98% after education and 100% at the end of implementation. There were no recorded incidences of pulmonary aspiration or complications during implementation.

Conclusion: This project was successful in implementing a policy and assessment tool for carbohydrate-based liquid nutrition for women in labor. Barriers to compliance included the additional step of adding the clear liquid diet order in the electronic medical record and disagreement with the high-risk characteristics in the assessment tool. Recommendations for continued success include adding the clear liquid diet order to the admission order set and adjusting the risk factors in the assessment tool to allow more women to be categorized as low risk of operative delivery and receive carbohydrate-based liquid nutrition.

Introduction

In 2018 there were more than 3.7 million births in the United States (US) (Martin et al., 2019). Pregnancy, labor and delivery are natural physiological processes of the human life span (American College of Nurse-Midwives, 2016). The labor and delivery experience is very personal and individual for each woman (King et al., 2011). Throughout the process of labor and delivery, a woman in labor (parturient) experiences emotional, psychological and nutritional demands requiring support and strength to be successful. Support comes in many forms including support from loved ones, personal beliefs, a feeling of control, a sense of decision making with the healthcare team, and replenishment of lost nutrients during the strenuous process of labor. Unsatisfying birth experiences are associated with psychological disorders in the postpartum period such as postpartum depression and even posttraumatic stress disorder (Fair & Morrison, 2012). In the United States, labor and delivery often is treated as a disease process rather than a natural process, limiting a woman's right to make decisions about her care. Specifically, the ability to consume nutrition in labor is limited or denied for fear of a rare risk of pulmonary aspiration during an emergency cesarean delivery. This leads to a feeling of a lack of control by the parturient.

A large community hospital, in the mid-Atlantic region, was lacking a policy on oral nutrition in labor and continued to limit or deny oral nutrition to the more than 2,400 women who deliver at the facility each year. In patient satisfaction survey, women have voiced a lack of control and decision-making ability in their care with 52% of women stating the staff did not consider their preferences for care. Women who are at low risk for operative delivery or general anesthesia should be allowed moderate amounts of clear liquids (including carbohydrate drinks) for uncomplicated labor (American College of Nurse-Midwives, 2016; American College of

Obstetricians and Gynecologists, 2009; The American Society of Anesthesiologists, 2016; The Royal College of Midwives, 2012). The purpose of this Quality Improvement (QI) project was to implement an obstetrical risk assessment for operative delivery (ORAOD) tool and diet/nutrition order based on a policy for oral nutrition in laboring women (see Appendix A).

Literature Review

Dr. Mendelson (1946) linked aspiration pneumonitis with eating and drinking during labor in women who were administered intravenous narcotics or general anesthetics, especially during cesarean deliveries. Since that time the practice of withholding oral nutrition for women in labor has continued despite significant advancements in the methods of analgesia and anesthesia in the parturient population (American College of Nurse-Midwives, 2016; American College of Obstetricians and Gynecologists, 2009; King et al., 2011; O'Sullivan et al., 2009; Sharts-Hopko, 2010; The American Society of Anesthesiologists, 2016). There is no increase in aspiration pneumonitis when women who are at low risk of operative delivery (forceps assisted delivery, vacuum assisted delivery, or cesarean delivery) or receiving general anesthesia are allowed oral nutrition during labor (American College of Nurse-Midwives, 2016; American College of Obstetricians and Gynecologists, 2009; Ciardulli et al., 2017; King et al., 2011; O'Sullivan et al., 2009; Sharts-Hopko, 2010; Singata et al., 2013; The American Society of Anesthesiologists, 2016; Vallejo et al., 2013).

An evidence review was completed to determine how oral nutrition in labor can affect changes in the labor and delivery process. The most common outcomes measured were satisfaction with the labor experience, duration of the first and second stages of labor, rates of cesarean deliveries versus vaginal deliveries, changes in neonatal Appearance, Pulse, Grimace, Activity and Respiration (APGAR) scores at birth, need for augmentation of labor, and rates of

aspiration pneumonitis. The evidence consistently showed no reports of aspiration pneumonitis and no difference between the groups who were allowed oral nutrition and those who had restrictions for these measures except patient satisfaction and the duration of the second stage of labor. Lack of oral nutrition caused stress and discomfort with corresponding lower satisfaction scores with parturients rating their stress levels as moderate to very stressful 57% of the time when denied oral nutrition (Sharts-Hopko, 2010). When oral nutrition was allowed there was an increase in rates of nausea and vomiting; however, despite the increase in nausea and vomiting the satisfaction scores were still higher (King et al., 2011; Sharts-Hopko, 2010). Satisfaction increased due to the comfort provided by being able to eat or drink at a time of high energy expenditure, stress, and emotional turmoil. It allowed the parturients to have some control of their labor experience and added an element of normalcy to a new and sometimes unknown stressful experience (Fair & Morrison, 2012; King et al., 2011).

King et al. (2011) performed a systematic review which included 15,448 parturients from 20 studies demonstrating no change in the outcomes listed. O'Sullivan et al. (2009) conducted a randomized controlled trial (RCT) with 2,426 low risk parturients demonstrating the rate of cesarean sections and the duration of the first stage of labor were unchanged when oral nutrition was provided compared to no nutrition. A meta-analysis including five RCTs with a total of 3,130 parturients reported no statistically significant difference in the outcomes in cesarean births, operative vaginal births, and APGAR scores less than seven at five minutes (Singata et al., 2013). The most recent meta-analysis with over 3,900 parturients demonstrated a statistically significant decrease in the duration of the second stage of labor (defined as the time from full dilation of the cervix, pushing and finally delivery of the neonate) by an average of 16 minutes

(Ciardulli et al., 2017). This difference was most likely due to the increased energy reserves needed for the parturients to be more effective in the "pushing" phase of delivery.

The energy expenditure required in labor is similar to the energy expenditure required with moderate aerobic exercise (Ciardulli et al., 2017; King et al., 2011; O'Sullivan et al., 2009; Sharts-Hopko, 2010; Singata et al., 2013; Vallejo et al., 2013). However, the energy expenditure was not specified or quantified. In a seminal study by Eliasson et al. (1992) energy expenditure during labor was quantified using a measure of oxygen consumption as a determinant of energy use. Eliasson et al. were able to determine oxygen consumption increased by approximately 26% in the first stage of labor and as high as 86% during the peak of contractions. This is consistent with the amount of energy expended for moderate aerobic exercise and according to the sports medicine and dietary experts should have nutritional replenishment if performed for more than one hour (Rodriguez et al., 2009). The type of nutritional replenishment is recommended to be carbohydrate-based to allow for rapid replenishment of lost glucose stores (Rodriguez et al., 2009).

Many national and international organizations support the use of oral liquid nutrition for women in labor (American College of Nurse-Midwives, 2016; American College of Obstetricians and Gynecologists, 2009; Sperling et al., 2016; The American Society of Anesthesiologists, 2016; The Royal College of Midwives, 2012). Two of these organizations have evidence-based practice guidelines for the care of women in labor which are specific for oral liquid nutrition or include oral nutrition within a larger guideline. Both organizations agree, and are supported by the other organizations, that moderate amounts of liquid oral nutrition in labor is appropriate if there is a low risk of operative delivery or the use of general anesthesia. An evaluation and risk stratification is recommended of the parturient for an operative delivery

or general anesthesia prior to making a decision to limit or deny oral nutrition during the natural process of labor (The American Society of Anesthesiologists, 2016; The Royal College of Midwives, 2012).

In summary, there is agreement in the evidence allowing carbohydrate-based liquid nutrition, while slightly increasing nausea and vomiting, does not increase the risk of aspiration pneumonitis or change the outcomes for low risk laboring women. Allowing liquid oral nutrition could decrease the length of the second stage of labor while increasing the satisfaction of women in labor and help them to feel a sense of normalcy during a natural process (American College of Nurse-Midwives, 2016; American College of Obstetricians and Gynecologists, 2009; Ciardulli et al., 2017; Fair & Morrison, 2012; King et al., 2011; O'Sullivan et al., 2009; Sharts-Hopko, 2010; Singata et al., 2013; Sperling et al., 2016; The American Society of Anesthesiologists, 2016; The Royal College of Midwives, 2012; Vallejo et al., 2013) (see Appendix B for complete evidence review).

Theoretical Framework

The strategies necessary to be successful in implementation of a QI project in an obstetrical unit are different than other areas of healthcare due to the unique nature of care offered in these units. The uniqueness of the obstetrical unit is explained by different forces and variables influencing obstetric care such as the preventative and curative nature of care, strong medical-legal concerns, limited amount of time to make decisions in emergency situations, and invasive monitoring of the patients by highly skilled and specialized staff. A multifaceted approach with early identification of barriers, recruitment of opinion leaders, involvement of leadership, good communication, frequent educational sessions with audit and feedback are all necessary for sustained practice change in the obstetrical environment (Chaillet et al., 2006). To

achieve this multifaceted approach Kotter's Theory of Change was chosen as the theoretical framework for the QI project (Henry et al., 2017; Kotter & Schlesinger, 2008).

Kotter's Theory of Change is designed to help positively affect the thinking of those involved in a change process (Kotter & Schlesinger, 2008). The first step of this framework was to assess the resistance to change that was expected. There are four types of resistance defined by Kotter (see Figure 1). Each of these four types of resistance were identified at the beginning of this QI project. Kotter's Change Theory recommended specific ways to overcome these types of resistance (see Figure 2) which align with the recommended phases for implementation. There were three phases used for the implementation of this project based on the framework. The first phase was to create a climate of change by instilling a sense of urgency, forming a guiding coalition, and creating a vision for the change. The second phase was to engage and enable the organization by communicating the vision, removing barriers, and sharing short term wins. Finally, implementation and sustainment of the change by building on the change and anchoring the change in the new culture (Henry et al., 2017; Kotter & Schlesinger, 2008; Neumeier, 2013).

Methods

This was a QI project aimed at allowing women at low risk of an operative delivery to have carbohydrate-based clear liquids during labor at a large community hospital in the mid-Atlantic region. The facility has over 2,400 deliveries per year. The only women excluded from this practice change were those admitted for a scheduled or elective cesarean section delivery. All parturients admitted for labor at the facility were assessed for their risk of an operative delivery using the ORAOD tool by an obstetrical provider. Women who were assessed to be at a high-risk of an operative delivery received the previous standard of care, a diet order of nothing

per oral (NPO) with ice chips. Parturients who were assessed to have a low risk of operative delivery were ordered a clear liquid diet, which included carbohydrate-based liquids.

As part of the QI project several structures and processes changed. The structural changes included creation of a policy for carbohydrate-based liquid nutrition in labor, adjustments to the available clear liquid diet options on the unit (added carbohydrate sports drinks), creation of an educational labor nutrition flyer and education for the anesthesia, obstetric, labor and delivery nursing staff and patients. A labor nutrition flyer was created for distribution during the prenatal birthing classes to provide education for the parturients (see Figure 3). The education for the staff included the new processes for each department. The obstetrical staff were trained on use of the ORAOD tool and adding the clear liquid diet order separate from the admission order set. The anesthesia staff were trained on the use of the ORAOD tool for each woman requesting epidural analgesia and communication with the obstetrical provider if the patient needed a diet order adjustment. The nursing staff were trained on which clear liquids, including carbohydrate-based liquids, were appropriate for the patients as well as the need to communicate patient status changes to the obstetrical provider, and use of the ORAOD tool and policy. The education for the anesthesia and obstetrical staff was provided during a monthly department meeting while the education for the nursing staff was provided over a two-week period during morning change of shift/safety huddles.

Data collection included two process measures. The first process measure was distribution of the nutritional flyer in the birthing classes. The birthing flyer was given to the birthing class educator for distribution. After each class the educator reported the number of attendees and the number of flyers distributed which was recorded in an audit tool (see Appendix C). The second process measure evaluated compliance with the appropriate diet order for each

parturient admitted to the labor and delivery unit, and use of the ORAOD tool by the obstetrical provider. The data was collected from weekly reports run by the informatics nurse in the department and supplemented by chart reviews as necessary. The informatics nurse developed a report which included the date of admission, the admitting diagnosis (used to verify risk based on the ORAOD tool), and the type of diet ordered. If information was missing a chart review was conducted to collect the necessary data. The data was collected using an appropriate audit tool (see Appendix D). Data analysis included descriptive statistics and run charts with corresponding provider compliance rates.

To minimize risk to human subjects the data collected did not include any patient identifiable data. The weekly reports from the informatics nurse did not leave the facility and were destroyed as soon as the non-identifiable data was entered into the audit tool. If chart audits were necessary, they were performed on a computer at the facility. The audit tools were kept in a password protected computer and encrypted to ensure security of the information. Finally, a project description was submitted to the University of Maryland Baltimore (UMB) Institutional Review Board (IRB) for a Non-Human Subjects Research (NHSR) determination. Following designation as NHSR by UMB IRB, a description was submitted to the facility IRB for verification of NHSR and designation as a QI project.

Results

This QI project was successful in changing several structures and processes. A policy on nutrition in labor, including the ORAOD tool, was developed and approved for use at the institution (see Appendix A). The staff in three departments were successfully trained on the new policy and use of the ORAOD assessment tool. The nutritional supplies for the department were updated to include carbohydrate-based sports drinks for the parturients given a clear liquid

diet order. The nutritional flyer was approved for use and distributed at each of the birthing classes to 100% of attendees during the nine-week implementation period.

A total of 235 parturients met the inclusion criteria and had vaginal deliveries during the nine-week project implementation. Following the unit education, the overall diet order compliance rate in both high and low risk groups was 61%, increasing to 75% by the end of the implementation (see Figure 4). The greatest change in provider compliance from 38% to 55% occurred at the end of implementation in women who were in the low risk group. There were four days with 0% compliance rates. There were no reported incidences of aspiration or complications during implementation. The results are summarized in Table 1 including compliance rates for both the low and high-risk groups as well as the frequency of the high-risk characteristics.

Discussion

The initial implementation plan and data collection focused on application of the assessment tool and allowing parturients at low risk of an operative delivery to have the option of carbohydrate-based liquids during their labor. After all departmental education the diet order compliance rates for the high-risk parturients was 98% and remained between 96% and 100% throughout the implementation. This was expected since the workflow for these parturients remained the same and required no additional steps by the obstetrical providers. The greatest change to the obstetrical providers' clinical practice required an additional step of adding the clear liquid diet order for women at low risk of an operative delivery. During the education phase several obstetrical providers began using the new policy with 38% compliance at the end of the education period. These providers were the innovators and early adopters and were motivated to make the change. Over the remaining implementation period the compliance rate

increased to 55% demonstrating the move into the early majority as defined by Rogers theory of diffusion (Rogers, 1962; Turner, 2007). There were four days during the implementation phase with 0% compliance. The obstetrical providers on these days were resistant to the change and only women at low risk of an operative delivery were admitted, leading to 0% compliance.

The common outcome measures in the literature included satisfaction with the birthing experience, duration of first and second stages of labor, rates of cesarean deliveries, and rates of aspiration pneumonitis. There were no reported complications, including aspiration pneumonitis, during the nine-week implementation, which is consistent with the literature. It was not feasible to measure the other common outcome measures such as patient satisfaction in this setting during the QI project implementation. The facility was in the process of evaluating and changing their patient satisfaction survey vendor. The transition in vendors and adjustments being made to the questions precluded use of the results for comparison at the time. A new electronic medical record (EMR) was also being implemented in the labor and delivery department. The transition to a new EMR limited the ability to make changes, such as adjusting the admitting order set to include a new diet order, or create new reports to track data, such as length of labor. Once the EMR and satisfaction survey transitions are completed these outcome measures can be examined and used to improve and sustain the practice change.

Another important measure to consider when implementing a practice change is the cost the additional dietary supplies for the labor and delivery unit. Unfortunately, the cost of the additional carbohydrate-based liquids for the unit and the increase in use of existing dietary supplies was unable to be measured. During a review of dietary supplies when adding the carbohydrate-based clear liquids to the dietary supplies an unintended review of par levels of supplies was conducted. This resulted in a significant change to all supplies stocked on the unit

and invalidated any potential comparisons pre-implementation. There was also an unintended result of adding the clear liquid diet order in the EMR for women at low risk of operative delivery. The clear liquid diet order was intended to allow the nursing staff on the unit to use the dietary supplies stocked on the unit, but the added diet order triggered delivery of clear liquid diet trays from food services. This led to an increase in clear liquid diet trays with very little use of dietary supplies stocked on the unit. With these unintended consequences it was not possible to analyze the change in cost of supplies.

Conclusion

The goal of creating and implementing a policy for oral nutrition in labor, including an assessment tool, was achieved in this QI project. Identified barriers to compliance, in this facility, were the additional step of adding the clear liquid diet order in the EMR and some disagreement with the high-risk characteristics in the assessment tool. To increase the use of the carbohydrate-based liquids with low risk women, the admitting order set needs to include the option for a clear liquid diet. Adding the ORAOD assessment tool to the EMR will allow more efficient use of the tool leading to higher rates of compliance. Based upon feedback from the staff, the high-risk characteristics could be adjusted based upon the specific population of the facility. For example, in this department the maternal age could be increased which would allow more women to be categorized as low risk and allowed nutrition in labor.

According to the literature, allowing women carbohydrate-based clear liquids in labor can decrease stress, labor pain, and increase satisfaction with the labor experience (American College of Nurse-Midwives, 2016; Ciardulli et al., 2017; Fair & Morrison, 2012; King et al., 2011; O'Sullivan et al., 2009; Sharts-Hopko, 2010; Singata et al., 2013; Sperling et al., 2016). With the adjustments being made to the EMR and the satisfaction survey used by the facility these

quality indicators can be assessed in the near future. Analysis of these quality indicators will provide more information for the staff and help to sustain this practice change. The further collection of this data and correlation with the literature could help spread this practice change to other facilities in the medical system providing labor and delivery services. Recommendations for future QI projects include the impact of nutrition in labor on the duration of the first and second stages of labor, the rate of vaginal deliveries converted to cesarean delivery, the impact on workload for the nursing staff with the addition of the clear liquid diet order, and assessing the impact on stress, pain and dissatisfaction with the labor experience.

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Tables

Table 1
Compliance with Appropriate Diet Orders over Nine Week Implementation Period

	High-Risk of Operative Delivery	Low Risk of Operative Delivery	Total Parturients
	N = 137 (58.3%)	N = 98 (41.7%)	N = 235
Compliance with Appropriate Diet Orders	Mean	Mean	Mean
Baseline	98%	0%	61%
Completion of 2 Week Education	98%	38%	74%
After Reminder Email	96%	52%	75%
Final	100%	55%	75%
Reported Complications	0	0	0
High-Risk Characteristics	Frequency		Frequency
Maternal Age > 35	20 (8.5%)	Pre-Term Gestation	15 (6.4%)
Gestational HTN	19 (8.1%)	Pre-Eclampsia	7 (3%)
Non-Reassuring FHR	19 (8.1%)	History of Previous C-Section	5 (2.1%)
Illicit Drug or Alcohol Use	19 (8.1%)	Increased Indication for C-Section	5 (2.1%)
Diabetes	17 (7.2%)	Post-Term Gestation	1 (0.4%)
BMI >40	17 (7.2%)		

Figure 1: Kotter's Model of Change

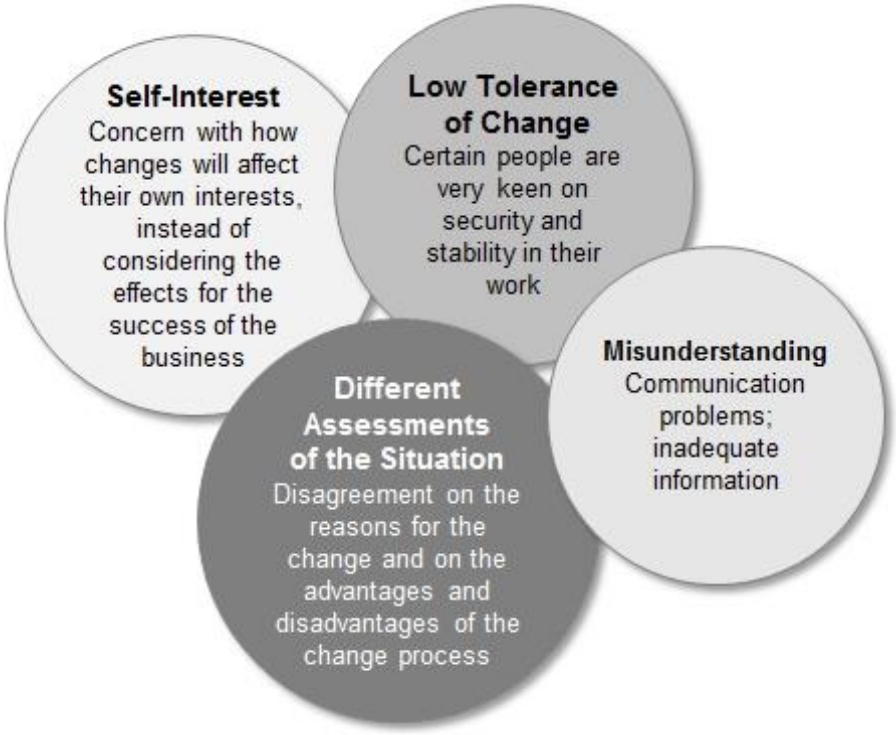

Figure 1. The four primary reasons for resistance to change in Kotter's Model of Change (Jacoby, 2011)

Figure 2: Kotter's Model of Change: Dealing with Resistance

Approach	Commonly used in situations	Advantages	Drawbacks
Education + Communication	Where there is a lack of information or inaccurate information and analysis.	Once persuaded, people will often help with the implementation of the change.	Can be very time consuming if lots of people are involved.
Participation + Involvement	Where the initiators do not have all the information they need to design the change, and where others have considerable power to resist.	People who participate will be committed to implementing change, and any relevant information they have will be integrated into the change plan.	Can be very time consuming if participators design an inappropriate change.
Facilitation + Support	Where people are resisting because of adjustment problems.	No other approach works as well with adjustment problems.	Can be time consuming, expensive, and still fail.
Negotiation + Agreement	Where someone or some group will clearly lose out in a change, and where that group has considerable power to resist.	Sometimes it is a relatively easy way to avoid major resistance.	Can be too expensive in many cases if it alerts others to negotiate for compliance.
Manipulation + Co-optation	Where other tactics will not work or are too expensive	It can be a relatively quick and inexpensive solution to resistance problems	Can lead to future problems if people feel manipulated
Explicit + Implicit Coercion	Where speed is essential, and the change initiators possess considerable power.	It is speedy and can overcome any kind of resistance	Can be risky if it leaves people mad at the initiators.

Figure 2. Methods for dealing with resistance to change (Kotter & Schlesinger, 2008)

Figure 3: Nutritional Flyer for Prenatal Classes

During Active Labor:

For most women, it is ok to drink during labor. Your hospital care team will discuss with you if restrictions arise during your labor. Consider bringing your favorite drinks with you to the hospital.

Suggestions:

Choose drinks high in carbohydrates without carbonation or pulp:

Carbohydrate based Sports Drinks: Gatorade®, PowerAde®, Ensure Clear®

Fruit Juices without pulp

Popsicles without fruit pieces

Tea, Broth, Water

Figure 3. Labor nutritional flyer for distribution in the prenatal birthing class

Figure 4: Run Chart of Daily Compliance with Appropriate Diet Orders

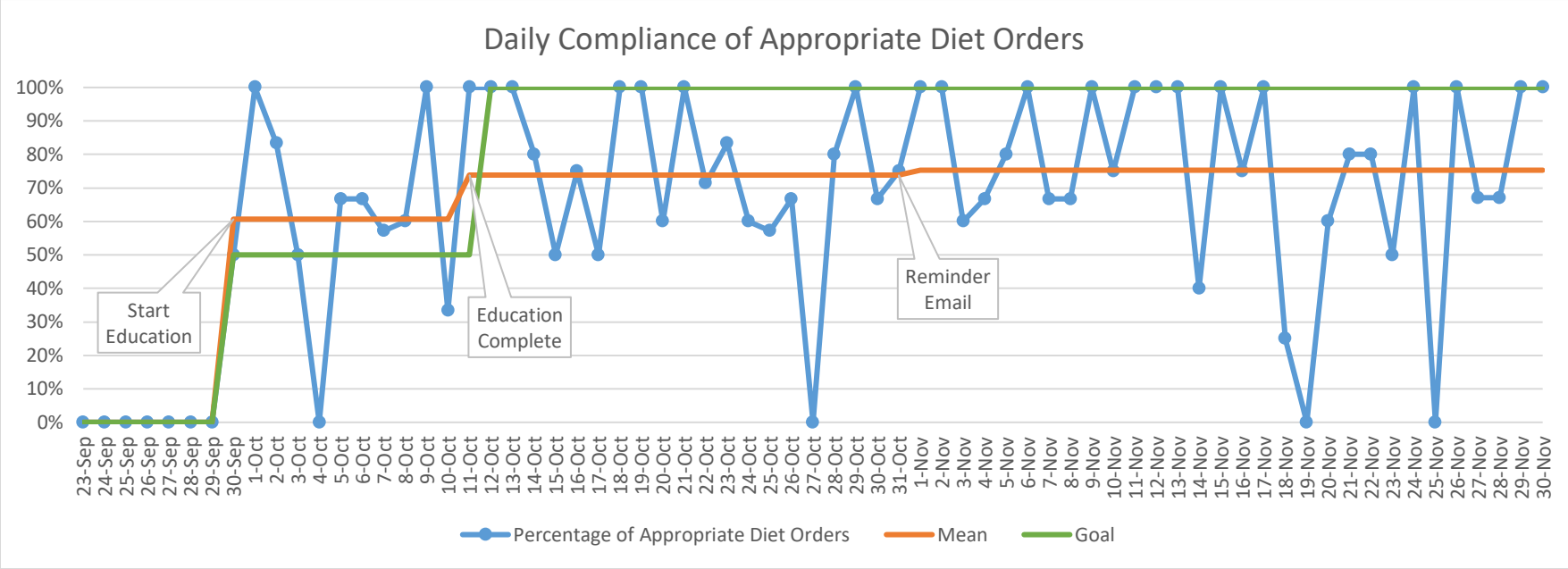

Figure 4. Run chart with daily percentage of compliance with appropriate diet orders over nine week implementation period.

Appendix A: Policy for Carbohydrate Based Liquid Nutrition for Women in Labor

TITLE:	Carbohydrate Based Liquid Nutrition for Women in Labor
DEPARTMENTS:	Anesthesia, Obstetrics, Labor and Delivery, Food and Nutrition Services
ATTACHMENTS:	1. Obstetrical Risk Stratification for Operative Delivery Tool
	2. Example of Carbohydrate Based Clear Liquids

PURPOSE:

I. To provide guidelines for the safe administration of carbohydrate based clear liquids for oral nutrition in the laboring woman at low risk of an operative delivery.

DEFINITIONS:

I. Carbohydrate based clear liquids: A clear liquid with less than 8% carbohydrates, un-carbonated, and pulp free. (Examples in attached table)

LEVEL OF RESPONSIBILITY:

I. The admitting Obstetrical Provider: Obstetrician or Certified Nurse Midwife
II. The Anesthesia Provider: Anesthesiologist or Certified Registered Nurse Anesthetist

POLICY:

I. Laboring women who are admitted to MedStar Franklin Square Medical Center will be evaluated by their admitting obstetric provider, who will order an appropriate diet based on individual risk of an operative delivery. The women will be reassessed by an anesthesia provider, who will adjust the diet order if necessary, prior to anesthetic care to determine the risk of a general anesthesia in case of an operative delivery. These women will have their nutritional needs supported by the Food and Nutrition Department.

PROCEDURE:

I. Admitting Obstetrical Provider
   A. Risk of Operative Delivery Screening: A laboring woman will be screened, using the attached screening tool, by the admitting provider to determine if she is an appropriate candidate to drink during labor.

1. Ordering: Women determined to be at low risk of an operative delivery will have a "Clear Liquid Diet" as part of their admission order set
2. Ordering: Women determined to be at low risk of an operative delivery will have an "NPO + Ice Chips" order as part of their admission order set

B. Change in maternal or fetal status: If at any time the risk of an operative delivery for a woman has changed, the obstetric provider will change the diet order

II. Anesthesia Provider
- A. Risk of Operative Delivery Screening: A laboring woman will be screened, using the attached screening tool, by the anesthesia provider to determine her risk of a general anesthetic should an operative delivery be necessary.
  1. Ordering: If she is an appropriate candidate to continue drinking during her labor no change is necessary.
  2. Ordering: If the woman is determined to be high-risk and she needs to stop drinking during her labor, the anesthesia provider will consult the obstetric provider and the diet order will be changed to "NPO + Ice Chips".

III. Labor and Delivery Registered Nurses
- A. NPO + Ice Chips diet order: provide the woman in labor only ice chips
- B. Clear Liquid diet order: provide the woman in labor with appropriate clear liquid nutrition, based on the examples in the attached table.
  1. Carbohydrates are to be limited to < 90 grams every 3 hours
  2. Clear liquids should be un-carbonated, pulp free, and be < 8% carbohydrates
- C. Change in maternal or fetal status: If at any time the risk of an operative delivery for a woman has changed, the registered nurse will notify the obstetric provider for re-evaluation and possible change to the diet order

IV. Food and Nutritional Services
- A. Food and Nutrition Services will furnish the Birthing Center with appropriate carbohydrate based clear liquids
  1. Examples are included in the attached table and should be un-carbonated, pulp free, and contain 8% or less carbohydrates

DOCUMENTATION:

I. Diet Order
- A. The initial diet order will be entered by the obstetric provider with the admission order set.
- B. The obstetric provider or anesthesia provider will modify the diet order as necessary if the status of the woman in labor changes

II. Consumption of Clear Liquids
- A. The registered nurse will document the amount of liquids consumed in the Intake/Output section of the EMR.

Obstetrical Risk Assessment for Operative Delivery Tool	
Low Risk (Clear Liquid Diets)	**High-Risk (NPO + Ice Chips)**
Full Term (> 37 weeks Gestation)	Pre-term (< 37 weeks Gestation) Post-term (> 42 weeks Gestation)
Singleton Pregnancy	Multiple (Twins) Pregnancy
Vertex Presentation	Breech presentation (Non-Cephalic Presentation)
No history of previous cesarean section	History of previous Cesarean Section
BMI < 40	BMI > 40
Maternal Age < 35 years	Maternal Age > 35 years
Use of Labor Epidural for analgesia	Antepartum Hemorrhage
	Illicit Drug or Alcohol Abuse
	Diabetes (Blood Glucose > 150)
	Hypertension, Pre-Eclampsia, Eclampsia
	Protracted Labor Course
	Increased Indication for Cesarean Section
	Non-Reassuring Fetal Status
Anesthesia Risk Assessment in case of General Anesthesia	
Low Risk	**High-Risk**
ASA Physical Status 1-2	ASA Physical Status 3-5
Mallampati Score 1-2	Mallampati Score 3-4
	Limited Range of Motion in Neck or Jaw

High-Risk Patients: Allowed only ice chips or Nothing by Mouth (NPO)

Low Risk Patients: Allowed Clear Liquids with 30- 90 grams of carbohydrates every 3 hours (See table below for examples)

Clear Liquids	**Carbohydrates per Serving**
Tea	0
Coffee	0
Broth	1 gram
Fruit Juices	15 gram
Carbohydrate Sports Drink	35 grams
Ensure Clear Supplement	43 grams

Appendix B: Literature Review

Author, Year	Study objective/ intervention or exposures compared	Design	Sample (N)	Outcomes studied	Results	Level and Quality of Rating
Ciardulli et al. (2017)	Meta-analysis to evaluate the effect of oral nutrition in labor compared to traditional ice chips/sips of water. The oral nutrition group were allowed to have a low residue diet in 3 studies, honey date syrup in 1 study, carbohydrate drinks in 5 studies and unrestrictive food intake in 1 study.	Meta-analysis	10 Randomized Controlled Trials (RCTs) were included with a total sample size of 3,982 low risk laboring women with singleton pregnancies. The women were homogeneous in low risk characteristics, but were from all areas of the world and ethnicities.	The primary outcome measured was the mean duration of labor (in minutes). The secondary outcomes were cesarean delivery, operative vaginal delivery (forceps or vacuum), ketosis, low (less than 7) Apgar scores at 5 minutes, vomiting, epidural analgesia, labor augmentation, regurgitation during general anesthesia, and fetal admission rates for the neonatal intensive care unit.	The primary outcome of shorter duration of labor with less restrictive food intake was associated with a reduction in labor duration with a mean difference of -16 minutes, 95% CI -25 to -7. The secondary outcomes were unchanged or no difference between groups in all instances. The intervention group (1,329 subjects) had no instances of regurgitation during general anesthesia (Mendelson Syndrome) with 95% CI of 0-0.28%.	Level I (A-High)
Singata et al. (2013)	A meta-analysis, conducted by the Cochrane Library, of RCTs evaluated the use of multiple forms of oral nutrition vs complete restriction or ice chips/sips of water during labor.	Meta-analysis	19 studies were identified with 5 RCTs categorized as appropriate for inclusion. The 5 RCTs had a combined total of 3,130 women identified as low risk for potential of requiring an operative delivery or general anesthetic. The women were homogeneous in	The outcomes measured were rates of caesarean section, operative vaginal births, Apgar scores less 7 at 5 minutes, and rates of Mendelson Syndrome.	The outcome measures showed no statistically significant differences. The results were: cesarean births (average risk ratio (RR) 0.89, 95% CI 0.63 to 1.25), operative vaginal births (average RR 0.98, 95% CI 0.88 to 1.1) and Apgar scores less than 7 at 5 minutes (average RR 1.43, 95% CI 0.77 to 2.68). There was not enough data to assess incidence of Mendelson Syndrome. Based on the evidence the authors reported no benefit or harm when	Level I (A-High)

			low risk characteristics, but were from all areas of the world and ethnicities.		women were provided oral nutrition in labor.	
O'Sullivan et al. (2009)	An RCT designed to evaluate a control group with only ice chips/water and the experimental group with a low fat, low residue diet as well as ice chips and water. The experimental group was allowed bread, biscuits, vegetables, fruits, low fat yogurt, soup, isotonic drinks, and fruit juice.	Randomized Controlled Trial	This was an RCT of 2,426 non-diabetic, nulliparous women with a cephalic presenting singleton, full term fetus and in labor with 6cm or less cervical dilation. Homogenous population of women in one location with the same low risk pregnancy	The primary measure was the rate of vaginal versus cesarean deliveries. The secondary measures were duration of labor, need for augmentation of labor, incidence of vomiting, and neonatal outcomes.	The results of the primary measures, vaginal vs. cesarean delivery, were no differences between the two groups at 44% each. There was no difference in any of the secondary measures, specifically duration of labor was 597 minutes in the experimental group vs. 612 minutes in the control group (ratio of geometric means 0.975, 95% CI 0.927 to 1.025)	Level II (B-Good)
King et al. (2011)	The authors of this review noted a lack of evaluation of the other factors affecting women's choice of nutrition in labor such as personal opinions, outdated or non-existent policies. This review of the literature aimed to determine the evidence regarding safety of oral nutrition in labor with the other factors. The authors noted a much wider search in time to find evidence of the other factors.	Systematic Review	A total of 15,468 women and 1,091 practitioners were included in the analysis from a total of 20 studies ranging from qualitative surveys up to RCTs.	The primary outcome measures were implications/impacts that oral intake had on maternal and fetal/infant outcomes (length of labor, mode of birth, emesis and gastric aspiration, metabolic alterations of the woman, and fetal birthing outcomes. Barriers to oral nutrition in labor (lack of policy, opinions, evidence or lack of evidence) were the secondary outcomes measured.	The primary outcomes measured showed no difference when oral nutrition was allowed during labor. The amount of emesis and the length of labor had small increases, but women did not show a decrease in satisfaction or experience in the studies as well as cause any harm. Women stated they would accept the risk of higher emesis or longer labor in exchange for the benefits of nutrition during their labor experience. The authors identified outdated and non-existent policies, lack of evidence, and health practitioner's opinions as significant barriers to providing oral nutrition in labor.	Level I (B-Good)
Vallejo et al. (2013)	To determine whether a high protein drink in labor vs. ice chips/water decreased nausea and	Randomized Controlled Trial	150 women with gestation > 36 weeks, singleton pregnancy in vertex position, cervical	Incidence of Nausea (on a VRS scale 1-10) and Emesis (rated as yes/no)	No difference in the rates of Nausea (protein drink: 20.6%, control: 33.3%, p=0.14) or Emesis (protein drink: 4.8% and control: 13.3%, p=0.15) between the	Level II (B-Good)

	emesis and increased patient satisfaction.		dilation < 5cm, requesting a laboring epidural analgesic with > 4 hours of previous NPO time.	were measured hourly until 1 hour post-delivery. Patient satisfaction was rated the day after delivery on a VRS scale of 0-100.	control group and the protein drink group. The satisfaction scores were higher in the protein drink group (100/100) than in the control group (95/100) (*p*=0.007).	
Sharts-Hopko (2010)	Review evidence and practices within and outside the United States related to maternal fasting during labor	Systematic Review	16 studies (ranging from RCTs to qualitative surveys) were included for comparison and review from 8 different countries.	The effects of oral intake during labor were evaluated from the studies to include: energy needs in labor, ketosis, hyponatremia, maternal stress, vomiting, and obstetric outcomes (length of labor, method of delivery, fetal acid-base balance, Apgar scores, etc.)	Energy demands/needs are similar to moderate aerobic exercise. Hyponatremia is seen in those who only ingest ice chips/water and less common with oral nutrition. Maternal stress is higher in those not receiving oral nutrition (as high as 57% report moderate to very stressful). Vomiting rates were highest in women who consumed food, higher in the women who consumed carbohydrate liquids, and lowest in the ice chips/water group; however, there were no differences in aspiration rates or satisfaction rates. No differences shown in any studies with obstetrical outcomes.	Level I (B-Good)
The American Society of Anesthesiologists (2016)	Update the Practice Guidelines for Obstetric Anesthesia via an evidence review and survey of experts. The purpose of the guideline is to enhance the quality and safety of anesthetic care for obstetric patients.	Systematic Review	Scientific evidence was determined via a literature search of peer-reviewed journals, PubMed, healthcare databases, direct internet searches, task force members and experts in the field. All evidence was graded/rated with a clear and well described scale	The focus was on anesthetic management of patients during 1)labor, 2) non-operative delivery 3) operative delivery 4) selected aspects of postpartum care and analgesia 1) Peri-anesthetic evaluation and preparation – Specifically aspiration prevention 2) Anesthetic Care for Labor and Vaginal	The recommendation for aspiration prevention and oral nutrition in labor are the same. -Oral intake of moderate amounts of clear liquids may be allowed for uncomplicated laboring patients. The volume of liquid is less important than the presence of particulate matter. Examples of acceptable liquids include water, fruit juices without pulp, non-carbonated beverages, clear tea, black coffee and carbohydrate sports drinks. -Laboring patients with additional risk factors for aspiration or operative delivery (morbid obesity, diabetes, difficult airway, non-reassuring fetal	Level 1 (B-Good)

				Delivery – Specifically oral nutrition during labor 3) Anesthetic Care for Cesarean Delivery 4) Management of Obstetric and Anesthetic Emergencies	heart rate pattern) may need further restrictions of oral intake -Solid foods should be avoided	
Eliasson et al. (1992)	Determine the energy and ventilatory requirement of normal labor and delivery. After determination of energy and ventilatory requirements determine if there is an efficient method to predict a woman's ability to tolerate the increased demand of labor with chronic lung conditions.	Randomized Controlled Trial	16 healthy women in the third trimester of pregnancy had Pulmonary Function Tests in the office and then 8 had the tests repeated during the first stage of labor.	Oxygen consumption (VO2) and minute ventilation (VE) were measured breath by breath for 10 minutes in the office and then again during the first stage of labor. The oxygen consumption and minute ventilation were used to extrapolate the amount of energy necessary for labor.	The VO2 at rest was 3.56 ml/kg/min (+/- 0.82 SD) and 4.25 ml/kg/min (+/- 0.93) during labor showing an average increase of 23% (p=0.04). The mean VE was 0.15 l/kg/min (+/- 0.03) in the office and 0.24 L/kg/min (+/- 0.11) in labor showing an average of 65% increase (p=0.05). At the peak of contractions the VO2 increased as high as 86% and VE increased as high as 167% above baseline.	Level II (C-Low) This is a Seminal study used to quantify energy needs during labor and was included as a definitive measure of energy expenditure
Rodriguez et al. (2009)	To determine optimal nutrition to help enhance physical activity, athletic performance, and recovery from exercise.	Systematic Review	A work group of American dietitians, Canadian dietitians, and the American College of Sports Medicine performed a systematic analysis and evaluation of supporting research evidence using the ADA's Evidence Analysis Process.	Five topic specific questions were answered. First, the relationship of energy balance and body composition. Second, evidence to support a particular meal timing, energy intake and macronutrient for optimal performance and training. Third and fourth, support of a particular meal timing, energy intake and macronutrient intake before performance and	Hydration is critical during sustained moderate to high athletic performance. The goal is to prevent a water deficit of greater than 2% of body weight. For athletic performance lasting longer than 1 hour, 0.7 grams of carbohydrates/kg of body weight per hour (30-60 grams per hour and should primarily yield glucose) has shown extended endurance and performance. Greater impact is seen when patients have not carbohydrate loaded prior to the exercise.	Level I (B-Good)

				during performance. Fifth, what is the evidence to support a particular meal timing for recovery	Sports drinks containing 6-8% carbohydrates are recommended and have shown short amount of time for gastric emptying when the carbohydrates are limited to <8%.	
Henry et al. (2017)	A case report for implementation of a practice change (Improving Breastfeeding) on an obstetrical unit using a specific change theory framework.	Qualitative Study (Case Report)	Free standing 98 bed maternity facility trying to achieve a "Baby Friendly" Designation. They implemented a practice change with a follow up survey to evaluate results. After primary survey the implementation was unsuccessful and a second attempt at implementation based a framework was performed with follow up survey	After the primary survey it was determined a cultural change did not occur with the primary implementation based on practice changes in 10 areas (only successfully changed 2 of 10 measures). The primary outcome of the new implementation was to achieve change in all 10 areas necessary to be designated as "Baby Friendly".	By implementing a Change Theory framework (Kotter's Change Theory) a cultural change was achieved, specifically by changing attitudes and behaviors of the staff. With the change in staff and furthering the change the facility was able to obtain the desired designation/certification.	Level VI (B-Good)

Rating System for Hierarchy of Evidence

Level of the Evidence	Type of the Evidence
I (1)	Evidence from systematic review, meta-analysis of randomized controlled trails (RCTs), or practice-guidelines based on systematic review of RCTs.
II (2)	Evidence obtained from well-designed RCT
III (3)	Evidence obtained from well-designed controlled trials without randomization
IV (4)	Evidence from well-designed case-control and cohort studies
V (5)	Evidence from systematic reviews of descriptive and qualitative studies
VI (6)	Evidence from a single descriptive or qualitative study
VII (7)	Evidence from the opinion of authorities and/or reports of expert committees

(Melnyk & Fineout-Overholt, 2015)

Rating Scale for Quality of Evidence

A: High – consistent results with sufficient sample, adequate control, and definitive conclusions; consistent recommendations based on extensive literature review that includes thoughtful reference to scientific literature

B: Good – reasonably consistent results; sufficient sample, some control, with fairly definitive conclusions; reasonably consistent recommendations based on fairly comprehensive literature review that includes some reference to scientific evidence

C: Low/major flaw – Little evidence with inconsistent results; insufficient sample size; conclusions cannot be drawn

(Newhouse, 2006)

Appendix C: Audit Tool: Distribution of Nutritional Flyer in Birthing Class

Audit Tool: Distribution of Nutritional Flyer in Birthing Class			
Date of Birthing Class	# of Participants	# of Nutritional Flyers Distributed	Rate of Compliance (percentage)

Appendix D: Audit Tool: Use of Appropriate Diet Order Daily Compliance Rates

Audit Tool: Use of Appropriate Diet Order Daily Compliance Rates						
September 2019	**# of Appropriate NPO + Ice Chips Diet Order (High-Risk)**	**# of High-Risk Women**	**High-Risk Characteristics**	**# Appropriate Clear Liquid Diet Order (Low Risk)**	**# of Low Risk Women**	**Total # of Patients Admitted**
29						
30						
October 2019	**# of Appropriate NPO + Ice Chips Diet Order (High-Risk)**	**# of High-Risk Women**	**High-Risk Characteristics**	**# Appropriate Clear Liquid Diet Order (Low Risk)**	**# of Low Risk Women**	**Total # of Patients Admitted**
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