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NICU Staff Use of Taste For Preterm Infants

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NICU Staff Use of Taste For Preterm Infants

by

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Abstract

Background: Food taste experience for tube fed preterm infants is sporadic and provided with milk feeds or glucose solutions. It is unknown how often taste experience is provided with tube feeding.

Objectives: The research examined the knowledge, beliefs, and practices of NICU staff regarding preterm infant taste and whether these factors differ among staff by NICU site, experience, or profession.

Methods: A cross sectional survey method was used and a 14 item questionnaire was developed.

Results: The majority of staff lacked knowledge regarding fetal and preterm sense of taste development. Conversely, staff believed strongly in, and routinely provided taste during tube feeding. Practice varied across professions and by months of experience. Practice did not vary to the same degree by NICU sites.

Conclusions: Opportunities exist to address gaps in NICU staff knowledge of preterm infant taste. Standardization of taste practices and updating of guiding documents are needed.

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Sydney, I always saw your face, no matter where I was or what I was doing

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List of Symbols, Abbreviations, and Nomenclature

0.9% NS	0.9% Normal Saline
AHS	Alberta Health Services
CA	Content Analysis
CQI	Continual Quality Initiative
CHREB	University of Calgary Conjoint Research Ethics Board
EBM	Expressed Breast Milk
ETT	Endotracheal Tube
FMC	Foothills Medical Centre
FMRI	Fetal Magnetic Resonance Imaging
GA	Gestational Age
GI	Gastrointestinal
IQR	Inter Quartile Range
Kcal/kg/day	Kilocalorie per kilogram per day
KW	Kruskal-Wallis test
LDA	Linear Discriminant Analysis
LPN	Licensed Practical Nurse
LR	Logistic Regression
MD	Medical Doctor
μg/kg/minute	Micrograms per kilogram per minute
mg%	Milligram percent
mg/dl	Milligrams per deciliter
mg/kg/day	Milligrams per kilogram per day

MRI	Magnetic Resonance Imaging
MW-U	Mann-Whitney U test
n	Number of subjects in a sub-sample
N	Number of subjects in the sample
NGT	Nasogastric Tube
NICU	Neonatal Intensive Care Unit
NNP	Neonatal Nurse Practitioner
NNS	Nonnutritive Sucking
NPO	Nil Per Os (nothing by mouth)
OAD	Oral Aversion Disorder
OFG	Oral Feeding Guidelines
OGT	Oral Gastric Tube
OMM	Own Mother's Milk
p	Probability, statistical significance level
PCA	Post Conceptual Age
PIPP	Premature Infant Pain Profile
PLC	Peter Lougheed Centre
PO	Per Os (by mouth)
RGH	Rockyview Medical Centre
ROFG	Regional Oral Feeding Guideline
RN	Registered Nurse
SD	Standard Deviation
TRA	Theory of Reasoned Action

χ^2	Chi square test statistic
VAS	Visual Analog Scale
>	Greater than
<	Less than

Chapter One: Introduction

Preterm birth, defined as birth at a gestation of less than 37 completed weeks, is rising in Canada with over 26,000 preterm infants born in 2010 [Canadian Institute for Health Information (CIHI), (2011)]. Alberta has the highest preterm birth rate in Canada at 8.8 per 100 births with 4715 live preterm births in 2010 (CIHI, 2011; Statistics Canada, 2011). Feeding preterm newborns is especially challenging for infants born at or less than week 33 of gestation (Edwards & Spatz, 2010; Kristoffersen, Skogvol, & Hafström, 2011; Medoff-Cooper, Verklan, & Carlson, 1993; Rodriguez et al., 2010; Vandenberg, 1990). Providing nutrition for infants born preterm can be difficult with far reaching consequences such as long term feeding problems in infancy and beyond (Daley & Kennedy, 2000; Edwards & Spatz, 2010; Premji & Paes, 2000; Rodriguez et al., 2010; Zorc, 2001). Infants born at less than 33 weeks gestation are tube fed milk feeds due to immature breathing and swallowing coordination (Edwards & Spatz, 2010; Kristoffersen, Skogvol, & Hafström, 2011; Medoff-Cooper et al., 1993; Vandenberg, 1990). Tube feeding delivers expressed breast milk (EBM) or formula directly into the stomach using an oral gastric (OG) or naso gastric (NG) catheter (Kristoffersen et al., 2011; Medoff-Cooper et al., 1993; Vandenberg, 1990). Tube feeding bypasses the mouth and therefore the sense of taste. In the early neonatal period and in later infancy, taste may be important to the well-being of infants born preterm (Edwards & Spatz, 2010; Rodriguez et al., 2010; Zorc, 2001).

Providing taste with tube feeding of preterm infants is practiced in the neonatal intensive care unit (NICU) but the frequency and the reasons for which taste might be provided are unknown. Thus, before the efficacy of providing taste with feeding can be

explored, there needs to be investigation of staff knowledge, beliefs, and practices of using taste. Identifying the practices and understanding the influences that guide staff might facilitate modification of existing guidelines and permit consistency in care. This will also provide a basis for future studies examining effectiveness of taste in promoting feeding outcomes and preventing or reducing feeding problems later in life.

1.1 Background

Prenatally it is known that the fetal sense of taste is functional (Browne, 2008). It is also known that the developing infant swallows the surrounding amniotic fluid (Browne, 2008; Tong et al., 2009). The intrauterine environment is not only replete with maternal sounds such as heart beat, respirations, and bowel sounds, it features the rich chemosensory input of taste as well (Browne, 2008; Weiss, Hofman, Winter, Pürstner, & Lichtenegger, 1985). In addition to other functions and types of sensory input, the amniotic fluid carries the flavours of maternal diet and is directly influenced by maternal glucose levels which renders it sweet (Browne, 2008; Sozanskii, 1961; Weiss et al., 1985). However, extrauterine life for the infant born preterm is vastly different.

When born prematurely infants are placed in a warmed dry isolette. This is a much different environment from the warm, sweet, fluid filled medium of the amniotic sac with its commensurate rich, moist taste experience (Browne, 2008). The taste experiences offered in the NICU are latex and plastic from the placement of endotracheal tubes (ETT), OG and NG tubes, and soothers. Taste is also experienced from emesis, salty solutions (0.9% saline), and sterile water. Sugary solutions are offered by a variety of methods during painful procedures and moments of distress. These experiences are reflective of what occurs in the Calgary, Alberta NICUs located in the Foothills Medical

Centre (FMC), the Peter Lougheed Centre (PLC), and the Rockyview General Hospital (RGH).

At all three hospitals, the care in Level II NICUs is tailored for two types of infants with high care-needs. The first type of Level II infants are those born at a gestational age of 32 weeks or greater and/or with a birth weight of 1500 grams or greater, and whose illnesses are not severe. The second type of Level II infants are those who no longer require the highly intense environment of the Level III NICU but still require close monitoring and nursing support. The infants are often call "graduates" of Level III care (Jefferies & Kirpalani, 2012). In the FMC, where the Level III NICU is located, the care is designed for any neonate, regardless of size or gestation, who requires various forms of mechanical ventilation support and/or surgical intervention (Jefferies & Kirpalani, 2012). Often assignments in the FMC's NICU will pair the care of a Level III infant with the care of a Level II infant, thus making care delivered on this part of the unit mixed Level II and Level III care.

All three units utilize a team approach to care with respect to most medical decisions and particularly feeding decisions. In the team approach to feeding decisions a dietician is consulted as well as a pharmacist, neonatologists, parents, and direct care clinical staff. Decisions are made with respect to amount of calories consumed, any drug interactions, plans for increasing or decreasing feeds, and best times for initiating first feeds, timing between feeds, type of feed to use (formula or EBM) and method of feeding (i.e. if feed is drained into the tube by gravity or delivered by syringe pump over time). From observation, it is evident that in both levels of NICU care, tube feeding is a common practice with breast or bottle feeding being more common in Level II care. It

might be that Level II care provides more opportunity for tasting during tube feeding, but the frequency of occurrence is unknown. While the factors associated with staff decision making around providing taste for preterm infants who are tube fed are unknown, the long term implications of tube feeding are relatively well known.

Problems associated with feeding are a concern for many preterm born infants while in the NICU (DeMauro, Patel, Medoff-Cooper, Posencheg, & Abbasi, 2011; McNeil, 2008). Additionally, there can be long lasting feeding difficulties, such as oral aversion, requiring costly and complex treatment once infants are discharged from hospital (Cerro, Zeunert, Simmer, & Daniels, 2002; Edwards & Spatz, 2010; McNeil, 2008; Rodriguez et al., 2010; Zorc, 2001). By far the best approach would be to prevent feeding problems. Providing taste with tube feeding for preterm infants in the differing levels of NICU might contribute to preventing feeding problems.

Providing sweet taste and taste-of-feed experience with tube feeding has been suggested by the authors of four studies as an intervention to improve feeding performance in preterm newborns (Edwards & Spatz, 2010; Mattes et al., 1996; Rodriguez et al., 2010; Zorc, 2001). The one small randomized controlled trial (RCT) that used a sweet soother demonstrated no conclusive proof of beneficial effect, but did not demonstrate harm either (Mattes et al., 1996). Despite small sample sizes, two RCTs demonstrated beneficial effects of taste stimulation to promote oral feeding readiness and performance (Rodriguez et al., 2010; Zorc, 2001). The other published study on taste intervention successfully used expressed breast milk (EBM) for mouth care as one of three interventions to promote breast feeding (Edwards & Spatz, 2010). Providing an EBM taste experience was found to be safe and provided some benefit to future feeding

outcomes in the short term for infants who were born very preterm (infants born at or less than week 25 of gestation) (Edwards & Spatz, 2010; Mattes et al., 1996; Rodriguez et al., 2010; Zorc, 2001). It is therefore reasonable to conclude that, within the Calgary NICUs, providing EBM taste experiences for preterm infants might also be beneficial.

However, staff guidelines for feeding preterm newborns may be worded ambiguously or, in certain cases, may be interpreted as contraindicative of taste experiences. The Alberta Health Services (AHS) Regional Oral Feeding Guideline (ROFG), which was adopted in 2004, describes oral stimulation with taste, but provides little developmental data about the appropriateness of the intervention (Alberta Health Services, 2009; Lasby, 2011; Premji, McNeil, & Scotland, 2004). Furthermore, the guideline is worded to discourage over stimulation of the very preterm infant. Thus, provision of taste experiences might be considered by staff as over stimulation. The decision to offer taste in the NICU is thus discretionary, with emphasis placed on minimal handling of the very preterm infant, and based on assumptions that the staff are knowledgeable about the fetal development of sense. However, it was unknown at the time the study was contemplated the level of knowledge and other factors (years of staff experience, profession, level of care, or profession of the staff member on the unit) that might guide staff in taste provision as part of routine feeding. It was also difficult to know how the guideline was being used when decisions to offer taste were being made. Also unknown were if beliefs about the sense of taste influenced the decision to offer taste experience.

Factors that guide care and guideline uptake have been researched (Baker, McGrath, Lawson, Liverman, & Cohen, 2009; Ellsworth, Stevens, & D'Angio, 2010; El-

Naggar & McNamara, 2012; McCord, 2011) and reviewed (Coombs & Eressor, 2004; Dennis, 2002; Flodgren et al., 2011; Mackintosh, Berridge, & Freeth, 2009). Factors that have been found to play a role in practice decisions are personal knowledge base, experience, beliefs, influence of leaders, input from other colleagues, and clinical guidelines (Coombs & Eressor, 2004; Dennis, 2002; Flodgren et al., 2011; Mackintosh et al., 2009). However no investigations were found on how feeding guidelines are interpreted with respect to offering taste experience to preterm infants.

Outside of the AHS, informal discussions with neonatologists, registered nurses (RNs), and licensed practical nurses (LPNs) about taste development indicated a general lack of knowledge about fetal taste development. This is understandable when some of the current texts on the care of preterm infants are examined. The content of seven commonly available text-books on either maternity, neonatal care, or both, that can be referred to by staff working in NICUs, were examined. One text, which was devoted only to neonatal care, provided information on fetal development of the sense of taste but no guidance on taste provision during tube feeding (Gardner, Carter, Enzman-Hines, & Hernadez, 2011). The remaining six did neither (Boxwell, 2010; Hockenberry & Wilson, 2007; Kenner & Lott, 2007; Kyle & Kyle, 2007; Merenstein & Gardner, 2011; Pilliteri, 2009). This general omission of developmental information about preterm infant sense of taste and failure to mention taste as an adjunct to tube feeding, may explain the lack of knowledge and lack of uniformity in practice that I observed.

In Calgary I have observed a wide range of practices to provide taste experience including the single use of soothers, swabs, fingertips, and drops of EBM from a syringe, or combinations of these practices. Thus, in addition to a perceived lack of knowledge for

decision making, there were observed inconsistent practices in providing taste for preterm infants. It was unknown if these differences were based on staff experience, level of care, profession, or location of hospital in which the NICU resides in Calgary. It is important to understand when, why or even if, staff in both levels of care are offering taste with feedings as a practice. Modification of practice guidelines might be justified based on answers to these questions. Furthermore, taste interventions to improve feeding performance can be more rigourously evaluated if all nursing staff implement the intervention consistently.

In summary, the sense of taste is functional prenatally and taste is thought to be a normal experience in the intrauterine environment (Browne, 2008; Gardner, Carter, Enzman-Hines, & Hernadez, 2011; Ross & Nijland, 1998; Sozanskii, 1961; Weis et al., 1985). By contrast, taste for the neonate in the NICU is more commonly associated with non-feeding interventions (Merenstein & Gardner, 2011). Providing taste experiences might prevent feeding issues in NICU as well as positively impact feeding outcomes for prematurely born infants (Edwards & Spatz, 2010; Rodriguez et al., 2010; Zorc, 2001). Four small studies demonstrated either short term benefits of taste provision (Edwards & Spatz, 2010; Rodriguez et al., 2010; Zorc, 2001) or no overt harm from the practice (Mattes et al., 1996) but the ROFG (Alberta Health Services, 2009) may be ambiguously worded, thus decisions might be discretionary when it comes to directing care in this regard. Staff discretion might be associated with knowledge and beliefs about the sense of taste in the preterm infant and might further be associated or affected by staff years of experience, unit worked in, profession, level of care, and/or role on the unit.

1.2 Research Objectives

The three main objectives for this thesis were to:

1. Determine the level of health care professionals' knowledge about preterm infant sense of taste.
2. Describe healthcare professionals' beliefs about preterm infant sense of taste.
3. Describe the practices of professionals in utilizing the sense of taste of preterm infants while tube-feeding.

1.3 Research Questions

The primary question about providing preterm infants with taste experience during tube feedings was:

1. What are the knowledge, beliefs, and practices of NICU staff?

The secondary questions about health care professionals providing preterm infants with taste experience during tube feedings were:

2. Do knowledge, beliefs, and practices differ in NICU staff working by site?
3. With respect to knowledge, beliefs, and practices, are there differences when compared by:
    - months of service?
    - profession?

Chapter Two: Literature Review

2.1 Introduction

When healthcare staff tube feed a preterm infant, the sense of taste is bypassed and EBM or formula is delivered directly into the infant's stomach. Provision of taste with feeding may be dependent on factors such as knowledge, beliefs, and practice guidelines. However, before staff knowledge, beliefs, and practices are examined, it is important to examine the evidence for and the relevance of the sense of taste in the tube fed preterm infant.

To address the evidence and relevance of the sense of taste in the tube fed preterm infant, the first part of the literature review includes a) the proposed time when the preterm infant's ability to taste is functional; b) practices that exist for allowing preterm infants to taste their feeds; c) potential implications of preterm infant taste provision; and d) previous studies on the use of EBM taste during tube feeding. These first four sections are followed by a review of the literature associated with staff knowledge, beliefs, and practices of taste with feeding and clinical decision making as it relates to guideline uptake. The AHS ROFG (Alberta Health Services, 2009), is discussed first followed by other guidelines that incorporate taste as an adjunct to feeding and then uptake of NICU guidelines in general is examined. The emphasis of the final section focuses on how guideline uptake is affected by the critical nature of NICU patients and how attitudes of staff toward their patient or the guideline influence uptake of recommended practices. Also the relationships between guidelines and practice changes will be discussed with an emphasis on what in the guideline best affects uptake and practice change.

2.2 Fetal Physiology, Development, and Taste Environment

Literature exploring the development of taste in the fetus and NICU professionals' beliefs, practices, and knowledge of the orosensory system of preterm neonates were gathered from the MEDLINE, CINAHL, Pub Med, and the Google Scholar databases. Combinations of the words and phrases "*preterm neonates*, *NICU staff*, *taste*, *gustation, practice*s, *knowledge*, *beliefs*, *expressed breast milk*, *EBM*, *non-nutritive sucking, sucrose, pain, digestion, taste, trials and outcomes,* and *fetal development of taste*" were used in the search. To capture landmark works as well as to provide a broad sampling of the literature, no time limits were applied. Searches with these terms using these databases were carried out from February, 2009 to April, 2012 to ensure that current work was captured.

Over five hundred articles were retrieved. Thirty two studies or review articles were selected for review and eleven other studies were identified using the reference lists from the retrieved literature. Through an iterative process, these articles were categorized and those selected for review contained content that covered factors influencing the development of taste in the fetus, the use of the sense of taste in care of preterm infants associated with feeding, or the use of EBM for pain control. The categories are a) fetal physiology, development, and taste environment; b) maternal diet contribution to taste; c) uses of the taste of sweet solutions in the NICU; d) potential for feeding disorder; and e) studies and interventions based on preterm infant sense of taste.

Additionally, it should be noted that in the literature the sense of taste is referred to by the term "gustation" and the associated sense of smell by the term "olfaction". For the purposes of describing the development of these senses, these scientific terms will be

used where appropriate. When the physical perception of odour or taste is being referred to, the terms “smell” and “taste” will be used, respectively.

2.2.1 Development of Fetal Taste Anatomy

The anatomical and biological development of taste and smell will be discussed. In addition, the uterine environment and its role in the taste experience will be reviewed. Sources for the evidence of fetal taste include animal studies, primarily using rat and mouse models, human *magnetic resonance imaging,* ultra-sound, amniocentesis, and fetal tissue studies.

From these sources, it has been determined that human development of the external and internal anatomy of the mouth, nose, and tongue, as well as the fetal digestive tract, begins between the third and fifth week of gestation (Buck, 2000; Diewert, 1985; Humphrey, 1971; Lebenthal & Lebenthal, 1999; Schaffer, 1910; Witt & Reuter, 1996;Witt & Reuter, 1998). Between six weeks and 18 weeks, the polypeptides responsible for regulating the gastrointestinal tract (e.g. somatostatin, gastrin, and motilin) begin to be secreted (Lebenthal & Lebenthal, 1999). Early into the tenth week the face has a human-like appearance (Humphrey, 1971; Schaffer, 1910) with a developed primary and secondary palate (Diewert, 1985). The fetal tongue develops at the same time as the face and the neural anatomy is able to convey information to the brain by 14 weeks (Achiron et al., 1997; Diewert, 1985; Witt & Reuter, 1996; Witt & Reuter, 1998).

The tongue is central to taste. The tongue’s gustatory anatomy, nervous tissue, and papillae development begins at approximately six to seven weeks and continues through to about 18 weeks of gestation (Witt & Reuter, 1996; Witt & Reuter, 1998).

Gustatory cells are clustered in taste buds located on the tongue, palate, pharynx, epiglottis, and upper third of the esophagus (Achiron et al., 1997; Witt & Reuter, 1996; Witt & Reuter, 1998). On the tongue, taste buds are located in the papillae embedded in the epithelium (Witt & Reuter, 1996). They determine the primary tastes of sweet, sour, salty, bitter, and umami (the taste of savoury substances) (Shaeffer, 1910; Witt & Reutter, 1998). All major steps of gastrointestinal tract development are completed by 18 weeks after conception (Lebenthal & Lebenthal, 1999).

While the tongue is capable of sensing primary tastes (Shaeffer, 1910; Witt & Reutter, 1998), the complete sense of flavour requires the sense of smell (Beauchamp & Mennella, 2011; Buck, 2000). Like the gustatory structures, the development of the different olfactory structures takes place in first three months of gestation (Diewert, 1985; Schaffer, 1910). A distinct nose forms from nasal tissue supporting and enclosing the chemo-receptors by eight weeks of gestation (Schaeffer, 1910). The nose itself can be reliably detected by about 13 weeks on ultrasound (Schaal, Marlier, & Soussignan, 1998).

Before 15 weeks, the nares are plugged with epithelial cells (Schaeffer, 1910), thereafter the plug is shed and the fetus can inhale amniotic fluid (Schaal et al., 1998). Fetal activities like respiratory efforts, swallowing, and other fetal movements influence the flow of fluid bathing the nasal pathways (Menella, Jagnow, & Beauchamp, 2001; Schaal, Marlier, & Soussignan, 2000). This process of bathing the sinus in amniotic fluid is thought to stimulate the odour receptors (Menella et al., 2001; Schaal et al., 2000).

Smell is achieved when odorant molecules reach the olfactory epithelium at the back of the nasal passage and stimulate the olfactory receptors (Buck, 2000). Olfactory information is sent via the olfactory sensory neurons along their axons to the brain and is

converted into perceived sensation in olfactory processing areas of the brain (Buck & Axel, 1991; Buck, 2000). Squire (1987), a neuropsychologist who provided a synthesis of the widely scattered psychological and neurobiological work on memory, noted that many of these olfactory processing areas impact emotions and memories (Squire, 1987). Squire, after examining results of studies from rats, monkeys, and humans later theorized that some of these processing areas are involved in emotional and autonomic responses to odour as well as in motivation and memory (Squire, 1992). Squire also noted that the olfactory system has many anatomical ties to the limbic system and hippocampus which are areas of the brain involved in emotion and the ability to recall where things are left (place memory), respectively (Sapolsky, 2003). The action and longevity of memory from the neonatal or preterm infant experience is unknown. However, it is theorized that odour information has strong connections to emotional memory and long-term memory (Sapolsky, 2003; Schaal et al., 1998; Schaal et al., 2000).

While the sense of taste in adults is theorized to be in large part a function of the sense of smell (Beauchamp & Mennella, 2011; Buck & Axel, 1991; Buck, 2000; Kettenmann, Mueller, Wille, & Kobal, 2005), no studies were found that identify the percent of taste that is a function of the neonate's or the fetus's sense of smell. However, with the structures for taste and smell physiologically present and theorized to be functioning by week 14 of gestation (Witt & Reutter, 1998), it is reasonable to conclude that some contribution of smell to taste may be experienced by the preterm newborn.

In addition to those fetal activities that are likely to stimulate the sense of taste, fetal swallowing of amniotic fluid has been observed between 10 and 15 weeks using

ultrasound (Grand, Watkins, & Torti, 1976). This is corroborated with Fetal Magnetic Resonance Imaging (Miller, Sonies, & Macedonia, 2003). Swallowing amniotic fluid is believed to assist in gut nourishment and maturation (Diehl-Jones & Askin, 2004). Amniotic fluid swallowing has also been interpreted as practicing how to feed (Miller et al., 2003). The amniotic fluid, rich in proteins, growth factors, and glucose, also provides the fetus with constant food taste experiences related to maternal dietary intake (Mennella, Johnson, & Beauchamp, 1995; Sozanskii, 1961; Weiss et al., 1985).

2.2.2 Maternal Diet

The contribution of maternal diet to the taste of amniotic fluid is well documented in both animal (Bilkó, Altbäcker, & Hudson, 1994; Teicher & Blass, 1977) and human studies (Mennella et al., 1995; Mennella et al., 2001; Schaal et al., 1998; Schaal et al., 2000). Schaal et al., (1998) determined that fetal learning of taste in human newborns occurred in response to foods consumed during pregnancy. In that work, Schaal et al. enrolled 85 term newborn infants, 46 males and 39 females, at three days of age. The infants ranged from 37 to 41.5 weeks gestation and from 2420 g to 4650 g in weight. They were stratified by feeding type, either breast or bottle. The infants were laid on a clean surface and smells were applied to the surface on either side, near the head. One group of breast fed infants was stimulated with distilled water smell as a control, and the smell of their own amniotic fluid to the other side, as the intervention. The other breast fed group received the smell of another mother's amniotic fluid to one side and the distilled water control to the other side. The same method was used with the bottle fed groups.

Schaal et al. (1998) demonstrated that newborns turned preferentially towards the smell of their mother's amniotic fluid significantly more than another mother's. They remained oriented toward that smell significantly longer over controls or another mother's amniotic fluid regardless of breast or bottle feeding. While this study demonstrated smell-memories of fetal life, it was carried out on term infants who possess mature olfactory apparatus whereas preterm infants do not. It was not possible to say from this study what factors in their own mother's amniotic fluid attracted the infants.

In a later study, Schaal et al. (2000) enrolled 24 pregnant women who were at 38 weeks gestation. Twelve were randomly selected to consume commercially prepared sweets, foods, and drinks flavoured with anise as tolerated, and 12 were assigned no special diet but specifically told to not consume anise flavoured foods. The subjects kept detailed dietary records and ceased consumption of anise flavoured foods immediately after the onset of labour and delivery. In the postnatal period, neither maternal group consumed anise and the infants were subjected to a smell stimulus test at eight hours of age and four days of age. The anise smell was presented on a cotton swab at room temperature with a 20 cm long stick to prevent hand odour from contaminating the scent. A third investigator, blinded to the interventions, scored infant facial reactions, head turning, lip smacking, forehead and eyelid movements, and activity level to the anise smell stimulus. The pregnant mothers, who had consumed foods flavoured with anise, gave birth to infants who demonstrated a preferential or neutral reaction to the anise smell which was significantly different compared to the negative and aversive reactions by control infants. The preferential or neutral reaction occurred on day one as well as on day

four. Thus, fetal memory of smell and taste was concluded to persist after birth; a conclusion which has been corroborated by others (Mennella et al., 2001).

The study was limited by drop-out of five infants for jaundice, discharge, or fussing (three from the anise consuming group and two from the control group). Also it is not possible to determine if the breast fed infants continued to receive anise taste from feeding, as traces of anise flavour might have been transmitted via breast milk and it is unknown how long the flavour takes to clear the systems of adults. The infants were not followed or re-tested at later dates, so it is unknown how long the memory of fetally encountered odours or tastes persisted. The persistent memory of taste from fetal life may be important to the acceptance of food tastes, so the lack of follow up is a noteworthy limitation.

It is therefore important to take note of the research by Mennella et al. (2001) who demonstrated persistence of fetal memory of taste using carrot juice. Carrot juice was selected as it had been demonstrated in earlier research to penetrate amniotic fluid and breast milk (Mennella & Beauchamp, 1999). Forty-six (sic) women in the last trimester of their pregnancy were enrolled and divided into three groups. They drank 300 ml of either carrot juice or water twice a day, four days per week. For the rest of the time, the mothers were free to drink ad lib. Using this liquid intake criteria, the first group (n = 16) drank only carrot juice for the remainder of the pregnancy and, following delivery, water for the duration of breastfeeding until solids were introduced to the infants. The second group (n = 17) drank water until delivery then carrot juice for the duration of breastfeeding. The third group (n = 14) drank only water as their liquid intake while pregnant and for the duration of breastfeeding (Mennella et al., 2001). When solids were

introduced into the infants' diets, their mothers were asked to rate their children's reaction to carrot juice flavoured rice cereal on a nine point scale. Group one and two infants exhibited fewer negative facial reactions compared to group three infants (Mennella et al., 2001). Since infants in group one (exposed in utero) exhibited the same reaction as infants in group two (postnatal exposed infants), the investigators concluded that the human fetus can perceive taste and remember those tastes into post natal life.

As maternal diet was not controlled outside of the parameters cited, it is not possible to determine its influence on fetal familiarity with carrot juice. Additionally, demonstrating the effects of remembered fetal life based on maternal diet with a larger sample size and subsequent studies would demonstrate consistency and replicability. Nevertheless, the conclusion was reached that fetal memory was retained, insofar as taste is concerned, for a significant majority of the test subjects.

Memory of fetal taste is important given that one of the major taste constituents of amniotic fluid is glucose which is present in high concentrations throughout pregnancy (Sozanskii, 1961; Weiss et al., 1985). These amniotic fluid glucose levels were documented in a cross sectional study carried out in the former Soviet Ukraine. Sozanskii (1961) used amniocentesis and blood samples to evaluate the glucose concentration of amniotic fluid from 136 women. In this study, 38 women undergoing early abortion and 23 women undergoing late term abortion had amniocentesis. In addition, ten women and their preterm infants and 60 women and their term born infants had amniotic fluid collected at delivery. Sozanskii found that from week eight to 12, amniotic fluid concentration of glucose averaged 58 mg% and, from 17 to 26 weeks, the amniotic fluid glucose level averaged 35.5 mg%. At term, the concentration of glucose in amniotic fluid

was an average of 23.4 mg%. Sozanskii's study demonstrates that the fetus is exposed to constant, relatively high concentrations of glucose during development.

An Austrian longitudinal study by Weiss et al. (1985) corroborated the findings of Sozanskii (1961) although there were differences in average glucose concentrations. Using amniocentesis, Weiss et al. obtained 2295 (sic) amniotic fluid samples from pregnancies ranging from 14 to 42 weeks gestation. Samples were obtained from 1655 pregnancies that were deemed normal, 50 from pregnancies with fetal malformations, 115 from pregnancies with hydramnios, 246 from pregnancies with abnormal oral glucose tolerance tests, and 230 from pregnancies with insulin-dependant diabetes. Weiss et al. found consistently lower average glucose concentrations for the normal pregnancies. Glucose levels ranged from an average of 44.8 mg/dl (mg/dl = mg%) at 14 to 16 weeks to an average of 15.8 mg/dl by 42 weeks. In addition, amniotic fluid glucose concentration was noticeably higher in the diabetic groups (Weiss et al., 1985).

There are limitations to the studies measuring amniotic glucose levels. As the Sozanskii (1961) study was cross sectional, the same women were not followed throughout their pregnancies. Additionally, Sozanskii did not report stress level, socioeconomic status, maternal age, or ethnicity. Stress is known to be associated with elevated glucose levels (Clark, Warren, Hagen et al., 2011) and it would be logical to conclude women undergoing therapeutic abortions or early labour would be experiencing stress. Lower socioeconomic status groups are more likely to have undiagnosed diabetes and gestational diabetes (Anna, Van der Ploeg, Cheung, Huxley, & Bauman, 2008). This may account for the higher average values obtained by Sozanskii.

While it remains unclear as to the specific mechanisms involved in regulating

maternal glucose levels, maternal age is recognized as a common risk factor in diabetic pregnancies associated with elevated amniotic fluid concentration of glucose (Anna et al., 2008; Berkowitz, Lapinski, Wein, & Lee, 1992; Bo et al., 2002; Gunderson et al., 2010; Luke & Brown, 2007; Stephansson, Dickman, Johansson, & Cnattingius, 2001). In addition to these factors, neither Sozanskii (1961) nor Weiss et al. (1985) disclosed the time of year in which the studies were carried out. Time of year might be important to maternal glucose levels as blood glucose is known to be higher in the winter than summer months depending on the severity of the climate (Adams, 1926; Christau et al., 1977; Durruty, Ruiz, & Garcia de los Rois, 1979; Joner & Søvik, 1981; Liang, 2007).

In summary, the fetal environment contains glucose and the fetus is exposed to varying levels of sweet taste. By week 14 of gestation, taste and smell structures are present and functional. It is reasonable to conclude that the developing fetus has the functional capacity to taste and smell amniotic fluid. This familiarity is remembered after birth for term infants, and may be of particular use in the care of premature infants. The observed swallowing of amniotic fluid and the presence of glucose in the intrauterine environment may explain the efficacy of sweet tastes to comfort, calm, and soothe infants during uncomfortable procedures in the NICU.

2.3 Uses of the Taste of Sweet Solutions in the NICU

2.3.1 Taste and feeding outcomes

It is unknown what effect taste has on improving outcomes for preterm infants. Few researchers have investigated the use of taste for improving feeding outcomes in tube fed preterm infants. A 2008 Canadian critical review of published literature from

1995 to 2007 on oral stimulation of preterm neonates, found only one study (Mattes et al., 1996) that incorporated taste as a means to transition infants to full oral feeds (Tenhaaf, 2008).

The randomized control trial was conducted by Mattes et al. (1996) in the United States. Taste was used in conjunction with non-nutritive sucking as the experimental intervention to determine if time to being fully breast or bottle fed could be decreased and weight gain could be improved after 14 days of treatment. Mattes et al. (1996) divided 42 medically stable infants into three groups of 14. The infants were all less than 34 weeks gestation at the time of study, equal to or greater than 1250 grams in weight, appropriate for gestational age, free of intraventricular haemorrhage, being tube fed at least100 Kcal/kg/day, and gaining weight. The first group was offered a sweet tasting soother (made of corn syrup, glucose and gelatin) for non-nutritive sucking during tube feeds. The second group was offered a latex soother during tube feeds. The third group experienced maternal heart beat during their tube feeds.

Mattes et al. (1996) observed that the strength of sucking was significantly higher in the sweetened soother group. Sucking frequency was not significantly different between groups, although the sweetened soother group tended to have more sucks. Analysis of variance and median values using Kruskal-Wallis analysis for the length of transition period from tube feed to first oral feed was not significantly different between groups. Likewise, the average age to full oral feeds was also not significantly different between groups. In summary, Mattes et al. did not demonstrate a clear and significant advantage of sweet taste and non-nutritive sucking stimulation on feeding performance over the control groups (latex soother and maternal heartbeat).

The Mattes et al. (1996) study did not demonstrate that the sweetened soother shortened transition time to full nipple feeds. This may have been because of the short two week duration of the intervention and the small sample size with 14 infants per group. Over a longer time period with a larger sample size, the differences in the groups might become significant as the sweetened soother group showed stronger sucking and trends toward quicker transition to full nipple feeding. Furthermore, the sweetness of the soother itself was never established relative to the latex soother. The soother may not have been different enough in sweetness to elicit a strong enough response or it may have been overpoweringly sweet. It is difficult to extrapolate the effect of sweet taste itself on feeding maturation from this study as the researchers did not have a taste only (exclusive of non-nutritive sucking) control group. Those findings might have been critical given the implications for how the sense of taste of preterm born infants is commonly used.

2.3.2 Sweet taste and pain

The usefulness of providing sucrose by mouth for feeding maturation, with or without non-nutritive sucking, remains largely unexplored. The most common use for the sense of taste in preterm infants is in the form of sucrose by mouth and non-nutritive sucking to reduce pain accompanying some procedures such as heel lancing or venipuncture. (Shah, Aliwalas, & Shah, 2006; Stevens, Johnston, Petryshen, & Taddio, 1996). The use of EBM and non-nutritive sucking for pain has been examined as a practice in a systematic review (Shah et al. 2006)

Shah et al. (2006) examined 11 published studies that used breast milk for pain associated with venipuncture or heel lance. The pain reduction interventions of breastfeeding versus a control (placebo, non-nutritive sucking, positioning, sweet

solutions, or nothing) and EBM by bottle versus the same controls were evaluated. The reviewers noted that, while there were marked differences in intervention and pain measurements, all studies reviewed concluded that EBM coupled with non-nutritive sucking or breastfeeding in the presence of painful stimulus reduced crying time and expression of pain more than either no intervention or non-nutritive sucking on its own.

Shah et al. (2006), however, proposed that associating pain with sweet and food tastes may contribute to associating pain with eating and lead to later feeding difficulties due to conditioning. Currently, no human studies examining the long term impact of pairing food taste with pain were found. It seems likely that consistently pairing food and sweet taste with pain, without consistently pairing food and sweet taste with feeding, might condition oral aversion or oral defensive behaviours. Practices such as pairing taste with pain are very similar to classic negative reinforcement (Pierce & Cheney, 2013).

The main category of negative reinforcement is avoidance learning (Domjan, 2014; Pierce & Cheney, 2013; Skinner, 1953). Subjects in avoidance learning, mainly test animals such as rats, learn that certain responses will result in the cessation or prevention of a negative stimulus of some sort (Neuringer, 1969). Experimentally, avoidance learning is demonstrated when a novel stimulus such as a taste, light, or auditory input is followed by a painful or negative stimulus such as a shock (Brown & Jenkins, 1968). Test animals will learn to avoid the painful experience by avoiding the paired signal (Brown & Jenkins, 1968; Neuringer, 1969; Neuringer, 2002). Researchers theorized that because of the aversive nature of the painful stimulus, a conditioned emotional reaction takes place. In this case, the aversive reaction is fear of pain in the presence of the stimulus (Brown & Jenkins, 1968; Domjan, 2014; Neuringer, 1969; Neuringer, 2002). It

is theorized that human behaviour can be shaped by the same processes that are used on test animals (Skinner, 1953).

Complicating matters around the use of sweet taste for pain is a United Kingdom study in which researchers examined brain activity in newborns during painful procedures with and without intraoral glucose (Slater et al., 2010). Glucose was given by drops from a syringe. Researchers found no difference in neural activity during painful procedures in newborns regardless of whether intraoral glucose was given or not. This lack of difference occurred even though there were lower measures of pain using the Premature Infant Pain Profile (Stevens et al.,1996) in the infants given glucose (Slater et al., 2010). Thus, while pain scores were lower, there was no evidence to indicate that the infants experienced pain alleviation as measured by neural activity (Slater et al., 2010). Both Slater et al. (2010) and Shah et al. (2006) discussed the possible long term implications of pairing sweet tastes with pain. Although no studies were found that demonstrated long term effects in neonates, it is reasonable to conclude that consistent negative reinforcement may lead to associating feeding with pain and, as a consequence, potentially contributing to the development of feeding problems.

2.4 Feeding Disorders

The Diagnostic and Statistical Manual of Mental Disorders (DSM – IV) defines a feeding disorder as poor eating manifested by failure to eat enough to maintain and gain weight. Often significant weight loss is noted over a month with the condition being associated commonly with reflux and other gastrointestinal conditions (American Psychiatric Association, 2000). Oral defensiveness and sensitivity is not recognised or

defined in the DSM – IV. However oral defensiveness and oral sensitivity are described by researchers (Arvedson & Brodsky, 2002) and clinicians (Wolf, Glass, & Carr, 1992) together or separately as facial defensiveness that includes avoidance when food approach is anticipated, pushing food away, biting, head turning, crying, gagging, and vomiting.

Many parents whose infants were tube fed in NICU, report later feeding problems including oral defensiveness in the first year of their children's lives (Cerro et al., 2002; McNeil, 2008). The feeding problems include food refusal and the need for long-term tube feeding (Cerro et al., 2002; McNeil, 2008). It is important to note that premature birth and tube feeding have been associated with later-in-childhood feeding disorders (Burklow et al., 1998; Dodrill et al., 2004; Martin & Shaw, 1997).

Rates of feeding problems ranged from as low as 7% (DeMauro et al., 2011) to as high as 43% in infants ranging from 10 to 14 months, adjusted age (McNeil, 2008). Many of these infants will have had their procedural pain alleviated with sweet solutions and non-nutritive sucking. It is logical to conclude these practices might have some bearing on feeding outcomes and concurrent feeding disorders.

In a recent study carried out in Pennsylvania, DeMauro et al. (2011) support these assertions of increased prevalence of feeding disorders based on negative oral experiences. A questionnaire based survey design was used to identify abnormal feeding patterns and therapist intervention comparing early preterm infants (born at 25 to 33 $^{6/7}$ weeks) (n = 319) to late preterm infants (born at 34 to 36 $^{6/7}$ weeks) (n = 571). Questionnaires were mailed to parents at three, six, and 12 months of their infant's corrected age. Results reflected that the early preterm infants displayed more oromotor

dysfunction and avoidant feeding at three months and 12 months than late preterm infants in the same time period. Both groups had similar rates of therapist intervention, hospitalization, and poor appetite. Among other reasons, the authors point to long term tube feeding as one of the likely contributors to persistent feeding problems that linger into childhood.

Douglas and Bryon (1996) described oral and facial sensitivity in 201 seven year old children. The common characteristics of these children were prematurity, long term intubation, insertion of orogastric tubes, force feedings, suctioning of the mouth, and other unpleasant practices that are part of care provision in the NICU. As a group, they were very similar in terms of demographic characteristics and NICU experiences to those who participated in the DeMauro et al. (2011) study. While Douglas and Bryon (1996) drew no links to taste provision, according to Canadian speech pathologist Dr. S. Leew, in her expert opinion, during the preterm period, feeding practices that do not consistently provide taste as part of the feeding experience, might also have some bearing on oral defensiveness (S. Leew, personal communication, March 26, 2009).

In summary, there are studies that link prematurity to the emergence of later feeding problems (Cerro et al., 2002; DeMauro et al., 2011; Douglas & Bryon, 1996; McNeil, 2008). Additionally, there are practices around preterm infant pain alleviation which have unknown consequences (Shah et al. 2006) while being of questionable use for pain control (Slater et al., 2010). With the normal NICU practices of long term intubation, insertion of orogastric tubes, force feedings, and suctioning of the mouth factored in (Douglas & Bryon, 1996) it seems reasonable to expect feeding disorders in later childhood, given the lack of non-noxious taste associative stimulation. With the lack

of information around the knowledge, beliefs, and practices of staff who feed these infants, it is important to frame how those factors might contribute to long term feeding outcomes.

With this lack of information in mind, the studies carried out on the subject of taste and preterm infants are significant. It is important to note that a few researchers have investigated if a) taste can be perceived in the extremely preterm (Rodriguez et al., 2010; Zorc, 2001); b) there are any safety concerns with offering taste (Rodriguez et al., 2010; Zorc, 2001); c) the practice has any positive effect (Rodriguez et al., 2010; Zorc, 2001); and d) mouth care with EBM can affect breastfeeding outcomes (Edwards & Spatz, 2010). Two of these studies were randomized controlled trials (Rodriguez et al., 2010; Zorc, 2001) and the third was a large continuous quality improvement initiative (Edwards & Spatz, 2010).

2.5 Studies and Interventions Based on Preterm Infant Sense of Taste

Over a 13 month period, Zorc (2001) carried out an experimental study to determine if the taste of EBM was perceived and tolerated in preterm infants who required surgery. The setting was a large children's hospital Level 3 NICU located in Washington, D.C. The subjects were 21 surgical preterm infants (thirteen males and eight females) who a) ranged in gestational age from 22 to 30 weeks at birth (mean = 27 weeks); b) were enrolled at gestational age ranging from 24 to 32 weeks (mean = 28 weeks); c) ranged in weight from 492 to 1370 grams (mean = 902 grams); d) were at least two days of age; e) were medically stable; f) were born to English speaking parents; and g) not being orally fed for at least two weeks after study commencement.

These infants required complex surgical interventions for birth anomalies and typically were held *nil per os* (NPO) (nothing by mouth) or allowed to taste feeds until recovered from surgery (Zorc, 2001). In the initial phase of the study, Zorc identified if preterm infants perceived the taste of feeds. Then the researcher determined if infants tolerated taste as well as tolerating tactile stimulation to the tongue based on behavioural responses like sucking and lip smacking. Tolerance was, in part, measured by taste induced change in vagal tone as measured by changes in heart rate from a baseline state in comparison to changes exhibited with control (tactile stimulation). Finally, the researcher identified if there was bradycardia, which is defined as heart rate less than 100 beats per minute, in the experimental group as compared to the control group.

Infants were randomly assigned to taste (n = 11) or non-taste (n = 10) groups from birth (Zorc, 2001). These infants remained in the study until oral feeds were initiated. In the intervention (taste) group, EBM was placed onto the tongue with a dropper. The control, non-taste group experienced the dropper touched to the tongue with no taste component. These activities were blinded from the attending staff and from parents.

Zorc (2001) reported that the intervention group had significantly more oromotor movements observed in response to taste compared to the control group who had only tongue stimulation. The subjects did not exhibit significantly more vagal tone changes between orotactile stimulation and taste stimulation. Zorc found that the intervention group had non-significant increases in the number of bradycardias as compared to the non-taste group; therefore, adding taste as a regular part of care was considered by Zorc to be safe. Zorc hypothesized that the increased oromotor responses were indicative of improved feeding structures and feeding behaviours and may potentially reduce the

incidence of long term feeding disorders not only in pre-orally fed surgical infants but all preterm infants.

The strengths of this study which demonstrated the usefulness of taste with feeds include a) the two group blinded (staff and parents) design; b) random allocation of infants to groups; and c) the infants were followed to discharge. A number of limitations to this study are evident however, and do not justify the conclusion that there is evidence of safety. These limitations include that a) the study was not adequately powered to detect differences in frequency of bradycardias across experimental and control conditions; b) the *P* values for tests of significant were not reported; c) follow-up beyond discharge was not conducted; and d) the results are not generalizable to the broader population of preterm infants as only surgical infants were enrolled in the study. Both strengths and limitations are summarized in table 2.1.

Rodriguez et al. (2010) carried out a one group quasi experimental pilot study with non-surgical infants in the United States to determine whether taste of own mother's milk was tolerated. In a 44-bed, level three NICU, the researchers used a pre-post test design and recruited 15 women during their pregnancies. At birth, five infants met the study requirements. The infants weighed from 585 to 785 grams (mean = 657 grams) and ranged from $24^{3/7}$ to 28 weeks (mean = 25.5 weeks) gestation. Once the infants were stable and required less than 10 μg/kg/minute of vasopressor support, they were considered in a satisfactory state to participate in the study. The intervention consisted of serially dropping 0.1 ml (approximately seven drops) of own mother's milk over two minutes into the infants' mouths at two hourly intervals over the course of 48 hours. Even in the smallest infants, this amount consisted of a volume of less than 2 ml/kg/day. This

volume is well below the threshold of 10 mg/kg/day, which is the ROFG (Alberta Health Services, 2009) threshold for nutritive feeding.

The primary data collected were heart rate, respiratory rate, oxygen saturation, and oromotor movements in response to the taste of own mother's milk. The researchers demonstrated that taste of the mother's milk did not cause harm and was well tolerated by the study infants as evidenced by no episodes of bradycardia, apnea, hypotension, or drop of oxygen saturation below 80% (Rodriguez et al., 2010). Additionally, the researchers noted either a stable oxygen saturation or a rise in oxygen saturation during the administration of mother's milk, and were thus able to demonstrate an association between the taste of the infant's own mother's milk and clinical maintenance or improvement in infant state (Rodriguez et al., 2010). The authors suggested the need for further exploration of infant responses to taste as an intervention.

The study had a number of strengths which included data collection to discharge, taste was offered in conjunction with feeds, preterm infants were enrolled, and parents and staff were blinded. The Rodriguez et al. (2010) study is the only study that aimed to demonstrate the beneficial effects of taste of EBM on feeding non-surgical preterm infants. It is, however, limited by the small sample size, the short period over which the intervention of taste was applied, and lack of long term follow up post discharge. The issue of safety is a concern in light of the small sample size. Furthermore, the authors did not report the gestational age of the study infants or the methods used to quantify changes in infant state (see Table 2.1). While these limitations are notable, the study itself did lay the foundation for future work by others.

Edwards and Spatz, (2010) carried out a larger cross sectional study (n = 80) which was based on the work of Rodriguez et al., (2010). These researchers instituted a continuous quality improvement initiative on the safety and efficacy of EBM for mouth care in routine NICU practices at the NICU of the Children's Hospital of Philadelphia. In this initiative, the goal was to assist with transitioning infants to breast feeding. These infants required surgery and were NPO for extended periods (infant demographics undisclosed). Interventions included the use of EBM by cotton swab for mouth care, offering of non-nutritive sucking, and increased amount of skin to skin parental kangaroo care. Staff were educated by clinical nurse educators in the use of each of these interventions and encouraged to carry them out as a routine in the care of surgical preterm infants.

Surveys of staff were used at the beginning and midpoint of the continuous quality improvement initiative to evaluate staff attitudes, practices, and perceptions of the improvement initiative. After one year, all data were compared to data collected over the previous year. Data were examined to identify changes in a) the percentage of infants who transitioned successfully to breast feeding; b) the number of times EBM by cotton swab was used for mouth care; d) the amount of time non-nutritive sucking was offered; and e) the amount of skin to skin kangaroo care infants had with their parents. The above interventions were used either concurrently or separately depending on infant tolerance (Edwards & Spatz, 2010). Ultimately all subjects enrolled, who stayed in the continuous quality improvement initiative (73%), transitioned successfully to breast feeding, compared to 62% from the previous year.

Mouth care with EBM was used 71% of the time compared to one year earlier where it was used only 21% of the time. No adverse effects from mouth care with EBM were reported (Edwards & Spatz, 2010). This study provides evidence for the safety of providing EBM taste experience in preterm infants who are not being fed due to surgical need. The strength of this study to demonstrate the usefulness of taste with feeds is further augmented by the large sample size, that staff were surveyed before and during the initiative, and that infants were followed until they were discharged home.

Limitations include the lack of questionnaire description and the multiple interventions used in various combinations making it difficult to identify the individual effect of any one intervention. Furthermore, the design was non-experimental, the subjects were all surgical infants, and the infant demographics were undisclosed. Both strengths and limitations are summarized in Table 2.1.

Table 2.1 Summary of EBM◆ for Taste Studies

Investigator &Study	**Edwards and Spatz, (2010)**: An Innovative Model for Achieving Breast-feeding Success in Infants With Complex Surgical Anomalies	**Rodriguez et al. (2010)**: A Pilot Study to Determine the Safety and Feasibility of Oropharyngeal Administration of Own Mother's Colostrum to Extremely Low-Birth-Weight Infants	**Zorc (2001)**: An Exploratory Study of the Responses of Preterm Infants Younger Than 33 Weeks PCA❖ to Taste Stimulation Received Prior to the Introduction of Oral Feedings in the NICU❀
Design	-Survey based CQI* Initiative (Staff surveyed before & midway through study)	-Quasi - Experimental One Group	-Randomized controlled trial
Duration of Study	-1 year	-Not disclosed	-13 months
Time Subjects in Study	-Mothers & infants: Admission to discharge -Staff: as employed on unit	-48 hrs	-2 days post-admission until feeding started
Subject Characteristics	-58 infants requiring surgery and their mothers -Infants < 33 weeks gestation -NPO✧ at least 2 weeks -47 Staff Nurses	-5 infants: 3 male, 2 female - mean birth weight 657 g: < 1000g: -mean GA★ 25.5 weeks: < 28 weeks gestation - <10 μg/kg/min vasopressor	-21 preterm surgical infants: 13 male, 8 female -22 to 31 weeks: mean GA 28 weeks -Mean weight 902g -At least 2 days old -NPO 2 weeks or more
Intervention	-Mouth-care with EBM -Skin to Skin contact -NNS✦ -1:1 staff education by resource nurses	-Drops of EBM on tongue	-Drops of EBM on tongue
Outcome and/or Fidelity	-100% transitioned to breast feeds -Mouth-care with EBM increased from 20% to 71% -No change in morbidity or mortality	-No overt harm noted -Either stable or increased O_2 Saturation with taste. -No effect noted to mortality	-More oral motor movements -Fewer incidents of bradycardia -Vagal tone changes not associated with experimental group -No association to infection rate or mortality

◆Expressed Breast Milk, *Continuous Quality Initiative, ✧*Nil Per Os* (nothing by mouth), ✦Non-nutritive Sucking, ★Gestational Age, ❖Post Conceptual Age, ❀Neonatal Intensive Care Unit

Table 2.1 Summary of EBM for Taste Studies (continued)

Investigator &Study	**Edwards and Spatz, (2010)**: An Innovative Model for Achieving Breast-feeding Success in Infants With Complex Surgical Anomalies	**Rodriguez et al. (2010)**: A Pilot Study to Determine the Safety and Feasibility of Oropharyngeal Administration of Own Mother's Colostrum to Extremely Low-Birth-Weight Infants	**Zorc (2001)**: An Exploratory Study of the Responses of Preterm Infants Younger Than 33 Weeks PCA to Taste Stimulation Received Prior to the Introduction of Oral Feedings in the NICU
Strengths	-Large Sample size -Preterm infants -Before & during CQI, staff survey of knowledge & practices	-Infants followed to discharge -Taste in conjunction with feeds -Preterm infants enrolled -Blinded from bedside staff and parents	-Two group blinded design -Random allocation -Infants followed to discharge -EBM with NNS as intervention
Limitations	-Questionnaire undescribed -Interventions unseparated -Non Experimental -All surgical infants -Infant demographics undisclosed	-Small sample size -GA of infants undisclosed -Lacked follow up -Infection rate unreported -Duration undisclosed -Methods quantifying changes in state undisclosed	-*p* values undisclosed for some tests -Lacked follow up beyond discharge -Small sample size -Only surgical infants -Insufficient sample size across all groups to determine if taste had an effect on bradycarida

Importantly, the Zorc (2001) study and the continuous quality improvement initiative reported on by Edwards and Spatz (2010) were carried out on complex surgical preterm infants and both arrived at the same conclusions. Both sets of authors noted efficacy of taste with respect to oral feeding and the safety of offering taste, although the safety in the Zorc study is inconclusive given the small sample size. In NPO preterm infants requiring surgery, the Edwards and Spatz (2010) continuous quality improvement initiative is a validation of the Zorc (2001) study. The study by Rodriguez et al. (2010) also served as justification for the continuous quality improvement initiative by Edwards and Spatz (2010) in spite of the small sample size. Similar to the other two studies,

Rodriguez et al. (2010) also reported no safety concerns, with the small sample size duly noted, and did indicate an increase in oromotor movements as well as an improvement in oxygen saturation, which is indicative of improved state. These studies indicate that taste with feeds might have beneficial results with respect to feeding outcomes and that taste can be offered by relatively simple methods. However, the safety of taste with feeds requires further investigation with larger groups of patients and increased rigour in study design. To date, these are the only published studies found that paired EBM taste with either mouth-care or non-nutritive sucking to establish or improve oral feeding.

2.6 Clinical Decision Making and Guidelines

2.6.1 The Alberta Health Services Regional Oral Feeding Guideline (2009) and Clinical Decision-Making

The ROFG (Alberta Health Services, 2009) describes five stages of feeding readiness for the preterm neonate. The stages are a) Pre-Oral Stimulation Stage; b) Non-nutritive Sucking; c) Nutritive Sucking Stage I; d) Nutritive Sucking Stage II; and e) Nutritive Sucking Stage III. The Pre-Oral Stimulation Stage is defined as "Responds adversely to handling. Poor physiologic, motor, and state regulation with or without stimulation. None to very weak oral reflexes (transient). None to very weak non-nutritive skills. Not managing secretions (Neurological infants)" (p. 3).

Interventions for oral stimulation are worded to recommend stimulation based on developmental care and positive facial appearance as tolerated by the infant (Alberta Health Services, 2009). While this may be interpreted as suggestive of providing taste experience, taste provision is based on the staff member's knowledge of the preterm infant's ability to experience taste. In addition, the guideline definition is worded to

suggest *allowing* taste, rather than encouraging taste experience. The wording labels medically fragile infants with weak, uncoordinated sucking, and who are not being orally fed, as "pre-oral" (Alberta Health Services, 2009; Lasby & Dressler-Mund, 2011; Premji et al., 2004). The "pre-oral" label and its attendant definition may be interpreted as a contraindication to providing an oral experience. The label of "pre-oral" may in itself mislead NICU staff as to the orosensory capabilities and experiences of the extremely preterm infant. Therefore the label of "pre-oral" and its attendant definition might affect staff clinical decision making.

The ROFG (Alberta Health Services, 2009) lists the goals for the "pre-oral" infant as the minimization of negative experiences and zero percent oral intake (Lasby & Dressler-Mund, 2011; Alberta Health Services, 2009). It is difficult to reconcile the subsequent instructions to offer taste with these goals. If this document is accessed by staff who tube feed preterm infants, then its interpretation with respect to providing taste is in question. With this in mind, it is important to note that the understanding and use of the document has been assessed.

The uptake of the ROFG (Alberta Health Services, 2009) was evaluated in terms of staff awareness of its content, underlying principles, and use. McNeil, Scotland, Premji, and Mahon, (2006) evaluated the use of the ROFG (2009) using a cross sectional, pre and post-test, mixed method design. Three hundred and forty seven nurses and nine physicians were surveyed for awareness of the guideline's basic premises and principles. This was coupled with a review of approximately 50 charts, three focus group interviews, and 20 video tape analyses of care giver/infant feeding interaction (McNeil et al., 2006).

For the pre and post protocol implementation surveys, the researchers reported a

response rate of 32% and 13%, respectively for RNs and 89% and 0%, respectively for MDs (McNeil, et al., 2006). While the low participation rate limits the quality and quantity of inferences one can draw from this evaluation, the researchers noted that the guideline provided information that guides care and informs practice. This information and guidance were with respect to documentation of infant state prior to feeding, feeding method, reported disengagement cues, and listed interventions used to deal with these aspects. It was evident to the research team however, that further strategies to promote uptake of the protocol were needed as observed practices were noted to vary from consistent to inconsistent with the guideline. (McNeil, et al., 2006).

2.6.2 NICU Guideline Uptake and Clinical Decision Making

The uptake of another feeding guideline was examined in the continuous quality improvement initiative by Ewards and Spatz (2010). As noted previously, the continuous quality improvement initiative was implemented to assist non-fed surgical infants to transition to breast feeding. In order to facilitate successful breast feeding, educators sought to implement a clinical guideline known as the Transition to Breast Pathway. The authors pre-surveyed the staff on their knowledge of preterm infant feeding, their feeding practices, and their knowledge of the Transition to Breast Pathway. The staff was then given one on one education sessions on the Transition to Breast Pathway by nurses. Midway through the continuous quality improvement initiative, the staff was re-surveyed to assess for barriers that prevented implementation of the Transition to Breast Pathway. At the end of the study period, researchers were able to demonstrate changes in practice and an increase in the number of successful transitions of infants to breast feeding after

surgical intervention. Among these practice changes was the increased use of EBM for mouth care.

Important to this study is the fact that the continuous quality improvement initiative by Ewards and Spatz (2010) and the research by McNeil et al. (2006) specifically addressed uptake of feeding guidelines. These were the only two research studies about the topic of neonatal feeding guidelines. The continuous quality improvement initiative (Ewards & Spatz, 2010) was the only published research to specifically investigate change in practice associated with the use of EBM taste to promote feeding of tube fed infants. Furthermore, it should be noted that the central topics of staff knowledge, beliefs, and practices, as these factors relate to preterm infants sense of taste, have been largely unexplored. Due to the dearth of research on the topic of taste with feeding and NICU policy use by health care staff, it was necessary to carry out another search to determine if the findings by McNeil et al. (2006) and Edwards and Spatz (2010) were typical of uptake of other NICU guidelines. Another data base search was carried out using the MEDLINE, CINAHL, Pub Med, and the Google Scholar databases. The words and phrases, *"NICU", "preterm infant feeding"* were used with the terms and phrases *"protocols", "clinical guidelines", "staff"* and *"uptake*" were used.

Each database returned about 500 articles with some or all of these words in their titles. Using an iterative process studies were eliminated if they were not directly about NICU care and if they were more than three years old. An exception was made for two older review studies, which were selected to provide evidence for conclusions reached by newer research. This reduced the return to around 90. Ultimately four were selected for their relevance to clinical guidelines and either infant feeding, preterm infant pain

control, or caring for newborns. With the two older studies this made six research works selected.

As has been previously noted, only one published report on clinical decision making in relation to preterm infants and taste provision was identified (Edwards & Spatz, 2010). However, Dennis (2002) reviewed 11 trials and 11 studies, from around the world, on the related concept of breastfeeding support. The trials were undertaken to increase breastfeeding duration to a minimum of six months among groups of women who had low rates of breastfeeding. All of the trials and studies noted that staff knowledge of breastfeeding was often lacking (Dennis, 2002). This lack of knowledge seemed to influence staff when it came to following established guidelines for breast feeding guidance for young mothers, low income mothers, and single mothers, many of whom lacked support outside of the hospital (Dennis, 2002). As such it is evident that if staff knowledge is lacking, as it might well be around preterm infant sense of taste, guideline uptake may be problematic.

Grimshaw, Eccles, and Tetroe (2004) found much the same results as Dennis (2002) in a systematic review of the literature describing the evidence for successful implementation of clinical guidelines and uptake by staff. They examined 24 cluster randomized controlled trials that attempted to use educational materials, audit and feedback, and reminders to ensure uptake of evidence based research. Common factors identified that interfered with the uptake or interpretation of clinical guidelines by staff, both nursing and medical, include a) language characteristics in the guideline (is it easily understood, etc); b) electronic versus paper format of the guidelines; c) business of the setting; d) time constraints; and e) the feasibility of implementing a new guideline

(Grimshaw et al., 2004). Nurses' clinical decisions were commonly found to be influenced by personal knowledge base, the influence of leaders, input from other colleagues, clinical guidelines, and other printed material (Coombs & Eressor, 2004; Dennis, 2002; Flodgren et al., 2011; Mackintosh, Berridge, & Freeth, 2009). As far as uptake with respect to taste is concerned, the afore mentioned factors may well affect the provision of taste and the interpretation of the use of taste, in the feeding guideline.

Ethos of the unit must also be accounted for when facilitation of uptake, change in behaviour, knowledge, and beliefs are considered. This was investigated by Flodgren et al. (2011). These researchers noted that when changes to practices are proposed, influence by opinion leaders must be accounted for (Flodgren et al., 2011). Flodgren et al. (2011) reviewed 12 studies to determine if local opinion leaders can effect changes in uptake of clinical guidelines. These studies were randomized controlled trials that used objective measures of either staff behaviour and patient health outcomes or both. The reviewers noted that opinion leaders had a 10% larger effect than other interventions on uptake of guidelines. While Flodgren et al. (2011) did not investigate what directs opinion leaders, they noted that it was likely that these individuals were guided by beliefs and knowledge about the practice. As such it is important to understand what the taste knowledge, beliefs, and practices are of the opinion leaders in the NICU when it comes to feeding preterm infants.

Lack of knowledge playing a significant role in guideline interpretation and application, was demonstrated by Baker et al. (2009). These researchers investigated staff nurse co-operation or improvement of care for late preterm infants using evidence based practice as laid out by clinical guidelines. The investigators used an internet based survey

to query nursing staff related to their knowledge and comfort level while caring for late preterm infants (response rate not disclosed). The questionnaire covered the topics thermoregulation, hypoglycemia, hyperbilirubinemia, gestational age assessment, and feeding the late preterm infants, specifically breastfeeding and discharge teaching (Baker et al., 2009). The researchers identified knowledge deficits across the range of topics. They concluded that ultimately this lack of knowledge led to a lack of guideline uptake and implementation of evidence based practice by staff (Baker et al., 2009). Importantly, it is not just with nurses that this lack of uniformity with guideline uptake and evidence based practice has been noted.

El-Naggar and McNamara (2012) noted this lack of uniformity with guideline compliance in neonatologists who participated in a web-based questionnaire about medical practice regarding resuscitation of preterm infants in the delivery room. El-Naggar and McNamara (2012) concluded that delivery room resuscitation practices are highly variable in Canadian NICUs and the currently recommended NRP guidelines are not uniformly followed. Cited factors leading to variability and discordance in practice were a perceived lack of scientific evidence, the dynamic and often hectic nature of cardio-respiratory physiology in the early transitional period, controversy in the literature, and lack of endorsement by opinion leaders (in this case the International Liaison Committee on Resuscitation) (El-Naggar & McNamara, 2012). Other factors cited as contributing to the lack of uptake included perceptions that a) resuscitation was technically challenging; b) the guidelines' recommendations were not superior to other methods; c) the guidelines interfered with the resuscitation/monitoring process; and d) the resources to fully utilize the guidelines were lacking (El-Naggar & McNamara, 2012). As

can be noted from the preceding, the technicality and utility of the guideline in critical settings played a role in its uptake. As such, the technical aspects of the ROFG (Alberta Health Services, 2009) need to be considered when uptake is being assessed especially as it applies to the most unwell or vulnerable neonates. In the case of neonatal resuscitation, these factors are all based on application of highly involved techniques in a busy and stressful setting. This might be similar to the decision making for feeding a very preterm, medically fragile infant. If taste is seen as superfluous, not backed by research, or difficult to extrapolate as necessary from the guideline, then it might not be utilized. However, when more relaxed settings, and less fragile infants, are taken into account, uptake of guidelines revolve around less dramatic (life and death) factors. As an example, Ellsworth, Stevens, and D'Angio (2010) investigated NICUs in New York hospitals to see how staff attitudes towards race affected guideline interpretation in an effort to see if staff attitude played any role in uptake and application in the NICU.

These authors' aim was to determine if health care staff used race as a criterion for screening infants for intrauterine cocaine exposure. Ellsworth et al. (2010) used electronic medical records of 2121 newborn infants and their mothers to determine which mother-infant pairs had documented evidence of meeting criteria for screening infants for prenatal exposure to illicit drugs as set forth in the guidelines of their NICU. They then assessed the rates of drug screening to determine the strongest predictors of whether an infant would be screened.

Ellsworth et al. (2010) noted that infants born to African American mothers were more likely than those born to Caucasian mothers to be screened whether they met screening criteria (35.1% versus 12.9%) or not (5.3% versus 1.2%) respectively. By

logistic regression analysis, African American heritage remained independently associated with drug screening even when standard screening criteria and income, insurance status, and maternal education were controlled for (Ellsworth et al., 2010). It seemed that healthcare staff used race, in addition to recognized risk criteria, as factors in deciding whether to screen an infant for prenatal exposure to illicit drugs. In this case, the attitude of the staff led them to interpret the guideline differently from one person to the next. If taste is deemed unimportant to a particular child, perhaps for a surgical reason, or if the staff feel it is unreasonable, then taste might not even be considered. Thus, attitude of the staff towards their patients and the practice may be a factor in feeding guideline application.

While knowledge and attitude to the patient played a central role in guideline uptake and application in the preceding studies, the attitude the staff had towards the practice itself (belief in it) might also play into the decision to offer taste, irrespective of guideline. Belief was explored by McCord (2011) and the role it played in kangaroo mother care for heel lancing procedures in preterm infants. For this investigation, McCord used Interpretive Description qualitative methodology. Interpretive description is defined as a way of explaining, clarifying, or explicating the meaning of attitude or behavior as phenomena (Schwandt, 2007). McCord recruited eight RNs in a Nova Scotia NICU, including those who supported the kangaroo mother care guidelines and those that did not. The nurses were interviewed and audio-taped based on an interview guide. The eight RNs were then included as part of a focus group discussing their experiences with kangaroo mother care (McCord, 2011).

McCord (2011) found that a number of factors likely contributed to uptake and implementation of the guidelines for kangaroo mother care. The most cited factors were a) knowledge of the practice; b) clearness of the guidelines for ease of use; c) unit support of the practice; d) belief in the practice's efficacy; and e) ethical considerations. Among the more important of the cited factors was the simplicity of the care being a barrier for prioritizing it (more technically demanding care was a priority) and the safety of the procedure especially when carried out on the very preterm or small infant (McCord, 2011). In this study, belief in the practice, along with all the other previously mentioned factors, came into play as part of the decision making process for kangaroo mother care. It can be extrapolated that, if staff do not believe that taste offers any benefits, then they may not provide it as part of routine care.

Examining all of this literature together, it is evident that knowledge and attitudes contribute to decision making. The clinical setting, level of intensity, technical aspects, and ease of implementation all contribute to uptake. In a neonatal setting, knowledge of development, function, and perceived need for the intervention further affect uptake and implementation. Attitudes of staff towards the practice and their patients can also influence decision making. Finally, ethical consideration, efficacy, time, and timing consideration may also be factors. With respect to preterm infant tube feeding and taste, these factors may influence the practice of offering taste. Therefore gathering information on knowledge, attitude, and behaviour will provide an understanding of present practice and may lead to further investigation.

Summary

In summary, it is likely that the senses of taste and smell in developing fetuses are functional by week 15 of gestation (Schaal et al., 1998; Small, Jones-Gotman, Zatorre, Petrides, & Evans, 1997; Witt & Reutter, 1998). In addition, developing fetuses are accustomed to sweet taste (Sozanskii, 1961; Weiss et. al., 1985) and maternal diet tastes in utero (Mennella et al., 1995; Schaal et al., 2000; Schaal et al., 1998). The taste of 24mg/dl sucrose *in vivo* reduces pain scores in preterm infants undergoing painful procedures (Gibbins & Stevens, 2003; Shah et al., 2006; Stevens et al., 1996; Stevens et. al., 2005) and this practice has the potential to create negative associations between sweet taste and feeding which contribute to the development of feeding problems (Shah et al., 2006). Clinical decisions made by staff to allow taste paired with feeding may be based on personal knowledge of the development of the sense of taste. Other personal beliefs surrounding the sense of taste of preterm infants might play a role in the decision making process to use a taste intervention. As there is a demonstrable lack of research on these topics, it is timely and relevant to pursue inquiry into the knowledge, beliefs, and practices of NICU staff responsible for feeding preterm infants and providing taste experience.

Chapter Three: Methods

3.1 Study Design

Health care professionals employed by AHS Calgary NICUs were asked to participate in a study about their use and knowledge of the sense of taste in preterm infants. The health care professionals were responsible for either prescribing nutrition or directly tube feeding infants. Tube feeding by passes the sense of taste by delivering milk feeds directly to the stomach. It is unknown if staff are providing taste as a separate act with tube feeding. The practice of tube feeding is common across levels II and III care in the NICU. However, the practice of provision of taste is not standardized. As such, a cross sectional study design was used to gain an understanding of staff member's knowledge, beliefs, and practices regarding preterm infant sense of taste. Cross sectional designs are ideal for studies of common practices at a period in time in a given environment (Dillman, 2007; Polit & Beck, 2013).

3.2 Setting

The research was conducted in Calgary, Alberta at the Rockyview General Hospital (RGH) and the Peter Lougheed Centre (PLC), Level II NICUs, and the Foothills Medical Centre (FMC) NICU, a mixed Level II and III unit. Physicians at FMC work across both levels of care. It is common for RN patient assignments at the FMC to include a Level II infant paired with a Level III infant. At the time of this study, LPNs were employed at both the RGH and the PLC Level II NICUs. None were employed at the FMC NICU.

3.3 Study Population

The NICU staff population eligible for the study consisted of approximately four hundred and sixty three individuals and comprised of four hundred and seventeen RNs, sixteen LPNs[1], four Neonatal Nurse Practitioners (NNPs), and twenty six Medical Doctors (MDs) (K. Cowart, K. Foudy, & C. Palamar, personal communication, April 6, 2009; J Boulton, Head of Neonatology, personal communication, April 8, 2009).

3.3.1 Inclusion and Exclusion Criteria

The inclusion criteria were:

- current employment or contract with AHS at the FMC, the PLC, or the RGH NICUs in Calgary.

The exclusion criteria were:

- health care support staff (Respiratory Therapists, pediatric, and surgical consultants);
- staff undergoing training to work in the NICU;
- nursing and medical students.

3.3.2 Sample Size

A sample of convenience was used to obtain data. Convenience sampling involves drawing a sample from the available population found in a defined area (Polit & Beck, 2013). NICU staff members, represent a sample population that is readily available and

[1]For the purposes of this study LPN staff members were considered under the umbrella term "clinical care staff". Their role in tube feeding preterm infants is exactly the same as the RNs and their adherence to guidelines would be expected to be the same in this regard.

working in a defined area. Due to shift work, recruitment for the study occurred at different times of day, days of the week, and at three sites to increase the possibility of obtaining a representative sample.

It was determined that a sample size of 210 (46% of N) would provide a margin of error of 5% and a 95% level of confidence. This was based on a response distribution of 50% and considered the minimum sample size needed to address research questions one[2] and three[3] (Raosoft, 2004). For example, mean percentage differences would be detectable between Level II NICU staff providing taste experience 80% of the time (standard deviation = 2.4) and Level III NICU staff providing taste experience 20% of the time (standard deviation = 1.07) with an alpha of 0.05 and a power of 0.8 (Lenth, 2009).

3.4 Data Collection

In this cross sectional study, professional groupings share similar characteristics, such as educational background, job similarity, and work environments. Survey method was chosen for data collection as it is suited for such groups and describing respondents' perspectives or experiences on a specified subject in a structured manner. Survey methodology is commonly used with cross sectional study designs (Dillman, 2007).

3.4.1 Questionnaire Development

No questionnaire was available to use for NICU staff knowledge, beliefs, and practices related to infant sense of taste and taste development. Consequently, a 14-item

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[2] Research question one: What are the knowledge, beliefs, and practices of NICU staff?
[3] Research question three: With respect to knowledge, beliefs, and practices, are there differences when compared by months of service or profession?

questionnaire was developed (Appendix A). Resources used to develop and refine the questionnaire included text books on item design and examples of surveys (Dillman, 2007; McDowell, 2006; Polit & Beck, 2013; Streiner & Norman, 2008). The questions developed for this questionnaire were designed to correspond to the objectives and questions for this research.

In part, the aim of the study was to gain an understanding of knowledge and practice. Survey questions can be useful in ascertaining knowledge and practice as they allow for numerical coding and descriptive statistical analysis. To accomplish this, "yes" or "no" type questions were used for two knowledge questions and four practice questions. The "yes" or "no" questions are easily interpreted and are more specific and thus communicate similar meanings (Dillman, 2007; McDowell, 2006; Streiner & Norman, 2008).

Staff beliefs about the importance of taste for well-being, pain control, soothing, and digestion were sought. The literature is dominated by descriptions for the use of taste for comfort, soothing, and pain control (Edwards & Spatz, 2010; Gibbins & Stevens, 2003; Kristoffersen et al., 2011; Shah et al., 2006). How much staff believed in using these methods was in question, as no other measure of belief in this regard was identified from the literature. As for the use of taste to promote digestion, there was a dearth of research on this topic, and the notion of taste as an adjunct to digestion was a central idea behind this study. It was important to include taste for digestion to obtain some measure of how NICU staff regard the use of taste for this.

Beliefs tend to be subjective characteristics that can be difficult to determine precisely or quantify easily (Streiner & Norman, 2008). Hence, the visual analogue scale

(VAS) was chosen for the four-part belief question as it can be used to measure characteristics or attitudes, and provides a means for the respondent to quantify the intensity of their beliefs. Furthermore, the VAS tends to be easily understood, and analyses can be carried out using computer software (Dillman, 2007; Streiner & Norman, 2008).

The amount of time the ROFG (Alberta Health Services, 2009) was consulted for initiating trophic feeds was examined. A Likert scale question was selected for this practice question as it allows for increasing or decreasing amounts of time by category. Likert scales are easy to explain and for the respondent to understand hence the returned data is less subject to interpretation error (Polit & Beck, 2013). Likert scales also generate quantitative data that can be analyzed with relative ease by computer software.

Respondents were asked what methods and types of solutions they used for providing taste using two multiple-choice questions. Two multiple-choice questions were used to collect these practice data. Respondents selected from a range of choices. More than one selection was allowed to reflect variations in practice (McDowell, 2006; Streiner & Norman, 2008).

Four demographic questions related to NICU sites, months of service, and profession were included at the end of the questionnaire. These questions were used to compare answers in order to identify differences by groups (Appendix D). The last two questions were open-ended which allowed the respondents an opportunity to describe resources used to answer questions and provide any comments they might have. Respondents were afforded a chance to identify issues that were not covered by the questionnaire (Streiner & Norman, 2008).

3.4.2 .Recruitment.

The questionnaire was pilot tested in two ways. The first group to review the questionnaire for face, content validity, and alignment with the research questions were members of a research division in AHS with backgrounds in questionnaire development, survey design, epidemiology, and child health. Changes were made to the content, layout, and wording of the questionnaire based on feedback from these methods experts.

Next, the questionnaire was reviewed by two staff nurses, two nurse educators from pediatric intensive care units, and one neonatologist from outside of Alberta. Reviewers were asked to take the questionnaire as though being surveyed, note any items that were confusing or problematic, and offer any suggestions for improvements. In all, issues were identified with ambiguous wording and un-grouped topics. The questionnaire was modified to correct these issues.

Recruitment occurred on the units over a six-month period from May 1st to October 15th in 2010. Each NICU was visited four times. NICU staff members were approached as a group in the staff lounge during their breaks at three points during the day (1400, 1730, and 2100), and provided with a five-minute study-information session. The groups ranged in size from as few as two to as many as fifteen and were comprised of all professions. All staff members scheduled to work on each recruitment shift were approached individually about study participation. Subsequent visits occurred on different days of the week and included weekends and evening shifts.

Recruitment on the units was tracked using a list compiled from the daily staff schedule. This tracking-sheet contained the first name and last initial of each individual

approached. Each person was then checked off on the list after being approached about participating in the study. The tracking-sheet was then re-checked against the list of staff members on duty for each shift to make sure all had been approached. The system of tracking was effective in that no issues arose with individuals having the same last name and first initial. The tracking sheet was not shared with anyone and destroyed by October, 2010.

Questionnaires were also available in the lounge for staff members who were not present at the information sessions. Physician questionnaires were hand delivered to the physician's offices. NNPs were approached either in their offices or on the unit. All participants were instructed to independently complete the questionnaire. Completed questionnaires were returned in a drop box beneath a poster about the study (Appendix C) located in each staff lounge. To increase the response rate, three reminders, one per month, were sent to physicians and staff via email address using the AHS email directory.

3.5 Data Handling

Returned questionnaires were assigned identifying numbers and the responses coded and entered in Microsoft Excel:mac 2008, version 12.2.7. Decision rules for ambiguous or missing data were implemented. Missing data were not imputed, and, depending on responses, ambiguous data were handled case by case (Appendix E). The data were then imported into PASW Statistics 21, Release Version 21.0.0.

3.5.1 Analysis

Categorical variables were tabulated and frequency charts constructed. Continuous variables were examined by means, medians, ranges, modes, standard

deviations (SD), and interquartile ranges (IQR). Continuous data were assessed with the Shapiro-Wilk (S-W) test of normality in preparation for statistical testing.

Chi-squared (χ^2) tests, or Fisher's Exact tests for cell sizes less than five, were performed for testing differences in categorical variables. A requirement for Chi-squared tests is that each subject contributes data to only one cell. Therefore, the sum of all cell frequencies in the table must be the same as the number of subjects in the experiment (Polit & Beck, 2013). Thus, if a respondent failed to answer one of the two items being compared, the data were eliminated from the other item and entered as missing.

As the results of the VAS used to measure beliefs were not normally distributed, the non-parametric Mann-Whitney (MW) U and Kruskal-Wallis (KW) tests were used to test for differences in beliefs across sites, professions, and experience ranges. When a variable is continuous and the data clustered, the Mann-Whitney U test is suitable for two groups and the Kruskal-Wallis test for three or more groups. By using these tests, ranks are assigned to the data and the median is used to examine the differences between the groups (Polit & Beck, 2013).

Staff members' months of service were not normally distributed. Consequently, data were categorized into three groups: less than 24 months (< 24), 24 to 60 months, and greater than 60 months (> 60). These categories are similar to those used by others with similar data responses and depict levels of experience (Aiken, Clarke, Cheung, Sloane, & Silber, 2003; Alberdi et al., 2011; Fulbrook, Albarran, Baktoft, & Sidebottom, 2012).

The sample was examined in total and across each of the categories of occupation. Differences across occupation categories were tested by MW-U and, when responses were not significantly different (i.e. RNs and LPNs), categories were grouped together.

Due to low number of NNPs (n = 4) and response rate (n = 2) of the NNP group, their responses were eliminated from testing. NNP responses were included as part of the description of the whole sample.

In twelve cases where the omnibus tests[4] returned significant differences, or there was evidence of large proportional differences in the returned data, post hoc analyses were carried out to determine where the significant differences were[5]. For post hoc tests, the Bonferroni correction was applied to the resultant *p* values. The Bonferonni correction is a conservative method to control for the risk of making a type I error (Polit & Beck, 2013). SPSS is programmed to use the method of multiplying the resultant *p* value from the test by the number of comparisons made. If, after correction, the resultant *p* value is still less than 0.05 then the result was considered significant (Polit & Beck, 2013). Post hoc analyses were done for comparisons by site and by amount of experience. See Appendix D for the table of statistical tests.

Items 13 and 14 were open ended questions where the respondents could use their own words to describe sources used for answers and provide feedback on the topic. If anyone indicated a source used for answering knowledge questions, the source was checked against answers for the first two items. Written comments were then further examined using content analysis, which is a technique for systematically compressing large amounts of text into fewer and fewer categories based on stated rules of coding (Stemler, 2001; Weber, 1990). Hence, categories were developed for common terms and

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[4] Kruskal-Wallis and three-by-two Chi-square tests

[5] Post hoc tests are sometimes necessary even after omnibus tests return non-significant results as three or more groups are examined in one omnibus test. In these situations, there can be a "smoothing out" of the *p*

counts were used to quantify common terms, ideas, and subjects in responses.

3.6 Ethics

The study was approved by the Calgary Health Research Ethics Board (CHREB) on March 11, 2010 (Ethics ID: E-22962).

3.6.1 Free and Informed Consent

Informed consent was facilitated by including an information sheet with the questionnaire (Appendix B). There were additional oral explanations about the nature of the study and how information would be used. The information sheet contained the study's purpose, extent of respondent involvement, how responses would be used, and risks to respondents for being recognized by occupation or hand-writing. Subjects were asked if they understood the information sheet and the oral explanation. They were also informed that they did not have to complete the questionnaire. By voluntarily completing and returning the questionnaire, the respondents gave implicit consent.

I did not occupy a position of influence on the units nor did I have any other relationship with another staff member other than as a professional colleague at the FMC. There was no jeopardy to employment when a staff member declined to participate. No direct inducement was offered. A gift of chocolate or doughnuts was made available for all staff working on the units after questionnaire distribution was completed for that day.

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value in the omnibus test due to some of the returns being in between the values of the extremes (Perkins, Tygert, & Ward, 2012; personal communication, T. Fung, January 9, 2013).

3.6.2 Risks to Respondents

There were no risks to staff personal safety. The personal information sought was innocuous in nature and pertained to demographic questions (years of service by range, and level of practice). No age or gender data was sought or gathered. As the questionnaire was anonymous, there was no risk of jeopardy to staff employment or to be marginalized or stigmatized by their responses.

3.6.3 Privacy and Confidentiality

There was a statement on the information sheet describing the likelihood of being identified based on position of employment and handwriting. Staff members were not required to complete any of the open-ended items if they did not wish to do so. RNs, LPNs, NPs, and MDs were informed of these risks and were given the option of completing the questionnaire.

3.6.4 Storage Arrangements, Access to, and Final Disposal of Questionnaires

Data from the questionnaires were entered into a password-protected computer. Laptop entered data were sent by password protected email via The University of Calgary to the thesis supervisors. The University system is protected against intrusion by security software (University of Calgary, Information Technologies, n.d.). Data were kept on a single computer in the student's locked office. The open-ended responses were transcribed by a research assistant to ensure no identification by handwriting occurred. The paper questionnaires were given to the thesis supervisor who will keep them in a

locked office until completion of the thesis. Questionnaires will be stored at AHS Iron Mountain Secure Storage facility until 2020.

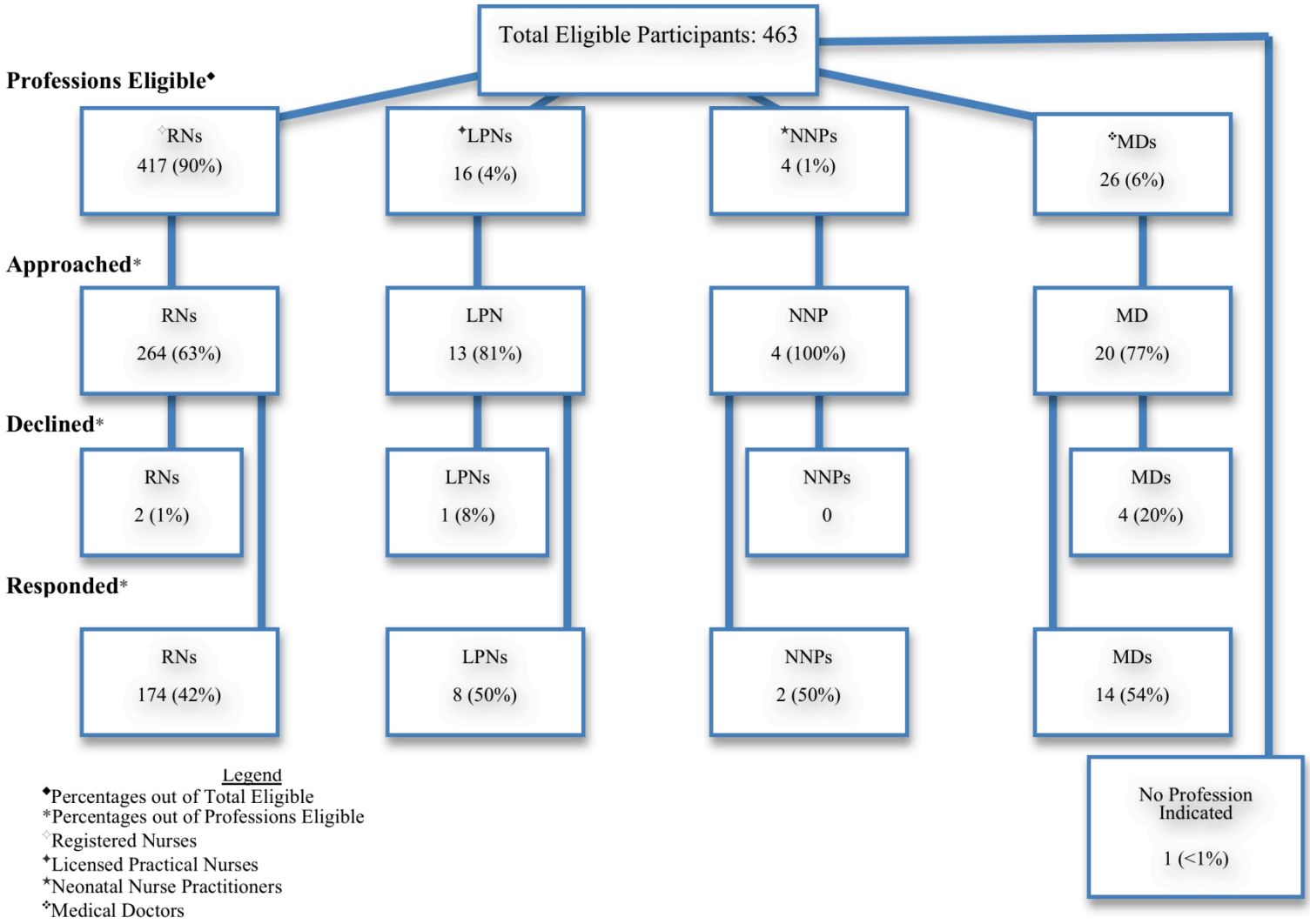
Chapter Four: Results

4.1 Sample Characteristics

4.1.1 Response Rates

Of the 463 eligible participants, 301 individuals were approached and 199 individuals (66% of those approached and 43% of those eligible) returned questionnaires. Approximately 162 individuals (35%) could not be approached due to infrequent casual work, maternity leave, vacation, or leaving employment on the units before or during data collection (K. Foudy, MN Unit Manager NICU, FMC, personal communication, April 6, 2009). See figure 4.1 for a summary of response rates by profession.

Figure 4.1 Response Rate by Profession



4.1.2 Sample characteristics

Respondents indicated the site at which they worked more than 50% of their shifts (FMC, RGH, or PLC). The FMC respondents accounted for more than half of the total respondents (n = 106, 53%) and consisted of half of those eligible at the FMC. The next highest response rate was 28% (n = 55) from the RGH and consisted of 43% of those

eligible at the RGH. The PLC respondents comprised 19% (n = 37) of total respondents and consisted of 38% of those eligible from the PLC (table 4.1).

Table 4.1 ◆NICU Staff Response Rate by Site

N=199 Site	Eligible (approximate)	n (% Eligible)	(% N)
Foothills Medical Centre	211	106 (50)	(53)
Rockyview General Hospital	127	55 (43)	(28)
Peter Lougheed Centre	125	37 (30)	(19)
Total	463	198 (43)	(99)
Missing		1 (<1)	(<1)

◆Neonatal Intensive Care Unit

Of the 199 respondents, RNs (n = 174, 87%) were the majority. NNPs were the least represented group with two respondents (1%) but represented half of the NNP population (n = 4). Physicians comprised 7% (n = 14) of total respondents, or 42% of eligible MDs. The majority of respondents provided direct clinical care (80%) and of those providing direct clinical care, eight were LPNs (five from the PLC and three from the RGH) and the rest RNs. Those who provided diagnosis and treatment (MD and NNP) were the least represented (8%) (table 4.2).

Table 4.2 ◆NICU Staff Responses by Professions & Area of Responsibility

N=199	
Profession	n (%N)
Licensed Practical Nurses	8 (4)
Neonatal Nurse Practitioners	2 (1)
Neonatologist or Neonatal Fellow	10 (5)
Clinical Associate	1 (<1)
Other Physician	3 (2)
Registered Nurses	174 (87)
Missing	1 (<1)
Area of Responsibility	
Clinical Care	160 (80)
Charge Nurse, Manager, or Educator	23 (12)
Diagnosis and Treatment	15 (8)
Missing	1 (<1)

◆Neonatal Intensive Care Unit

Respondents indicated the length of time they had worked in Level II NICU and Level III NICU. Total months of experience in NICU are found below in table 4.3. Table 4.4. represents experience by categories.

Table 4.3 Staff Months of ◆NICU Experience

N=199	Mean (SD)	Median (IQR)	Range	Missing n (%N)
Months of Experience	130 (123.72)	77 (198)	1 – 480	4 (2)

◆Neonatal Intensive Care Unit

Table 4.4 Staff Months of ◆NICU Experience by Categories

N=199	
Categories of Experience	n (%N)
< 24 months	34 (17)
24 – 60 months	54 (27)
> 60 months	107 (54)
Missing	4 (2)
Total	199 (100)

◆Neonatal Intensive Care Unit

4.1.3 NICU Staff Knowledge Descriptions and Comparisons by Demographics

Most staff (n = 178, 90%) were not aware of the fetal age at which the sense of taste develops. Half (n = 99, 50%) were not aware that maternal diet contributes flavour to amniotic fluid. Results are found in table 4.5 below.

Table 4.5 ◆NICU Staff Knowledge of Fetal Taste Development

N=199	Gestation of Sense Development	Maternal Diet Influence on Amniotic Fluid Taste
Knowledge	n (%N)	n (%N)
Correct	17 (9)	97 (<49)
Incorrect	178 (89)	99 (<50)
Missing	4 (2)	3 (<2)

◆Neonatal Intensive Care Unit

Fisher's Exact and Chi-squared test results comparing NICU staff knowledge of preterm infant sense of taste among the three NICU sites, by experience, and between professions are found in tables 4.6 to 4.8 below. There were no differences in NICU staff knowledge of fetal taste development by site. However, fewer of the FMC staff (n = 46, 44%) were aware that maternal diet flavoured amniotic fluid compared to the PLC staff (n = 24, 65%). There were no differences by months of experience or by profession in responses for knowledge of fetal taste and maternal diet influence on amniotic fluid taste.

Table 4.6 ◆NICU Staff Knowledge of Fetal Taste Development by Site

N* = 197	Total	✧FMC	✦RGH	★PLC
Knowledge	n (%N)	n (%)	n (%)	n (%)
Gestational Age at which Taste Develops				
Correct	17 (9)	10 (10)	4 (7)	3 (8)
Incorrect/Don't Know	177 (90)	93 (89)	50 (91)	34 (92)
Total	194 (98)	103 (99)	54 (98)	37 (100)
Missing	3❖ (2)	1 (1)	1 (2)	0
Fisher's Exact Test p =1.000				
Maternal Diet Influence on Amniotic Fluid Taste				
Correct	97 (50)	46 (44)	27 (49)	24 (65)
Incorrect/Don't Know	98 (50)	58 (56)	27 (49)	13 (35)
Total	195 (99)	104 (100)	54 (98)	37 (100)
Missing	2❖ (1)	0	1 (2)	0
Fisher's Exact Test p =.098				
Post Hoc Test[6] p < .05 FMC compared to PLC				

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧Foothills Medical Centre (104 returned), ✦Rockyview General Hospital (55 returned), ★Peter Lougheed Centre (37 returned), ❖Includes 1 (<1%) who did not report their site worked at

[2] Post hoc tests are sometimes necessary even after omnibus tests return non-significant results as three or more groups are examined in one omnibus test. In these situations, there can be a "smoothing out" of the p value in the omnibus test due to some of the returns being in between the values of the extremes (Perkins, Tygert, & Ward, 2012; personal communication, T. Fung, January 9, 2013).

Table 4.7 ◆NICU Staff Knowledge of Fetal Taste Development by Months of Experience

N* = 197 Knowledge	Total (%N)	✧< 24 n (%)	✦24 – 60 n (%)	★> 60 n (%)
Gestational Age at which Taste Develops				
Correct	17 (9)	0	6 (11)	11 (10)
Incorrect/Don't Know	175 (89)	33 (97)	48 (89)	94 (88)
Total	192 (97)	33 (97)	54 (100)	105 (98)
Missing	5❖ (3)	1 (3)	0	2 (2)
Fisher's Exact Test p = .120				
Maternal Diet Influence on Amniotic Fluid Taste				
Correct	93 (47)	19 (56)	26 (48)	48 (45)
Incorrect/Don't Know	99 (50)	14 (41)	28 (52)	57 (53)
Total (%Experience Range)	192 (97)	33 (97)	54 (100)	105 (98)
Missing	5❖ (3)	1 (3)	0	2 (2)
Fisher's Exact Test p = .492				

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧<24 months (34 returned), ✦24 – 60 months (54 returned), ★> 60 months (107 returned), ❖Includes 2 (1%) who did not report their experience

Table 4.8 ◆NICU Staff Knowledge of Fetal Taste Development by Profession

N* = 197 Knowledge	Total n (%N)	✦RN/★LPN ❖n (%)	✧MD n (%)
Gestational Age at which Taste Develops			
Correct	17 (9)	15 (8)	2 (14)
Incorrect/Don't Know	177 (91)	165 (91)	12 (86)
Total	194 (98)	180 (99)	14 (100)
Missing	3❀ (2)	2 (1)	0
Fisher's Exact Test p = .353			
Maternal Diet Influence on Amniotic Fluid Taste			
Correct	96 (49)	92 (50)	4 (29)
Incorrect/Don't Know	99 (50)	89 (49)	10 (71)
Total	195 (99)	181(99.5)	14 (100)
Missing	2❀ (1)	1 (<1)	0
$\chi^2 = 2.576$, p = .109			

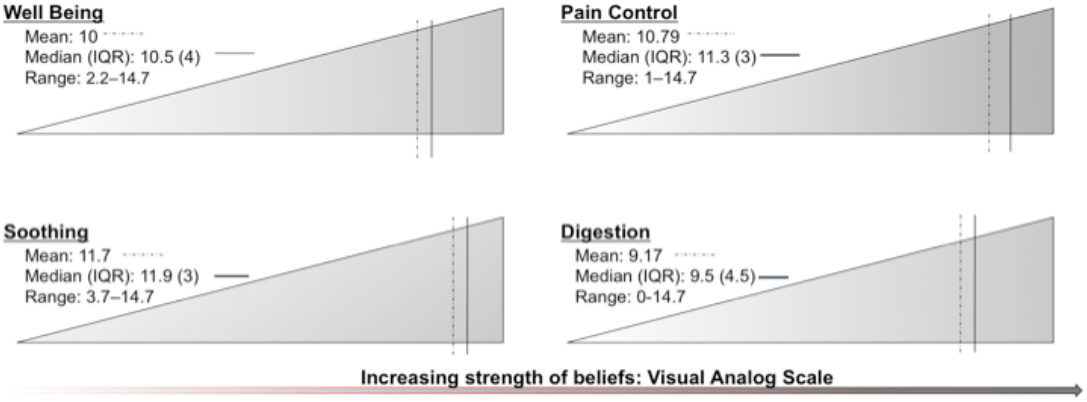
◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧Medical Doctors (14 returned), ✦Registered Nurses (174 returned), ★Licensed Practical Nurse (8 returned), ❖RNs & LPNs are a combined 182 returned, ❀Includes 1 (<1%) who did not report their profession

4.1.4 NICU Staff Belief Descriptions and Comparisons by Demographics

NICU staff beliefs about use of infant sense of taste to promote well-being, pain control, soothing and digestion were most often above the midpoint (7.35 cm) measured on Visual Analog Scales (VAS). Responses ranged from a low of 0 cm for belief in the use of taste for digestion to a high of 14.7 cm for each of the four uses of taste (figure 4.2).

Figure 4.2 Visual Analog Scales◆: Staff Beliefs

N = 199
Mid point of VAS = 7.35



Note. Three respondents did not answer this item.

Results of Kruskal–Wallis testing indicated no differences in belief responses by site or profession. However, in post hoc testing, differences were detected for experience. NICU staff with <24 months experience had a median of 7.7 compared to a median of 10 for those with >70 months (tables 4.9 to 4.11) indicating stronger beliefs for use of taste for digestion in those with more experience.

Table 4.9 Beliefs for Use of Taste by Hospital Site; Visual Analog Scale

N◆ = 197	FMC*	RGH✧	PLC✦	FMC	RGH	PLC
		Mean (SD★)				
		Range			Median	
Beliefs		❀n (%N)			(IQR❖)	
	10.4 (2.5)	9.7 (2.9)	9.6 (2.9)			
Well Being	2.9 – 14.7	2.2 – 14.7	4.2 – 14.7	10.9	10	10.2
	104 (53)	55 (28)	37 (19)	(8.6 – 11.9)	(7.9 – 12.1)	(7.6 – 11.3)
Z = 3.492, *p* = .174						
Pain	10.9 (2.7)	10.5 (2.5)	10.9 (3.2)	11.4	11.1	11.3
	2.2 – 14.7	2.1 – 14.7	1 – 14.7	(10 – 12.6)	(8.8 – 12.4)	(9.5 – 13.1)
	104 (53)	55 (28)	37 (19)			
Z = 1.368, *p* = .505						
Soothing	11.8 (2.2)	11.7 (2.1)	11.6 (2)			
	5.6 – 14.7	3.7 – 14.7	7.7 – 14.7	12	11.7	11.9
	104 (53)	55 (28)	37 (19)	(10.5 – 13.5)	(10.8 – 13)	(10.4 – 12.9)
Z = .370, *p* = .831						
Digestion	9.2 (3.1)	9.2 (3.2)	9.05 (3.7)			
	0 – 14.7	2.3 – 14.7	1 – 14.7	9.5	9.5	10
	104 (53)	55 (28)	37 (19)	(7.5 – 11.5)	(7.5 – 11.7)	(5.9 – 12)
Z = .004, *p* = .998						

◆N adjusted for removed NNP data, *Foothills Medical Centre, ✧Rockyview General Hospital, ✦Peter Lougheed Centre, ★Standard Deviation, ❖Interquartile Range, ❀Includes 1 (<1%) who did not report site worked at

Table 4.10 Beliefs for Use of Taste by Months of Experience; Visual Analog Scale

N◆ = 197	< 24	24–60	> 60	< 24	24–60	> 60
Beliefs		Mean (SD*) Range ✦n (%N) Missing (%N)			Median (IQR✧)	
Well Being	9 (2.96) 2.21 – 14.7 34 (17) 0	10.1 (2.58) 4.2 – 14.28 53 (27) 1 (<1)	10.3 (2.69) 2.94 – 14.7 105 (53) 2 (1)	9.1 (7.5 – 11.03)	10.6 (7.9 –11.87)	10.8 (2.9 – 14.7)
Z = 5.650, *p* = .059						
Pain	10.37 (2.86) 3.2 – 14.5 34 (17) 0	10.9 (2.54) 3.6 – 14.7 53 (27 1 (<1)	10.80 (2.79) 1 – 14.7 105 (53) 2 (1)	10.7 (8.4 – 12.9)	11.3 (9.8 – 12.5)	11.5 (1 – 14.7)
Z = .879, *p* = .644						
Soothing	11.62 (2.42) 5.6 – 14.7 34 (17) 0	11.42 (1.8) 6.6 – 14.7 53 (27) 1 (<1)	11.82 (2.16) 3.7 – 14.7 105 (53) 2 (1)	11.8 (10.5 – 14)	11.5 (10.5 – 12.5)	9.7 (3.7 – 14.7)
Z = 2.895, *p* = .235						
Digestion	8.07 (3.28) 1.9 – 14.5 34 (17) 0	8.55 (3.28) 1 – 14.7 53 (27) 1 (<1)	9.79 (3.13) 0 – 14.7 105 (53) 2 (1)	7.75 (6.05 – 10.5)	8.4 (6.2 – 11.2)	10 (0 – 14.7)
Z = 10.731, *p* = .005 Post Hoc Test *p* = .012 <24 months compared to >60 months						

◆N adjusted for removed NNP data, *Standard Deviation, ✧Interquartile Range, ✦ Includes 2 (1%) who did not report their experience

Table 4.11 Beliefs for Use of Taste by Profession; Visual Analog Scale

N◆ = 197	*RN/✧LPN	✦MD	RN/LPN	MD
	Mean (SD★)			
	Range		Median	
Beliefs	❀n (%N)		(IQR❖)	
	Missing (%N)			
Well Being	10.1 (2.8)	8.9 (1.6)		
	2.21 – 14.7	7.35 – 13.1	10.7	8.4
	182 (92)	13 (7.5)	(7.94 – 12.05)	(7.72 – 8.87)
	0	1 (<1)		
$Z = -1.872$, $p = .061$				
Pain	10.7 (2.8)	11.5 (1.7)		
	1.00 – 14.7	7.90 – 13.8	11.25	12
	182 (92)	13 (7.5)	(9.5 – 12.5)	(10.6 – 12.4)
	0	1 (<1)		
$Z = -.893$, $p = .372$				
Soothing	11.7 (2.2)	11.9 (1.2)		
	3.70 – 14.7	10.50 – 13.8	11.9	11.9
	182 (92)	13 (7.5)	(10.5 – 13.5)	(10.75 – 13.00)
	0	1 (<1)		
$Z = -.015$, $p = .988$				
Digestion	9.14 (3.3)	8.97 (2.7)		
	0 – 14.7	4.40 – 14.7	9.5	8.7
	182 (92)	13 (7.5)	(7.13 – 11.68)	(7.15 – 10. 85)
	0	1 (<1)		
$Z = -.107$, $p = .915$				

◆N adjusted for removed NNP data, *Registered Nurses, ✧Licensed Practical Nurse, ✦Medical Doctor, ★Standard Deviation, ❖Interquartile Range, ❀Includes 1 (<1%) who did not report their profession

4.1.5 NICU Staff Practice Descriptions and Comparisons by Demographics

Staff use of the ROFG (Alberta Health Services, 2009) for provision of taste during tube feeding was examined. Results are found in table 4.12, below. Less than one quarter (n = 44, 22%) of staff interpreted the ROFG definition for pre-oral infants[7] as encouraging regular provision of taste for infants identified as pre-oral.

Table 4.12 Routine Taste Practice of ◆NICU Staff for Pre–Oral Infants

N=199	
Offer Taste	n (%N)
Yes	44 (22)
No	154 (77)
Missing	1 (<1)

◆Neonatal Intensive Care Unit

No differences in use of the guide were found by site, months of NICU experience, or by profession using Fisher's Exact and Chi-squared tests (tables 4.13 to 4.15).

Table 4.13 Routine Taste Practice of ◆NICU Staff for Pre–Oral Infants by Hospital Site

N* = 197	**Total**	**✧FMC**	**✦RGH**	**★PLC**
Offer Taste	n (%N)	n (%)	n (%)	n (%)
Yes	43 (22)	17 (16)	17 (31)	9 (24)
No	152 (77)	87 (82)	37 (67)	28 (76)
Total	195 (99)	104 (100)	54 (98)	37 (100)
Missing	2❖ (1)	0	1 (2)	0

$\chi^2 = 4.874$, $p = .087$

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧Foothills Medical Centre (104 returned), ✦Rockyview General Hospital (55 returned), ★Peter Lougheed Centre (37 returned), ❖Includes 1 (<1%) who did not report site worked at

Table 4.14 Routine Taste Practice of ◆NICU Staff for Pre–Oral Infants by Months of Experience

N* = 197	**Total**			
Offer Taste	n (%N)	**< 24** n (%)	**24 – 60** n (%)	**> 60** n (%)
Yes	43 (22)	6 (18)	9 (17)	28 (26)
No	149 (78)	28 (82)	45 (83)	76 (71)
Total	192 (97)	34 (100)	54 (100)	104 (97)
Missing	5❖ (3)	0	0	3 (3)

$\chi^2 = 2.687$, $p = .261$

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧<24 months (34 returned), ✦24 – 60 months (54 returned), ★> 60 months (107 returned), ❖Includes 2 (1%) who did not indicate experience

[7] "Pre-Oral" is defined in the ROFG (Alberta Health Services, 2009) as "Responds adversely to handling. Poor physiologic, motor & state regulation with or without stimulation. None to very weak oral reflexes

Table 4.15 Routine Taste Practice of ◆NICU Staff for Pre–Oral Infants by Profession

N* = 197	Total	✧RN/✦LPN	★MD
Offer Taste	n (%N)	❖n (%)	n (%)
Yes	43 (22)	39 (21)	4 (29)
No	152 (77)	142 (78)	9 (64)
Total	195 (99)	181 (99.5)	13 (93)
Missing	2❀ (1)	1 (0.5)	1 (7)

Fisher's Exact Test p = .488

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧Medical Doctors (14 returned), ✦Registered Nurses (174 returned), ★Licensed Practical Nurse (8 returned), ❖RNs & LPNs are a combined 182 returns, ❀Includes 1 (<1%) who did not report their profession

The frequency with which NICU staff referenced the ROFG (Alberta Health Services, 2009) prior to initiating the first trophic feeds is presented by categories of time in table 4.16, below. The most frequent responses for using the guide when starting trophic feeds were "none of the time" (n = 58, 29%) or "some of the time" (n = 57, 29%). However, once results are examined as a whole, it was evident that at least two thirds of NICU staff refers to the ROFG at least occasionally.

Table 4.16 The Percent of Time ◆NICU Staff Referenced the Oral Feeding Guideline When Initiating Trophic Feeds

N=199							
	None (0%)	**Some (1–20%)**	**Moderate (21–40%)**	**Much (41–60%)**	**Most (61–80%)**	**All (81–100%)**	**Missing**
n (%N)	58 (29)	57 (29)	36 (18)	12 (6)	13 (6)	15 (8)	8 (4)

◆Neonatal Intensive Care Unit, *Regional Oral Feeding Guideline (Alberta Health Services, 2009)

Using the Fisher's Exact test, the percent of time NICU staff used the ROFG (Alberta Health Services, 2009) when initiating the first trophic feeds was compared by site, NICU experience, and profession. Subsequent post hoc testing revealed that percent of time consulting the ROFG differed by site and experience. NICU staff at the FMC and

(transient). None to very weak non-nutritive skills. Not managing secretions (Neurological infants)" (p. 3).

the RHG referred to the ROFG more than did staff at the PLC. Those with <24 months and those with 24-60 months NICU experience used the guide more often than those with >60 months of experience. No differences were found for use of the guide based on profession (tables 4.17 through 4.19).

Table 4.17 The Percent of Time ◆NICU Staff Referenced the Oral Feeding Guideline When Initiating Trophic Feeds by Hospital Site

N* = 197	**Total**	**✧FMC**	**✦RGH**	**★PLC**
Proportion of Time	n (%N)	n (%)	n (%)	n (%)
None (0%)	57 (29)	36 (35)	10 (18)	11 (30)
Some (1 – 20%)	57 (29)	31 (30)	23 (42)	3 (8)
Moderate (21 – 40%)	36 (18)	21 (20)	8 (16)	7 (19)
Much (41 – 60%)	12 (6)	5 (5)	5 (9)	2 (5)
Most (61 – 80%)	12 (6)	7 (7)	2 (4)	3 (8)
All (81 – 100%)	15 (8)	3 (3)	2 (4)	10 (27)
Total	189 (96)	103 (99)	50 (91)	36 (97)
Missing	8❖ (4)	1 (1)	5 (9)	1 (3)

Fisher's Exact Test = 31.841, *p = 1.000*
Post Hoc Test $p < 0.000$ FMC compared to PLC
Post Hoc Test $p < 0.000$ RGH compared to PLC

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧Foothills Medical Centre (104 returned), ✦Rockyview General Hospital (55 returned), ★Peter Lougheed Centre (37 returned), ❖Includes 1 (<1%) who did not report site worked at

Table 4.18 The Percent of Time ◆NICU Staff Referenced the Oral Feeding Guideline When Initiating Trophic Feeds by Months of NICU Experience

N* = 197	**Total**	**< 24**	**24 – 60**	**> 60**
Proportion of Time	n (%N)	n (%)	n (%)	n (%)
None (0%)	56 (28)	4 (12)	14 (26)	38 (36)
Some (1 – 20%)	56 (28)	11 (32)	13 (24)	32 (30)
Moderate (21 – 40%)	36 (18)	9 (26)	13 (24)	14 (13)
Much (41 – 60%)	12 (6)	3 (9)	3 (6)	6 (6)
Most (61 – 80%)	12 (6)	1 (3)	5 (9)	6 (6)
All (81 – 100%)	15 (8)	4 (12)	6 (11)	5 (5)
Total	187 (95)	32 (94)	54 (100)	101 (94)
Missing	10❖ (5)	2 (6)	0	6 (6)

Fisher's Exact Test *p =.010*
Post Hoc Test $p = .099$ 24 – 60 months compared to >60 months
Post Hoc Test $p < .05$ <24 months compared to >60 months

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧<24 months (34 returned), ✦24 – 60 months (54 returned), ★> 60 months (107 returned), ❖Includes 2 (1%) who did not report their experience

Table 4.19 The Percent of Time ◆NICU Staff Referenced the Oral Feeding Guideline When Initiating Trophic Feeds by Profession

N* = 197	Total	✧RN/✦LPN	★MD
Proportion of Time	n (%N)	❖n (%)	n (%)
None (0%)	57 (29)	49 (27)	8 (57)
Some (1 – 20%)	57 (29)	56 (31)	1 (7)
Moderate (21 – 40%)	36 (18)	33 (18)	3 (21)
Much (41 – 60%)	12 (6)	12 (7)	0
Most (61 – 80%)	12 (6)	11 (6)	1 (7)
All (81 – 100%)	15 (8)	15 (8)	0
Total	189 (96)	176 (96)	13 (93)
Missing	8❀ (4)	6 (4)	1 (7)

Fisher's Exact Test $p = 1.000$

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧Medical Doctors (14 returned), ✦Registered Nurses (174 returned), ★Licensed Practical Nurse (8 returned), ❖RNs & LPNs are a combined 182 returns, ❀Includes 1 (<1%) who did not report their profession

Resources accessed by respondents for feeding questions are found below in table 4.20. Greater than 70% (n = 146) referred to the ROFG (Alberta Health Services, 2009) for their questions about feeding practice. This was followed by a peer (n = 135, 68%) and then by an educator (n = 71, 36%).

Table 4.20 Resources Used by ◆NICU Staff for Feeding Practice Questions

N=199	Mentor	Educator	Charge Nurse	Other	Peers	Physician	Feeding Guide
n (%N)	49 (25)	71 (36)	124 (62)	42 (21)	135 (68)	62 (31)	146 (73)

◆Neonatal Intensive Care Unit

Fisher's Exact and Chi-squared tests were used to examine differences by site, amount of NICU experience, and profession in relation to staff seeking guidance from a) a mentor; b) educator; c) charge nurse; d) other (parent, therapist, specialist, etc); e) peers; f) physician; g) the ROFG (Alberta Health Services, 2009). Where applicable, post hoc testing was carried out to determine the differences.

No differences by site were found for consulting an educator, charge nurse, peer, physician, or the ROFG (Alberta Health Services, 2009). Among sites, differences were

found for consulting a mentor and an other (parent, therapist, specialist, etc.). Subsequent post hoc analysis found that consulting a mentor was found to differ in practice between the RGH (n = 8, 15% consulted a mentor) and the PLC (n = 14, 38% consulted a mentor). Differences in practice were also found for consulting an alternate (someone other than an educator, charge nurse, peer, physician or the ROFG between the RGH (n = 28, 24%) and the PLC (0%) and between the FMC (n = 13, 26%) and the PLC (0%). Respondents at the PLC did not consult an other (parent, therapist, specialist, etc.) for their questions about preterm infant feeding compared to staff at both the FMC and the RGH (table 4.21).

Practices also differed by months of NICU experience. Post hoc analysis revealed that staff with <24 months (n = 15, 44%) experience asked a mentor more than those with >60 months experience (n =19, 18%). Asking a charge nurse was found to be a more common practice with staff with 24 – 60 months (n = 42, 78%) experience as compared to staff with >60 months experience (n = 57, 53%). Asking an alternate (parent, therapist, specialist, etc.) was found to be more common a practice with those with >60 months (n = 29, 27%) experience compared to staff with 24 – 60 months (n = 3, 6%) (table 4.22).

Differences by profession were found with consulting the charge nurse, an alternate, and a peer. Approximately twice as many RNs and LPNs (n = 118, 65%), as compared to MDs (n = 5, 36%), consulted the charge nurse. Approximately three times as many MDs (n = 7, 50%) consulted an alternate compared to RNs and LPNs (n = 34, 19%). The largest differences were found with consulting a peer. RNs and LPNs (n = 131, 72%) reported relying on peer support approximately three and a half times more often than did MDs (n = 3, 21%) (table 4.23).

Table 4.21 Resources Used by ◆NICU Staff for Feeding Practice Questions by Hospital Site

N* = 197	Total	✧FMC	✦RGH	★PLC
Resource Consulted	n (%N)	n (%)	n (%)	n (%)
Mentor				
Yes	47 (24)	26 (25)	8 (15)	14 (38)
No	150 (76)	80 (75)	47 (85)	23 (62)
Total	196 (99)	104 (100)	55 (100)	37 (100)
Missing	1❖ (<1)	0	0	0
$\chi^2 = 6.545$, $p = .038$				
Post Hoc Test $p = .030$ RGH compared to PLC				
Educator				
Yes	71 (36)	39 (37)	17 (31)	15 (41)
No	125 (64)	65 (61)	38 (69)	22 (59)
Total	196 (99)	104 (100)	55 (100)	37 (100)
Missing	1❖ (<1)	0	0	0
$\chi^2 = 1.044$, $p = .593$				
Charge Nurse				
Yes	124 (63)	65 (61)	33 (60)	26 (70)
No	72 (37)	39 (37)	22 (40)	11 (30)
Total	196 (99)	104 (100)	55 (100)	37 (100)
Missing	1❖ (<1)	0	0	0
$\chi^2 = 1.060$, $p = .589$				
Other				
Yes	41 (21)	28 (26)	13 (24)	0
No	155 (79)	76 (72)	42 (76)	37 (100)
Total	196 (99)	104 (100)	55 (100)	37 (100)
Missing	1❖ (<1)	0	0	0
$\chi^2 = 12.300$, $p = .002$				
Post Hoc Test $p = .003$ FMC compared to PLC				
Post Hoc Test $p < .05$ RGH compared to PLC				
Peer				
Yes	135 (69)	67 (63)	41 (75)	27 (73)
No	61 (31)	37 (35)	14 (25)	10 (27)
Total	196 (99)	104 (100)	55 (100)	37 (100)
Missing	1❖ (<1)	0	0	0
$\chi^2 = 2.076$, $p = .354$				
Physician				
Yes	62 (31)	35 (33)	14 (25)	13 (35)
No	134 (68)	69 (65)	41 (75)	24 (65)
Total	196 (99)	104 (100)	55 (100)	37 (100)
Missing	1❖ (<1)	0	0	0
$\chi^2 = 1.377$, $p = .502$				
Feeding Guideline				
Yes	144 (73)	78 (73)	40 (73)	26 (70)
No	52 (26)	26 (24)	15 (27)	11 (30)
Total	196 (99)	104 (100)	55 (100)	37 (100)
Missing	1❖ (<1)	0	0	0
$\chi^2 = .335$, $p = .846$				

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧Foothills Medical Centre (104 returned), ✦Rockyview General Hospital (55 returned), ★Peter Lougheed Centre (37 returned), ❖Includes 1 (<1%) who did not report site worked at

Table 4.22 Resources Used by ◆NICU Staff for Feeding Practice Questions by Months of NICU Experience

N* = 197 Resource Consulted	Total ❖n (%N)	<24 n (%)	24 – 60 n (%)	>60 n (%)
Mentor				
Yes	48 (24)	15 (44)	14 (26)	19 (18)
No	145 (74)	19 (56)	40 (74)	86 (80)
Total	193 (98)	34 (100)	54 (100)	105 (98)
Missing	4❖ (2)	0	0	2 (2)
$\chi^2 = 9.353$, $p = .009$				
Post Hoc Test $p = .006$ <24 months compared to >60 months experience				
Educator				
Yes	69 (35)	16 (47)	20 (37)	33 (31)
No	124 (63)	18 (53)	34 (63)	72 (67)
Total	193 (98)	34 (100)	54 (100)	105 (98)
Missing	4❖ (2)	0	0	2 (2)
$\chi^2 = 2.786$, $p = .248$				
Charge Nurse				
Yes	121 (61)	22 (64)	42 (78)	57 (53)
No	72 (37)	12 (35)	12 (22)	48 (45)
Total	193 (98)	34 (100)	54 (27)	105 (98)
Missing	4❖ (2)	0	0	2 (2)
$\chi^2 = 8.486$, $p = .014$				
Post Hoc Test $p = .012$ 24 – 60 months compared to >60 months experience				
Other				
Yes	40 (21)	8 (24)	3 (6)	29 (27)
No	153 (78)	26 (76)	51 (94)	76 (72)
Total	193 (98)	34 (100)	54 (100)	105 (98)
Missing	4❖ (2)	0	0	2 (2)
$\chi^2 = 10.763$, $p = .005$				
Post Hoc Test $p = .003$ 24 – 60 months compared to >60 months experience				
Peer				
Yes	132 (67)	25 (74)	39 (72)	68 (64)
No	61 (30)	9 (26)	15 (28)	37 (35)
Total	193 (98)	34 (100)	54 (100)	105 (98)
Missing	4❖ (2)	0	0	2 (2)
$\chi^2 = 1.422$, $p = .491$				
Physician				
Yes	60 (30)	8 (24)	16 (30)	36 (34)
No	133 (68)	26 (76)	38 (70)	69 (64)
Total	193 (98)	34 (100)	54 (100)	105 (98)
Missing	4❖ (2)	0	0	2 (2)
$\chi^2 = 1.461$, $p = .482$				
Feeding Guideline				
Yes	142 (72)	25 (74)	37 (69)	80 (75)
No	51 (26)	9 (26)	17 (31)	25 (23)
Total	193 (98)	34 (100)	54 (100)	105 (98)
Missing	4❖ (2)	0	0	2 (2)
$\chi^2 = 1.080$, $p = .583$				

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧<24 months (34 returned), ✦24 – 60 months (54 returned), ★> 60 months (107 returned), ❖Includes 2 (1%) who did not report their experience

Table 4.23 Resources Used by ◆NICU Staff for Feeding Practice Questions by Profession

N* = 197	Total	✧RN/✦LPN	★MD
Resource Consulted	n (%N)	❖n (%)	n (%)
Mentor			
Yes	49 (25)	47 (26)	2 (14)
No	147 (75)	135 (74)	12 (86)
Total	196 (99)	182 (100)	14 (100)
Missing	1❁ (<1)	0	0
Fisher's Exact Test p = .524			
Educator			
Yes	71 (36)	68 (37)	3 (21)
No	125 (63)	114 (63)	11 (79)
Total	196 (99)	182 (100)	14 (100)
Missing	1❁ (<1)	0	0
Fisher's Exact Test p = .232			
Charge Nurse			
Yes	123 (62)	118 (65)	5 (36)
No	73 (37)	64 (35)	9 (64)
Total	196 (99)	182 (100)	14 (100)
Missing	1❁ (<1)	0	0
Fisher's Exact Test p = .030			
Other			
Yes	41 (21)	34 (19)	7 (50)
No	155 (79)	148 (81)	7 (50)
Total	196 (99)	182 (100)	14 (100)
Missing	1❁ (<1)	0	0
Fisher's Exact Test p = .012			
Peer			
Yes	134 (68)	131 (72)	3 (21)
No	62 (32)	51 (28)	11 (6)
Total	196 (99)	182 (100)	14 (7)
Missing	1❁ (<1)	0	0
Fisher's Exact Test p < .05			
Physician			
Yes	62 (32)	60 (33)	2 (14)
No	134 (68)	122 (67)	12 (86)
Total	196 (99)	182 (100)	14 (100)
Missing	1❁ (<1)	0	0
Fisher's Exact Test p = .233			
Feeding Guideline			
Yes	144 (73)	135 (74)	9 (64)
No	52 (26)	47 (26)	5 (36)
Total	196 (99)	182 (100)	14 (100)
Missing	1❁ (<1)	0	0
Fisher's Exact Test p = .529			

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧Medical Doctors (14 returned), ✦Registered Nurses (174 returned), ★Licensed Practical Nurse (8 returned), ❖RNs & LPNs are a combined 182 returns, ❁Includes 1 (<1%) who did not report their profession

Respondents indicated the percent of time over the past six months they offered taste in the four circumstances of a) during painful procedures as a means to soothe; b) before feeding; c) during feeding; and d) after feeding. On average, the percent of time staff used taste was highest for pain (87%), soothing (69%), and during feeds (64%). The lowest average percent was for after feeding (26%) (table 4.24).

Table 4.24 Percent of Time ◆NICU Staff Used Taste Practices

N=199					
Practices	**Total** n (%N)	Mean % (SD*)	Median (IQR✧)	Range	Missing
Pain	195 (98)	86.75 (17.81)	90 (20)	0 – 100	4
Soothing	195 (98)	68.90 (31.76)	80 (40)	0 – 100	4
Before Feeds	191 (97)	48.30 (31.84)	50 (55)	0 – 100	8
During Feeds	191 (97)	63.52 (30.32)	75 (40)	0 – 100	8
After Feeds	191 (97)	26.37 (30.42)	10 (50)	0 – 100	8

◆Neonatal Intensive Care Unit, *Standard Deviation, ✧Interquartile Range

Using the Kruskal-Wallis test, there were no differences detected in practice across sites and professions (tables 4.25 and 4.26) but there were differences by months of NICU experience (4.27). Post hoc analyses indicated that NICU staff with <24 months NICU experience provided taste for soothing more often than did those with >60 months NICU experience.

Table 4.25 ◆NICU Staff Taste Practices by Hospital Site

N* = 197	FMC✧	RGH✦	PLC★	FMC	RGH	PLC
Practices		Mean (SD❖) Range ♥n (%N) Missing (%N)			Median (IQR❁)	
Pain	89.41 (11.1) 50 – 100	82.46 (22.6) 10 – 100	88.75 (14.95) 50 – 100	90	90	95
n (%N) = 195 (99)	104 (53) 0	54 (27) 1 (<1)	36 (18) 1 (<1)	(80 – 99)	(80 – 100)	(80 – 100)
Z = 1.946, *p* = .378						
Soothing	70.44 (30.12) 0 – 100	68.96 (32.1) 0 – 100	67.94 (34.12) 0 – 100	80	80	80
n (%N) = 194 (98)	104 (53) 0	53 (27) 2 (1)	36 (18) 1 (<1)	(50 – 93)	(50 – 90)	(43 – 97.5)
Z = .044, *p* = .978						
Before Feeds	53.25 (27.23) 0 – 100	46.42 (35.29) 0 – 100	41.11 (35.26) 0 – 100	50	50	45
n (%N) = 191 (97)	102 (52) 2 (1)	53 (27) 1 (<1)	36 (18) 1 (<1)	(40 – 71.3)	(10 – 80)	(1.3 – 75)
Z = 3.423, *p* = .181						
During Feeds	63.83 (27.63) 0 – 100	64.43 (31.42) 0 – 100	64.94 (33.9) 0 – 100	70	75	75
n (%N) = 191 (97)	102 (52) 2 (1)	53 (27) 1 (<1)	36 (18) 1 (<1)	(50 – 90)	(45 90)	(40 – 99.5)
Z = .643, *p* = .725						
After Feeds	28.09 (30.94) 0 – 100	27.83 (31.14) 0 – 100	22.22 (28.32) 0 – 90	17.5	10	0
n (%N) = 191 (97)	102 (52) 2 (1)	53 (27) 2 (1)	36 (18) 1 (<1)	(0 – 50)	(0 – 50)	(0 – 50)
Z = 1.430, *p* = .489						

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧Foothills Medical Centre, ✦Rockyview General Hospital, ★Peter Lougheed Centre, ❖Standard Deviation, ❁Interquartile Range
♥Includes 1 (<1%) who did not report site worked at

Table 4.26 ◆NICU Staff Taste Practices by Months of Experience

N* = 197	< 24	24–60	> 60	< 24	24–60	> 60
Practices		Mean (SD◇) Range ★n (%N) Missing (%N)			Median (IQR✦)	
Pain	85.61 (16.43)	87.33 (18.01)	87.28 (15.4)			
	10 – 100	10 – 100	10 – 100	90	95	90
n(%N) =	33 (17)	54 (27)	103 (52)	(80 – 100)	(80 – 100)	(80 – 100)
190(96)	1 (<1)	0	4 (2)			
χ^2 = .798, *p* = .671						
Soothing	56.48 (36.72)	66.66 (30.50)	74.08 (29.06)			
	0 – 100	0 – 100	0 – 100	70	80	85
n(%N)	33 (17)	54 (27)	102 (52)	(20 – 85)	(50 – 90)	(57.5 – 99.3)
=189(96)	1 (<1)	0	5 (3)			
χ^2 = 8.069 *p* = .018						
Post Hoc test *p* = .027 <24 months compared to >60 months experience						
Before	37.27 (33.50)	47.66 (30.9)	52.21 (30.74)			
Feeds	0 – 100	0 – 100	0 – 100	40	50	50
	33 (17)	54 (27)	100 (51)	(0 – 60)	(20 – 75)	(30 – 80)
n(%N) =	1 (<1)	0	7 (4)			
186 (94)						
χ^2 = 4.979 *p* = .083						
During	55.09 (34.80)	67.45 (24.29)	65.06 (30.5)			
Feeds	0 – 100	0 – 100	0 – 100	50	75	75
	33 (17)	54 (27)	100 (51)	(30 – 90)	(50 – 90)	(50 – 90)
n(%N) =	1 (<1)	0	7 (4)			
186 (94)						
χ^2 = 2.116, *p* = .347						
After	17.88 (24.46)	28.21 (33.25)	28.38 (30.2)			
Feeds	0 – 80	0 – 100	0 – 100	0	10	20
	33 (17)	54 (27)	100 (51)	(0 – 30)	(0 – 50)	(0 – 50)
n(%N) =	1 (<1)	0	7 (4)			
186 (94)						
χ^2 = 2.743, *p* = .254						

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ◇Standard Deviation, ✦Interquartile Range, ★Includes 2 (1%) who did not report experience

Table 4.27 ◆NICU Staff Taste Practices by Profession

N* = 197	✧RN/✦LPN	★MD	RN/LPN	MD
	Mean (SD❖)			
	Range		Median	
Practices	♥n (%N)		(IQR❀)	
	Missing (%N)			
Pain	87.3 (15.9)	75.5 (28.3)		
	10 – 100	0 – 100	90	85
n (%N) = 192	179 (91)	13 (7)	(80 – 100)	(50 – 100)
(97)	3 (2)	1 (<1)		
Z = –.253 *p* = .800				
Soothing	70.2 (30.8)	41.8 (31.4)		
	0 – 100	0 – 90	80	40
n (%N) = 191	179 (91)	12 (6)	(50 – 90)	(21 – 71)
(97)	3 (2)	2 (1)		
Z = –2.706, *p* = .007				
Before Feeds	49.3 (31)	19.2 (32.5)		
	0 – 100	0 – 100	50	0
n (%N) = 188	179 (91)	9 (5)	(25 – 75)	(0 – 50)
(95)	3 (2)	5 (3)		
Z = –1.966, *p* = .049				
During Feeds	65.1 (28.7)	35 (42.6)		
	0 – 100	0 – 100	75	10
n (%N) = 188	179 (91)	9 (5)	(50 – 90)	(0 – 80)
(95)	3 (2)	5 (3)		
Z = –1.732, *p* = .083				
After Feeds	27.1 (30.6)	8.1 (15.2)		
	0 – 100	0 – 50	10	0
n (%N) = 188	179 (91)	9 (5)	(0 – 50)	(0 – 10)
(95)	3 (2)	5 (3)		
Z = –1.316 *p* = .188				

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧Registered Nurses, ✦Licensed Practical Nurses, ★Medical Doctors, ❖Standard Deviation, ❀Interquartile Range, ♥Includes 1(<1%) who did not report their profession

Detailed below is the routine provision of taste with tube feeding after feeding was established. More than two thirds of respondents (n = 141, 71%) indicated that they offered taste with feeds (table 4.28).

Table 4.28 Taste Used by ◆NICU Staff During Tube Feeding

N=199 **Regularly Provide Taste**	n (%N)
Yes	141 (71)
No	53 (27)
Total	194 (97)
Missing	5 (3)

◆Neonatal Intensive Care Unit

The routine practice of offering taste with feeds was compared by site, months of NICU experience, and profession using the Fisher's Exact and Chi-square tests. No differences were found by site or experience. RNs and LPNs offered taste with feeds more than twice as often as the MDs did (tables 4.29 through 4.31).

Table 4.29 Taste Used by ◆NICU Staff During Tube Feeding by Hospital Site

N* = 197 **Regularly Provide Taste**	**Total** n (%N)	✧**FMC** n (%)	✦**RGH** n (%)	★**PLC** n (%)
Yes	141 (72)	72 (68)	41 (75)	28 (76)
No	53 (27)	32 (30)	12 (22)	9 (24)
Total	194 (99)	104 (100)	53 (96)	37 (100)
Missing	3❖ (20)	0	2 (4)	0

$\chi^2 = 1.375$, $p = .503$

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧Foothills Medical Centre (104 returned), ✦Rockyview General Hospital (55 returned), ★Peter Lougheed Centre (37 returned), ❖Includes 1 (<1%) who did not report site worked at

Table 4.30 Taste Used by ◆NICU Staff During Tube Feeding by Months of Experience

N* = 197		<24	24 – 60	>60
Regularly Provide Taste	Total n (%N)	n (%)	n (%)	n (%)
Yes	139 (71)	23 (68)	39 (72)	77 (72)
No	51 (26)	10 (34)	12 (22)	26 (24)
Total	190 (96.5)	33 (97)	54 (100)	103 (96)
Missing	7❖ (3.5)	1 (3)	0	4 (4)

$\chi^2 = .360$, $p = .835$

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧<24 months (34 returned), ✦24 – 60 months (54 returned), ★> 60 months (107 returned), ❖Includes 2 (1%) who did not report their experience

Table 4.31 Taste Used by ◆NICU Staff During Tube Feeding by Profession

N* = 197		✧RN/✦LPN	★MD
Regularly Provide Taste	Total n (%N)	n (%)	n (%)
Yes	141 (72)	137 (75)	4 (29)
No	52 (26)	44 (24)	8 (57)
Total	193 (98)	181 (99.5)	12 (86)
Missing	4❀ (2)	1 (<1)	2 (14)

Fisher's Exact Test $p = .003$

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧Medical Doctors (14 returned), ✦Registered Nurses (174 returned), ★Licensed Practical Nurse (8 returned), ❖RNs & LPNs are a combined 182 returns, ❀Includes 1(<1) who did not report their profession

When providing taste experience, approximately three quarters of staff (n = 139, 70%) used EBM or formula during tube feeding of preterm infants. By contrast, none of the respondent indicated that they used 0.9% normal saline to offer taste (table 4.32).

Table 4.32 Solutions Used for Providing Taste During Tube Feeding

N=199	Yes	No	
Solution	n (%)		Missing (%N)
Sweet Solutions	12 (6)	180 (94)	7 (4)
◆EBM or Formula	139 (70)	60 (30)	7 (4)
Sterile Water	4 (2)	188 (98)	7 (4)
0.9% Normal Saline	0	192 (100)	7 (4)

◆Expressed Breast Milk

Using the Fisher's Exact and Chi-square tests , no differences were found among sites, by experience ranges, or by profession. Results are found below in tables 4.33 to 4.35.

Table 4.33 Solutions Used for Providing Taste During Tube Feeding by Hospital Site

N◆= 197	**Total**	***FMC**	**✧RGH**	**✦PLC**
Solution	n (%N)	n (%)	n (%)	n (%)
Sweet Solutions				
Yes	7 (4)	4 (4)	2 (4)	1 (3)
No	179 (91)	95 (91)	51 (93)	33 (89)
Total	186 (94)	99 (95)	53 (96)	34 (92)
Missing	11❖ (6)	5 (5)	2 (4)	3 (8)
$\chi^2 = .185$, $p = 1.000$				
★EBM or Formula				
Yes	131 (66.5)	69 (66)	39 (71)	23 (62)
No	54 (27)	29 (28)	14 (25)	11 (30)
Total	185 (93.5)	98 (94)	53 (96)	34 (92)
Missing	12❖ (6.5)	6 (6)	2 (4)	3 (8)
$\chi^2 = .370$, $p = .831$				
Sterile Water				
Yes	3 (1.5)	1 (1)	1 (2)	1 (3)
No	185 (94)	100 (96)	52 (95)	33 (89)
Total	188 (95)	101 (97)	53 (96)	34 (92)
Missing	9❖ (4.5)	3 (3)	2 (4)	3 (8)
$\chi^2 = 1.336$, $p = 1.000$				
0.9% Normal Saline				
Yes	2 (1)	1 (1)	1 (2)	0
No	189 (96)	102 (98)	53 (96)	34 (92)
Total	191 (97)	103 (99)	54 (98)	34 (92)
Missing	6❖ (3)	1 (1)	1 (2)	3 (8)
$\chi^2 = .931$, $p = 1.000$				

◆N adjusted for removed NNP data, *Foothills Medical Centre (104 returned), ✧Rockyview General Hospital (55 returned), ✦Peter Lougheed Centre (37 returned), ★Expressed Breast Milk
❖Includes 1 (<1%) who did not report site worked at

Table 4.34 Solutions Used for Providing Taste During Tube Feeding by Months of Experience

N◆ = 197	Total	<24	24 – 60	>60
Solution	n (%N)	*n (%)	✧n (%)	✦n (%)
Sweet Solutions				
Yes	7 (4)	0	2 (4)	5 (5)
No	175 (89)	32 (94)	51 (94)	92 (86)
Total	182 (92)	32 (94)	53 (98)	97 (91)
Missing	15❖ (8)	2 (6)	1 (2)	10 (9)
$\chi^2 = 1.265$, $p = .517$				
★**EBM or Formula**				
Yes	130 (66)	23 (68)	36 (67)	71 (66)
No	52 (26)	9 (26)	32 (59)	26 (24)
Total	182 (92)	32 (94)	53 (98)	97 (91)
Missing	15❖ (8)	2 (6)	1 (2)	10 (9)
$\chi^2 = .470$, $p = .790$				
Sterile Water				
Yes	3 (2)	0	1 (2)	2 (2)
No	182 (92)	33 (97)	52 (96)	97 (91)
Total	185 (94)	33 (97)	53 (98)	99 (93)
Missing	12❖ (6)	1 (3)	1 (2)	8 (7)
Fisher's Exact Test $p = 1.000$				
0.9% Normal Saline				
Yes	2 (1)	0	0	2 (2)
No	185 (94)	33 (97)	53 (98)	99 (93)
Total	187 (95)	33 (97)	53 (98)	101 (94)
Missing	10❖ (5)	1 (3)	1 (2)	6 (6)
Fisher's Exact Test $p = .692$				

◆N adjusted for removed NNP data, *<24 months (34 returned), ✧24 – 60 months (54 returned), ✦> 60 months (107 returned), ★Expressed Breast Milk, ❖Includes 2 (1%) who did not report their experience

Table 4.35 Solutions Used for Providing Taste During Tube Feeding by Profession

N◆ = 197	Total	*RN/✧LPN	✦MD
Solution	n (%N)	★n (%)	n (%)
Sweet Solutions			
Yes	7 (4)	6 (3)	1 (7)
No	178 (90)	168 (92)	10 (71)
Total	185 (94)	174 (96)	11 (79)
Missing	12❁ (6)	8 (4)	3 (21)
Fisher's Exact Test $p = .354$			
❖**EBM or Formula**			
Yes	131 (66)	129 (71)	2 (14)
No	53 (27)	44 (24)	9 (64)
Total	184 (93)	173 (95)	11 (79)
Missing	13❁ (7)	9 (5)	3 (21)
Fisher's Exact Test $p < .05$			
Sterile Water			
Yes	3 (2)	3 (2)	0
No	184 (94)	172 (95)	12 (86)
Total	187 (95)	175 (96)	12 (86)
Missing	10❁ (5)	7 (4)	2 (14)
Fisher's Exact Test $p = 1.000$			
0.9% Normal Saline			
Yes	2 (1)	2 (1)	0
No	188 (95)	176 (97)	12 (86)
Total	190 (96)	178 (98)	12 (86)
Missing	7❁ (4)	4 (2)	2 (14)
Fisher's Exact Test $p = 1.000$			

◆N adjusted for removed NNP data, *Medical Doctors (14 returned), ✧Registered Nurses (174 returned), ✦Licensed Practical Nurse (8 returned), ★RNs & LPNs are a combined 182 returns, ❖Expressed Breast Milk
❁Includes 1 (<1%) who did not report their profession

Respondents selected from the following list of methods used to offer taste a) dipped fingertip; b) dipped cotton swab; c) drops from a syringe; and d) dipped soother. Nearly all staff (n = 193, 97%) used soothers and more than three quarters (n = 167) used drops from a syringe as the method to deliver taste experience. The use of dipped fingertips was the least used method (n = 4, 2%) (table 4.36).

Table 4.36 Methods Used by ◆NICU Staff for Providing Taste

N = 199*	**Total**	
Method	n (%N)	Missing (%N)
Finger Tip	4 (2)	4 (2)
Cotton Swab	74 (37)	3 (2)
Drops From Syringe	167 (84)	5 (3)
Soother	193 (97)	4 (2)

◆Neonatal Intensive Care Unit, *More than one answer allowed

Using the Fisher's Exact test, no differences were found by site for methods of offering taste with feeds with a dipped fingertip or a dipped soother. Differences were found for the percent of staff that used a dipped cotton swab and drops from a syringe. Post hoc analyses results were that staff at the PLC (n = 5, 14%) used a cotton swab to offer taste less often than those at the FMC (n = 47, 44%) and the RGH (n = 22, 40%). Differences for using drops from a syringe were found between respondents at the RGH and those at the PLC. Ninety six percent at the RGH (n = 51) reported using drops from a syringe to offer taste compared to 78% (n = 29) at the PLC (table 4.37).

Using the Fisher Exact and Chi-square tests, differences in practices were found for using a cotton swab when offering taste when compared by months of experience. Post hoc analysis were carried out and it was found that NICU staff with >60 months experience (n = 53, 50%) used a dipped cotton swab more often than did those in the other two NICU experience ranges of <24 weeks and 24 to 60 weeks (n = 4, 12% and n = 16, 30%, respectively) (table 4.38).

No differences were found by profession for methods of offering taste using a) drops from a syringe; b) a fingertip; c) a dipped soother. However, almost six times more RNs and LPNs (n = 73, 40%) reported using a cotton swab than did MDs (n = 1, 7%) (table 4.39).

Table 4.37 Methods Used by ◆NICU Staff for Providing Taste by Hospital Site

N* = 197	Total	✧FMC	✦RGH	★PLC
Method	n (%N)	n (%)	n (%)	n (%)
Fingertip				
Yes	16 (8)	7 (7)	4 (7)	5 (14)
No	176 (89)	95 (90)	49 (89)	32 (86)
Total	192 (97)	102 (96)	53 (96)	37 (100)
Missing	5❖ (3)	2 (4)	2 (4)	0
Fisher's Exact Test $p = 1.000$				
Cotton Swab				
Yes	74 (38)	47 (44)	22 (40)	5 (14)
No	119 (60)	56 (53)	31 (56)	32 (86)
Total	193 (98)	103 (97)	53 (96)	37 (100)
Missing	4❖ (2)	1 (3)	2 (4)	0
Fisher's Exact Test $p = 0.002$				
Post Hoc Test $p = 0.003$ FMC compared to PLC				
Post Hoc Test $p = 0.012$ RGH compared to PLC				
Drops from Syringe				
Yes	165 (84)	85 (80)	51 (96)	29 (78)
No	27 (14)	17 (16)	2 (4)	8 (22)
Total	192 (97)	102 (96)	53 (96)	37 (100)
Missing	5❖ (3)	2 (4)	2 (4)	0
Fisher's Exact Test $p = 0.031$				
Post Hoc Test $p = 0.024$ PLC compared to RGH				
Soother				
Yes	190 (96)	100 (94)	53 (96)	37 (100)
No	2 (1)	2 (2)	0	0
Total	192 (97)	102 (96)	53 (96)	37 (100)
Missing	5❖ (3)	2 (4)	2 (4)	0
Fisher's Exact Test $p = 1.000$				

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧Foothills Medical Centre (104 returned), ✦Rockyview General Hospital (55 returned), ★Peter Lougheed Centre (37 returned), ❖Includes 1 (<1%) who did not report site worked at

Table 4.38 Methods Used by ◆NICU Staff for Providing Taste by Months of Experience

N* = 197	Total	✧<24	✦24 – 60	★>60
Method	n (%N)	n (%)	n (%)	n (%)
Fingertip				
Yes	16 (8)	3 (9)	3 (6)	10 (9)
No	174 (88)	31 (91)	51 (94)	92 (86)
Total	190 (96)	34 (100)	54 (100)	102 (95)
Missing	7❖ (4)	0	0	5 (5)
Fisher's Exact Test $p = .684$				
Cotton Swab				
Yes	73 (37)	4 (12)	16 (30)	53 (50)
No	117 (59)	30 (88)	38 (70)	49 (46)
Total	190 (96)	34 (100)	54 (100)	102 (95)
Missing	7❖ (4)	0	0	5 (5)
Fisher's Exact Test $p < .05$				
Post Hoc Test $p < .05$ <24 months compared to >60 months experience				
Post Hoc Test $p = .024$ 24 – 60 months compared to >60 months experience				
Drops from Syringe				
Yes	163 (83)	29 (85)	47 (87)	87 (81)
No	27 (14)	5 (15)	7 (13)	15 (14)
Total	190 (96)	34 (100)	54 (100)	102 (95)
Missing	7❖ (4)	0	0	5 (5)
$\chi^2 = .141$, $p = .961$				
Soother				
Yes	188 (95)	34 (100)	53 (98)	101 (94)
No	2 (1)	0	1 (2)	1 (1)
Total	190 (96)	34 (100)	54 (100)	102 (95)
Missing	7❖ (4)	0	0	5 (5)
Fisher's Exact Test $p = 1.000$				

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧<24 months (34 returned), ✦24 – 60 months (54 returned), ★> 60 months (107 returned), ❖Includes 2 (1%) who did not report their experience

Table 4.39 Methods Used by ◆NICU Staff for Providing Taste by Profession

N* = 197	Total	✧RN/✦LPN	★MD
Method	n (%N)	❖n (%)	n (%)
Fingertip			
Yes	16 (8)	15 (8)	1 (7)
No	176 (89)	164 (90)	12 (86)
Total	192 (97)	179 (98)	13 (93)
Missing	5❀ (3)	3 (2)	1 (7)
Fisher's Exact Test p = 1.000			
Cotton Swab			
Yes	74 (38)	73 (40)	1 (7)
No	119 (60)	107 (59)	12 (86)
Total	193 (98)	180 (99)	13 (93)
Missing	4❀ (2)	2 (1)	1 (7)
Fisher's Exact Test p = .018			
Drops from Syringe			
Yes	165 (84)	156 (86)	9 (64)
No	27 (14)	23 (7)	4 (29)
Total	192 (97)	179 (98)	13 (93)
	5❀ (3)	3 (2)	1 (7)
Fisher's Exact Test p = .019			
Soother			
Yes	190 (96)	178 (99)	12 (86)
No	2 (1)	1 (<1)	1 (7)
Total	192 (97)	179 (98)	13 (93)
Missing	5❀ (3)	3 (2)	1 (7)
Fisher's Exact Test p = .131			

◆Neonatal Intensive Care Unit, *N adjusted for removed NNP data, ✧Medical Doctors (14 returned), ✦Registered Nurses (174 returned), ★Licensed Practical Nurse (8 returned), ❖RNs & LPNs are a combined 182 returns, ❀Includes 1(<1%) who did not report their profession

4.1.6 Analysis of Written Responses

The open ended portion of the questionnaire was completed by 59 RNs, six MDs, and two LPNs. This represents 34% of the returned questionnaires. Respondents were asked to write down the resources they used to answer any of the questions. Twenty-two (11%) described various resources used. See table 4.40 below.

Table 4.40 Resources Used by ◆NICU Staff to Answer Questionnaire

Resource Cited N = 199	Colleague	Internet Source	*ROFG	Neonatal Handbook
n (%N)	6 (3)	7 (4)	9 (5)	1 (<1)

◆Neonatal Intensive Care Unit, *Regional Oral Feeding Guideline (Alberta Health Services, 2009)

4.1.6.1 Content Analysis

Subjects provided comments they had about the sense of taste of preterm infants. There were 58 comments (29%). These comments were examined for common patterns. Thirty five people provided responses which were directly supportive of using taste for preterm infants being tube fed. Twenty-three people/subjects provided responses which were either not supportive of taste (n = 10), offered information on topics not relevant to the issue (n = 5), or were asking for more information (n = 8). Some comments contained information that fit into more than one category. Table 4.41 below depicts common terms broken down by supportive and non-supportive statements.

Table 4.41 Common Terms Used by ◆NICU Staff to Answer Questionnaire

Terms	Supportive of Taste	Non-Supportive of Taste	Neither
Not Enough Taste Being Offered	3		
Taste is Very Important to Future Outcomes	6		
Taste is Very Important to Daily State	8		
Describing Practice/Knowledge	6	14	
Not Enough Known	11	10	
Questions			8
Other Information			5

◆Neonatal Intensive Care Unit

The term "Very Important" was used eight times by people supportive of taste for tube feeding preterm infants. The only other term to occur more than once was "very interesting", which occurred twice.

4.1.7 Summary

The sample was comprised of RNs, LPNs, NNPs, and MDs. The majority of respondents were RNs, with MDs and LPNs comprising the majority of the rest. Over

half of the respondents came from the FMC and the majority of respondents had greater than 60 months of experience.

Very few staff (n = 17) were knowledgeable about the development of taste occurring in the fetus and only half were aware that maternal diet flavours amniotic fluid. There were no differences in knowledge of taste by profession or months of experience. Fewer staff at the FMC were aware of maternal diet flavouring amniotic fluid compared to the PLC.

In general, NICU staff believed in the importance of the preterm infant sense of taste to promote well being, pain control, soothing, and digestion. The only difference was found for experience. Those with fewer months of experience believed less in taste for digestion than those with the most experience.

Generally NICU staff interpreted the ROFG (Alberta Health Services, 2009), as providing little encouragement around regular provision of taste for infants identified as pre–oral. No differences in this practice were found by site, months of NICU experience, or by profession. Results for referencing the ROFG revealed that at least two thirds of NICU staff refer to the ROFG at least occasionally for the very preterm. Practice in this regard did not differ based on profession. Referencing the guide differed by site and experience. NICU staff at the FMC and the RHG referred to the guide more than did staff at the PLC. Those in the lesser experience ranges reported using the guide more often than those with the most.

A relatively high proportion of staff reported referencing the ROFG (Alberta Health Services, 2009) at least occasionally (70%) and approximately three quarters of respondents indicated that the resource most used for their questions about feeding

practice was the guide. Consulting a mentor and an alternate (parent, therapist, specialist, etc.) was found to be different by site. More than twice as many NICU staff at the PLC consulted a mentor compared to the RGH. Fewer respondents at the PLC consulted an alternate as compared to staff at both the FMC and the RGH.

Feeding practice consultation differed by amount of NICU experience. Those with less experience asked a mentor more than those with the most experience. Asking a charge nurse was found to be a more common practice with staff in the middle range (24-60 weeks) of experience as compared to staff with the most experience. Asking an other (parent, therapist, specialist, etc) was found to be more common with those with the most experience compared those in the mid-range of experience. Proportionally, twice as many RNs and LPNs as compared to MDs consulted the charge nurse, while approximately three times as many MDs consulted an other as compared to RNs and LPNs. The largest differences were found with consulting a peer. RNs and LPNs reported relying on peer support approximately three and a half times more often than did MDs.

On average, NICU staff used taste mostly for pain, then soothing, and then during feeds. Taste was least used after feeding. This did not differ across sites and professions but there were differences by months of NICU experience. NICU staff with the least experience provided taste for soothing more often than did those with the most experience.

Once feeding was established, more than two thirds of respondents indicated that they offered taste with feeds. This did not differ by site or experience. However, this practice did differ by profession with RNs and LPNs offering taste with feeds more than twice as often than did MDs. To provide taste, approximately three quarters of staff used

EBM or formula during tube feeding preterm infants and none indicated that they used 0.9% normal saline. Otherwise, solutions used did not differ by experience ranges or profession.

Methods used for taste were predominantly a soother followed by drops from a syringe. The least used method was a finger-tip. No differences were found by site except for respondents at the RGH who reported using drops from a syringe to offer taste more often than respondents at the other two sites. Differences in practices were also found for using a cotton swab with experience ranges. Those with the most NICU experience used a cotton swab more often than did those in the other two lesser experience ranges. For profession, RNs and LPNs reported using a cotton swab to deliver taste six times more than did MDs.

The open-ended portion of the questionnaire was completed by approximately one third of respondents with the most common resource reported as the Feeding Guide. Most comments were supportive of allowing taste, and the term “very important” was the most commonly used term in relation to preterm infant sense of taste.

Chapter Five: Discussion

5.1 Introduction

The study was designed to achieve an understanding of NICU staff a) knowledge of fetal taste sense; b) beliefs about using taste; and c) practices of using taste when tube feeding preterm infants and in particular those born at less than 33 weeks gestation. These babies are tube fed milk feeds due to immature breathing and swallowing coordination (Edwards & Spatz, 2010; Kristoffersen, Skogvol, & Hafström, 2011; Medoff-Cooper et al., 1993; Vandenberg, 1990). Tube feeding delivers EBM or formula directly into the stomach using an OG or NG catheter (Kristoffersen et al., 2011; Medoff-Cooper et al., 1993; Vandenberg, 1990). By feeding this way, the sense of taste is bypassed in the early neonatal period. Tube feeding can persist for up to 10 weeks, with limited opportunities for the infant to taste prior to a feed unless the staff offer taste experiences (Edwards & Spatz, 2010; Rodriguez et al., 2010; Zorc, 2001). During this time, and later infancy, taste might be important to normal neurologic function, digestion, and to the well being of infants born preterm (Edwards & Spatz, 2010; Rodriguez et al., 2010; Zorc, 2001).

In order to determine the sense of taste knowledge, beliefs, and practices of NICU staff tube feeding preterm infants, a questionnaire was developed. The questionnaire was distributed to the level II and III NICU staff at three hospitals in Calgary. RNs, LPNs, NNPs, and MDs were included in the study. The study was carried out over a period of six-months from May 1st to October 15th in 2010. In all, there were 199 respondents.

5.2 Discussion

5.2.1 Knowledge

Overall, respondent knowledge of fetal taste development and environment was found to be low. Ninety percent of staff provided incorrect answers when asked when the sense of taste was present in the developing fetus. There were no demographic differences in this regard. Half knew that maternal diet flavoured amniotic fluid. Greater than 60% of respondents from the PLC answered correctly that maternal diet flavours the amniotic fluid. In comparison to the FMC, this was significantly better ($p = <0.05$) where only 44% provided correct answers. Answers from respondents at the RGH were not significantly different from the other two sites. Otherwise there were no knowledge differences in terms of work site, months of experience, or profession for knowledge of fetal taste development or environment.

Lack of knowledge is important, given the role that knowledge plays in practice (Dennis, 2002; Flodgren et al., 2011; Grimshaw et al., 2004). In studies of breastfeeding, knowledge of the practice was found to be key in nurses teaching new mothers how to breastfeed (Dennis, 2002). Dennis (2002) and Grimshaw et al. (2004) reported that lack of knowledge was directly related to reasons why certain practices (e.g. breastfeeding teaching, emergency resuscitation standards, etc) go unimplemented. Dennis (2002), Flodgren et al. (2011), and Grimshaw et al. (2004) describe education and knowledge-base as key to the use of clinical guidelines in practice.

However, Calkin noted in her Advanced Practice Nursing Model that though nurses grow in experience and practice, their knowledge often lags behind (Hamric, Hanson, Tracy, & O'Grady, 2013, p. 46). Calkin indicated that it is common for nurses to

gain experience and become proficient at certain practices without attaining a sufficient knowledge base to explain the evidence based rationale for their practice (cited in Hamric, et al., 2013, p. 46). In the case of taste provision, it is likely that staff who may lack knowledge about taste sense development might still offer taste experiences. Thus, in spite of the limited correct answers about taste development, it is not surprising that belief in taste for certain aspects of care was strong.

5.2.2 Beliefs

On the visual analog scale respondents indicated a strong belief in taste as a means for well being, pain control, soothing, and digestion. Responses on the belief visual analog scales had mean ratings of greater than 9.5 cm across all hospital sites for the use of taste to enhance well being, pain control, soothing, and digestion. The only difference found was that staff with greater than 24 months experience indicated stronger belief in taste for digestion than those with experience of less than 24 months.

The beliefs of experienced staff are important because they may influence the more junior staff over time. In a systematic review of 12 randomized controlled trials, Flodgren et al. (2011) noted that opinion leaders had a 10% larger effect than other interventions on uptake of guidelines. Opinion leader influence along with the ROFG (Alberta Health Services, 2009) (which contains instructions on taste provision), and the common use of taste for pain may be influencing staff belief. Also, tasting with eating both for comfort and digestion is a normal physiologic process (Sapolsky, 2003). Thus, the staff had a number of reasons to believe in taste for the range of stated purposes. In addition, although nearly all staff lacked the knowledge to explain the developmental rationale for offering taste, their practice does reflect correct use of the developing

anatomy. This is in line with Calkin's Model of Advance Practice Nursing (1984), which states that knowledge need not be present for a practice to be in effect. Calkin describes nurses in this scenario, where a practice is used often enough to become familiar, as "experts by practice" (cited in Hamric et al., 2013, p. 76).

The Theory of Reasoned Action (TRA) supports Calkin's theory of advance practice, (Ajzen, & Fishbein, 1980). The social psychology derived TRA is comprised of three parts. These are a) behavioral intention; b) attitude; and c) subjective norm (the prevailing peer opinions of the behaviour) (Ajzen, & Fishbein, 1980). The authors suggest that subject intentions and behavior depends on their attitudes and the prevailing peer opinions about the behavior. Thus, if a person intends to carry out a behaviour and the behaviour is common and supported among peers, then the intention is often acted upon (Fishbein & Ajzen, 2011). High belief was reported for use of taste as efficacious for well being, pain, soothing, and digestion. Thus it is reasonable to assume that despite the lack of a knowledge base, staff may use taste for their common practices during tube feeds. Indeed, as will be seen below, this is in fact what occurs.

5.2.3 Practices

5.2.3.1 The influence of the Regional Oral Feeding Guideline (Alberta Health Services, 2009) on Taste Practices

Staff interpretation of the definition for pre-oral infants was assessed to determine if staff felt the definition supported offering taste as a routine for the very preterm. Results indicated that less than a quarter of respondents (22%), with no differences by site, profession, or years of experience, interpreted the guideline's definition as encouraging regular provision of taste for pre-oral infants. It may be that respondent lack

of knowledge about taste development had a role in this interpretation. Regardless of staff knowledge level, what is significant about the definition of pre-oral infants is that it lacks precise developmental information related to taste.

First, in the section where taste practices are described, the initial instruction in the ROFG (Alberta Health Services, 2009), which is in regards to positioning, describes "Use (for the pre-oral infant) developmental care interventions . . ." (p. 3). In addition to this, the ROFG defines a pre-oral infant as "Responds adversely to handling. Poor physiologic, motor & state regulation with or without stimulation. None to very weak oral reflexes (transient). None to very weak non-nutritive skills" (p. 3). Between this definition of pre-oral infants and the instruction to use developmental care, it can be seen why respondents did not judge the ROFG definition as allowing taste. The ROFG does go on to encourage taste provision at the end of the section on care of infants in the Non-Nutritive Sucking Stage. The document provides guidance with respect to scenarios and methods where taste provision would be appropriate and offers an explanation for the high belief in taste as an adjunct to care. Also, the instructions for taste provision in the ROFG may promote the provision of taste, but the section itself does little to correct the knowledge gaps of staff. However, if staff misses this portion of taste provision, the staff may merely note the patient as pre-oral and provide usual care based on their lack of knowledge of fetal development and omit provision of taste.

Given the high belief in taste in the sample, one would think that the definition of "pre-oral" might not stop staff from using taste even in the very preterm. This may be the case, as the TRA, a robust way of predicting behaviour that has been tested across multiple studies and settings (Hale, Householder, & Green, 2002, p. 259), would predict

use of taste based on belief and subjective norm. Thus, there is potential for a disconnect between practice and the guidelines with a staff interpretation of the label as implying a lack of developmental ability on the part of the infant. Considered in the context of 2004, when the ROFG (Alberta Health Services, 2009) was developed, the lack of guidance to provide taste for pre-oral labeled infants is not unusual. At the time, the document set out clear instructions with much emphasis on developmental care including use of taste at a time when these factors were not in much evidence in the other guidelines (Premji et al, 2004). The focus was on recognizing that infants can have trouble feeding due to immaturity and physiologic instability. Thus, forcing unstable infants to feed could potentially lead to feeding problems (Premji et al., 2004). However, the avocation for lack of oral stimulation remains relatively common even in 2011. Lasby and Dressler-Mund discussing the ROFG wrote that "the best intervention at this stage is "no oral feeding" and no oral stimulation and to concentrate on care that promotes environmental control, developmental care, and physiologic homeostasis" (p. 18). It may be time to update the information in light of fetal development knowledge.

As a resource, the ROFG (Alberta Health Services, 2009) was referred to for questions about feeding practice by greater than 70% of respondents. However, more than half of respondents indicated that they used ROFG only rarely when starting trophic feeds. This appears to be in contrast to others who studied the ROFG's uptake, as it applied to preparing infants for oral feeding (McNeil et al., 2006). As an example, when McNeil et al. (2006) examined the ROFG's influence on staff feeding practices, the authors found that post implementation there was a significant increase in staff preparing preterm infants to feed using breast milk for stimulation (from 4% pre-implementation to

34% post). Hence, the guideline's implementation and information was affecting practice. This is indicative of staff use of the ROFG.

However, results from the McNeil et al. (2006) study and this current study indicate infrequent reference to the ROFG (Alberta Health Services, 2009). While the research did not seek to identify why use of the guideline is infrequent, it may be due to familiarity with the reference as more than two thirds of respondents reported using the ROFG at least some of the time. Hence, infrequent use of the ROFG might be common, especially as experience increased. However, McNeil et al. (2006) noted in their evaluation of staff use of the ROFG that there can be "incomplete understanding of the stages of oral feeding…" (p.12) which can lead to variation in practice. The authors concluded that, in general, even experienced staff might misinterpret the ROFG. Given the chance of misinterpretation and a label of "pre-oral" which might indicate a lack of ability, it is unsurprising that the majority of the staff interpreted the ROFG's pre-oral definition as not inclusive of taste provision.

Data support that experience plays a role in respondent use of the ROFG (Alberta Health Services, 2009). For example, those with >60 months of experience and those with 24-60 months NICU experience used the guide differently than those with <24 months. Overall, when accounting for any amount of ROFG use, the >60 months group reported 51% use, and the 24 – 60 months experience group reported 40% use to guide feeding decisions when initiating oral feeds. By contrast, the <24 month experience group reported that 80% of them used the ROFG in this circumstance. These results indicate that increasing respondent experience meant less reliance on the ROFG when initiating trophic feeds for preterm infants.

The ROFG (Alberta Health Services, 2009) was not the only resource used. A mentor, the charge nurse, the physician, an educator, a peer, or an alternate, were also consulted for feeding advice. Data indicate that feeding practice consultation differed by amount of NICU experience. Those with <24 months experience (44%) asked a mentor more than those with >60 months experience (18%). Asking a charge nurse was found to be a more common practice with respondents who had 24 – 60 months (78%) experience as compared to staff with >60 months experience (54%). Asking an alternate (parent, therapist, specialist, etc.) was found to be more common practice for those with >60 months (28%) experience compared to staff with 24 – 60 months (6%). This is not at all surprising, as increasing experience would dictate the need for more specialized guidance rather than common task based guidance. Procedural familiarity would have increased with experience such that guidance would be required more for unique care situations rather than common ones.

Profession also played a role in advice seeking. Approximately twice as many RNs and LPNs (65%), as compared to MDs (36%), consulted the charge nurse for feeding practice questions. Approximately three times as many MDs (50%) consulted an alternate (parent, therapist, specialist, etc.) compared to RNs and LPNs (19%). It is likely that experience reduces use of a resource and frequency of advice seeking for common care. However, there would be increased consultation for unique situations, hence experienced specialized colleagues (an alternate) might then be sought out.

The largest differences across professions in reported feeding advice resources were found for peer consultation. RNs and LPNs (72%) reported relying on peer support approximately three and a half times more often than did MDs (21%). It is difficult to say

why respondent MDs do not rely on peer support to the same degree as respondent RNs and LPNs. However, there is a reasonable rationale for this difference. RNs and LPNs work together as a group on all shifts while MDs do not. While MDs do collaborate with RNs and LPNs, MDs are far fewer in number, frequently the only MD working, and are not present the entire shift, hence there are commensurately fewer opportunities to collaborate. Hence opportunities to collaborate with peers occur much more frequently for RNs and LPNs and they thus see each other as resources. This also fits well with the TRA, which identifies that subjective norms derived from peer influences, predicts behaviour (Fishbein & Ajzen, 2011). Thus, increasing RN and LPN level of knowledge, there would likely be an improvement in the quality and standardization of advice and guidance being disseminated. Dennis (2002), Flodgren et al. (2011), and Grimshaw et al. (2004) indicate that by educating and supporting staff, practices become more uniform and evidence based.

Still, when regarded as a whole, the data indicate use of the ROFG (Alberta Health Services, 2009) (73%), peer (68%), and charge nurse (62%) as the primary resources for feeding advice. Although MDs referred more to alternate sources and did not demonstrate a greater body of knowledge than the LPNs or RNs, there were fewer in the study sample so this result may not be representative. It is unlikely that MDs would engage in actually providing feeding to infants. However, their stated support of taste practices might be beneficial. By encouraging the use of taste with all tube feeds, MDs would be key in initiating and perpetuating such practices since research evidence indicates that MD support is important when modifying practice (Grimshaw et al., 2004; Grol & Grimshaw, 2003; Shaw, Thornton, Chamberlain, & Ayiku, 2010). For nurses,

Calkin cites improved knowledge base as integral to advance practice and necessary for support of practice change (cited in Hamric et al., 2013, p. 76). While Calkin's (1984) theory was not meant to reflect MD practice, research by El-Naggar and McNamara (2012) support the idea that MD endorsement of a practice requires a substantive knowledge base.

El-Naggar and McNamara (2012) used a web-based questionnaire regarding resuscitation of preterm infants in the delivery room. They found a lack of uniformity with guideline compliance in neonatologists who participated in the survey and that delivery room resuscitation practices are highly variable in Canadian NICUs. Cited reasons ranged from a perceived lack of scientific evidence, the often hectic nature of cardio-respiratory physiology in the early transitional period, controversy in the literature, and lack of endorsement by opinion leaders. However, based on the TRA, given that the subjective norm was to provide taste for a broad spectrum of situations, it is likely that peers, educators, MDs, and management would be supportive of the practice and encourage it. Thus, one would expect that though the level of knowledge regarding taste sense development was low even for respondent MDs, there would be support of the practice.

In summary, it is evident that for those who directly tube feed infants, the ROFG (Alberta Health Services, 2009), peer, and mentor support may be the largest influences on practice. Given that those with less experience relied on peers or mentors and peers and mentors in turn relied on the ROFG, there is in this study ample, troubling indication for care based on belief rather than knowledge.

Authors have noted that knowledge, along with other factors like clearness of the guidelines and unit support of the practice, contribute to uptake and implementation of the guidelines (McCord, 2011). Baker et al. (2009) found much the same result when they investigated staff nurse co-operation for improvement of care for late preterm infants using evidence based practice as laid out by clinical guidelines. The researchers identified knowledge deficits across the range of topics and concluded that lack of knowledge led to a lack of guideline uptake and non-implementation of evidence based practice by staff (Baker et al., 2009).

It is evident from the data that the ROFG (Alberta Health Services, 2009) was important for guiding care. In examining its own guidelines the Registered Nurses Association of Ontario (RNAO) noted that well worded, correctly implemented guidelines were utilized and well regarded by staff. This was from a study that examined leadership, cultural diversity, professionalism, workplace health and safety, and staffing guidelines (RNAO, 2010). Respondents to the study indicated that implementation and usefulness of information was key to uptake and use of the documents. The RNAO reported an overall positive effect on the targeted units, especially with regard to evidence based practice pursuant to guidelines (RNAO, 2010). The difference between the ROFG and the RNAO guideline uptake might be that the ROFG lacks rationale for providing taste as a part of care. The RNAO study advocates for updating evidence based protocols to keep pace with current research (RNAO, 2010). While within the context of 2004, when the guide was developed, the ROFG provided much useful guidance and information where little had previously existed, it is perhaps in need of updating with current information.

5.2.4 Common Uses For Taste

Respondents revealed that on average, the percent of time they used taste was highest for pain (87%), soothing (69%), and during feeds (64%). The lowest average percent was for after feeding (26%). Also, those respondents with >60 months NICU experience used taste more for soothing (median 85% of the time) compared to respondents with <24 months (median 70%). Likely, increasing practice hours informed caregivers' perception that taste had a soothing effect, and likely encouraged use.

The role of experience deserves more examination. Results revealed that having less experience was associated with seeking mentoring advice. Almost half of those with the least experience reported seeking mentoring advice compared to less than 25% of those with greater experience. Delving into this further, it is notable that experience was not apportioned evenly across the three sites. The respondent staff at the PLC was notably less experienced than the respondents at the FMC and the RGH. Specifically, the PLC had a significantly higher percentage of staff with <24 months experience and a significantly lower percentage of those with >60 months, as compared to the FMC and the RGH. There are limited conclusions that can be drawn from the PLC results, however. Only 30% of those eligible returned questionnaires, and, of those that did, by far the greatest number of respondents reported experience in the lowest experience range (<24 months).

Once milk feeds were established, taste was used by more than two thirds of respondents. Perhaps, as the infants matured, and were able to tolerate enteral tube feeding, taste was provided. In effect, though respondent staff largely indicated that the definition of pre-oral did not allow taste, this did not stop staff from providing taste

experiences for the very preterm once feeds were a routine. However, given their lack of knowledge about taste with feeds, they were, in effect, not practicing based on evidence, but for some other reason. Given the results of the belief questions, it is likely that it was their strong belief in taste as a practice that was guiding them.

The lack of knowledge about taste development in the fetus might play a part in decision making to provide taste. Sozanskii (1961) and later, Weiss et al. (1985) noted that amniotic fluid possess a relatively high sugar concentration and, thus, must taste sweet. Hence it is likely a familiar and soothing sensation for the preterm infant who commonly swallows amniotic fluid *in utero*. The literature also suggests that by the 15th week of pregnancy, the fetal sense of taste is developed (Achiron et al., 1997; Diewert, 1985; Witt & Reuter, 1996; Witt & Reuter, 1998) and that memory of maternal diet tastes from amniotic fluid persist in life after birth (Beauchamp & Mennella, 2011; Mennella et al., 2001). Hence, the instructions for use of EBM for taste in the ROFG (Alberta Health Services, 2009) are appropriate but may fall short of providing adequate guidance.

Acknowledging that fetal movements include "practicing how to feed" (Grand, Watkins, & Torti, 1976, Miller et al., 2003), and that taste is integral to fetal life based on maternal diet (Mennella, et al., 1995; Sozanskii, 1961; Weiss et al., 1985), providing taste experiences for preterm infants prior to starting feeds could be considered more natural and potentially beneficial. However, taste prior to feeds was used a median of only 50% of the time and was the lowest on the belief scale data with a median of 9.5cm. This underscores a discrepancy between evidence and practice.

Respondents indicated providing taste during feeding a median of 75% of the time. This is in contrast to taste before feeding at a median of 50% of the time. Thus, with

taste reported as being offered routinely as high as 72% of the time, it is commonly being done so after the feed is commenced. This is at odds with the known fetal behaviour reported by Grand, Watkins, and Torti (1976) and Miller et al. (2003) who noted fetal drinking of amniotic fluid. They postulated that *in utero* the normal feeding pathway begins with taste, then swallowing, and then the stomach gets full. In this study, practice is reported as filling the stomach first and then offering taste. In other words, out of order from what the developing fetus would have normally experienced. Even so, 72% of the respondents reported use of taste routinely with feeds. There were no differences by site or experience and, RNs and LPNs used taste for feeds more than MDs (70% compared to 21%, respectively). This last result is unsurprising as physicians do not commonly tube feed infants. However, there are other uses of taste. One in particular is the comprehensive-use of sweet taste for painful procedures.

Overall, sweet taste for painful procedures was the highest rated on the VAS and the most frequently used intervention. This is noteworthy, as Shah et al. (2006) proposed that associating pain with sweet and food tastes may have unforeseen long term consequences. It seems likely that consistently pairing food and sweet taste with pain, without consistently pairing food and sweet taste with feeding, might condition oral aversion or oral defensive behaviours. Practices such as pairing taste with pain are very similar to classic negative reinforcement experiments (Pierce & Cheney, 2013).

It is arguable that this may be a reason for the large number of preterm infants who require occupational therapy for oral aversion disorders later in life (Burklow et al., 1998; Cerro et al., 2002; Dodrill et al., 2004; Martin & Shaw, 1997; McNeil, 2008).

These oral aversion outcomes might be changed if staff were made aware of the developmental path of the fetal taste sense and its functional status.

5.2.5 Common Solutions and Methods for Taste

EBM or formula was reported as the taste solution used by 70% of the respondents. Bilkó, Altbäcker, and Hudson (1994) noted that EBM, like amniotic fluid, carries the flavours of maternal diet. Hence, infants become acquainted with food flavours. It is not surprising then that, as taste is familiar to the infant, it would be efficacious for pain control and, soothing. Offering taste is also a way to involve parents in the care of their newborns. Practiced in this manner, taste provision is likely quite a successful intervention as a way to soothe infants and to involve parents. Likely this is why taste was used a median of 90% of the time for pain, 80% for soothing, and 75% of the time during feeds. Since the preferred method for taste delivery was by dipped soother, a method that encourages NNS and is endorsed by the ROFG (Alberta Health Services, 2009), this practice mimics natural feeding where an infant would breastfeed.

While the literature on taste is limited, reports show taste as either benign (Rodriguez at al., 2010) or, to some degree, beneficial (Edwards & Spatz, 2010, Zorc, 2001). The methods used for providing taste in these studies were by soother (Edwards & Spatz, 2010) or by dropper (Edwards & Spatz, 2010; Rodriguez at al., 2010; Zorc, 2001). However, in this study, some staff used a cotton swab to offer taste. While practices in this regard differed by profession, with more RNs and LPNs (41%) reporting using a cotton swab than did MDs (8%), the fact that the practice is virtually confined to RNs and LPNs is unsurprising as these are the groups most likely to feed infants. Also, drops from a syringe were found to be more common among respondents at the RGH as compared to

the PLC with nearly all respondents at the RGH reporting using drops from a syringe to offer taste compared to three quarters at the PLC. More FMC and RGH respondents used a cotton swab to deliver taste compared to PLC staff. As well, more RN and LPN respondents with >60 months experience (52%) used a dipped cotton swab more often than did those with <24 month and 24 – 60 months (12% and 30%, respectively). No other researchers have looked at use of a cotton swab and, from the results of this study, the practice itself seemed confined to those with the most experience and at the FMC and the RGH. Due to the lower numbers of staff with large amounts of experience who returned questionnaires at the PLC, it is unknown if the same results would have been obtained had the return numbers been similar to the other two units. However, if this practice is a subjective norm among more experienced staff then the use of a cotton swab might be prevalent among that demographic and its use seen as supported by peers. Less experienced staff might be influenced to use a cotton swab based on these factors.

Regardless of the overall numbers, there is a safety issue to be considered with this practice. It is unknown at this time if cotton fibers from the swabs are being introduced into the digestive tracts of preterm infants and what effect this might have. It should be noted that the ROFG (Alberta Health Services, 2009) offers the choice of a soother for NNS and suggests combining this with drops of EBM from a syringe, by dripping breast milk onto the soother as the infants sucks. The use of cotton swabs is not recommended but nor it is discouraged. This is not the only study of Calgary NICU's to note use of a cotton swab for taste. McNeil et al. (2006) also reported staff use of a cotton swab to deliver taste in their evaluation of the ROFG's uptake. Likely this is a common

practice which may be rooted in history and should probably be reviewed for risks and benefits.

5.2.6 Written Responses

Very few respondents in their written responses indicated disapproval of providing taste for preterm infants and many asked follow up questions like "What is the age at which a fetus can taste" and "Is there evidence that taste is of any use". These were clear statements asking for more information. This is similar to findings by McCord (2011), who noted that the factors influencing uptake and implementation of the guidelines for kangaroo mother care were a) knowledge of the practice; b) clearness of the guidelines for ease of use; c) unit support of the practice; d) belief in the practice's efficacy; and e) ethical considerations. As evidenced by the respondents to this study, these issues are found regarding taste.

Most of those who replied to the written portion of the questionnaire indicated a lack of knowledge in this area (60%). In general, the written answers mirrored the belief questions. Respondent replies indicated strong feelings of support for taste as an adjunct to feeds. This is similar to the strong belief in taste for a range of uses like pain control and soothing. Some respondents went so far as to describe their own taste practices and how they use taste while teaching parents to encourage latching during breast feeding.

These responses were similar to those obtained by McNeil et al. (2006) in the evaluation of the ROFG's use. Those authors found evidence of heightened awareness of the protocol, a sense of time commitment required for adequate care based on its precepts, as well as a need for more knowledge. As in this study, respondents indicated

willingness to access knowledge and be guided by evidence, but there was expressed concern over that which was available.

5.3 Strengths

The research was carried out across three sites in a large metropolitan city and included multiple professions that used the same practice guidelines which allowed comparisons to be made. The study intended to reach all NNPs, RNs, LPNs, and MDs in the Calgary area NICUs. To date, this is the only study to attempt to determine staff knowledge, beliefs, and practices with respect to the stimulation of taste sense of preterm infants. The sample represents those who were most often present on the units and engaged in the feeding of preterm infants. The returned data showed clear gaps in knowledge, strong belief in taste for a variety of instances, and identified taste practices that will inform care going forward.

5.4 Limitations

The response rate for the study was 43%. However, approximately 162 individuals (35%) of the 463 eligible participants were difficult to access due to casual work, maternity leave, vacation, or leaving employment on the units during data collection, (K. Foudy personal, Unit Manager, FMC, communication, April 6, 2009) The199 of the remaining 301 contacted-individuals returned questionnaires represents 66% of the staff who work the most frequently. It follows then that their practice likely represents the norm in the NICU.

Of particular concern, was the response rate from the level II NICUS at the RGH and the PLC. These were below 50% of the eligible respondents from the two sites with the PLC respondents only accounting for 30% and the RGH with 43%. In addition to this

and as mentioned previously, the bulk of respondents from these two units were in the lower levels of experience ranges. This renders the data from these two units difficult to generalize across all staff. In retrospect, the survey period could had been extended by a few weeks, which would have been within the time limit set out for data collection, more intensive efforts to approach all staff could have been made, and the questionnaire could have been made available electronically as well. All three measures could have improved the return rate.

There were a number of problems with the questionnaire. The questionnaire (Appendix A) had one question (item 12) that was not considered applicable and did not contribute to the analysis. A scale sizing discrepancy for the Well Being visual analog scale was not identified until after data collection. For analysis, all measurements from the Well Being scale were standardized to the other three scales. This was done by dividing the measurements by the length of the Well Being scale and multiplying the result against the length of the others.

Another issue with the study involved the demographics section. The question on months of experience was not worded precisely enough to collect data able to distinguish months of experience by level of care. Staff at the FMC work on a mixed level II and level III unit. Often their assignments include an infant from both levels of care. Thus it is difficult to quantify the amount of time one spends in the differing levels of care. In retrospect, this item should have been a two part question and expressed as “how much time spent working in the NICU” and “how much of that time, by percent, was split between the two levels”. During the analysis, to compensate for this, total experience was

examined, not level II or level III, as it was not possible to separate the two kinds for the FMC respondents.

The question regarding preferred taste solution could have been worded as "check the one that applies" rather than "Yes/No" and would have improved result interpretation as many respondents simply didn't check the "no" box if the item didn't apply to their practice. This same correction could be applied for the question about which method was used for taste with the caveat to "check all that apply".

Post data collection discussions with MDs revealed that many felt the questionnaire did not reflect their practice as well as it might have as it was focused on direct care not the prescribing of care. Only the smaller sections on knowledge and beliefs in the questionnaire were relevant to them. Thus, the analyses and conclusions drawn surrounding practice are generally only applicable to the RNs and LPNs. In retrospect, a Taste Survey specifically for medical staff would have been more appropriate. Such a questionnaire would contain questions about prescribing feeds, deciding on taste solutions, methods to order, and extracting knowledge data about fetal taste development in more detail.

In general, the questionnaire requires further validation for reliability and internal consistency or the extent to which the items in the questionnaire relate to one another. For the scale based questions, internal consistency can be assessed with the Cronbach's alpha coefficient. By eliminating one item at a time any items that significantly increase or decrease the alpha would be identified for re-evaluation. Using this method, an alpha greater than 0.70 is usually considered to show adequate internal consistency (Dillman, 2007; Polit & Beck, 2013).

The over all stability of the questionnaire to return reliable data could be re-examined using a test-retest method (Dillman, 2007). After enough time had passed, the same groups could be re-surveyed to see if they still returned the same results. However, with continual re-education on the units, it may not be possible to use the questionnaire on the AHS groups and expect similar results.

5.5 Implications

5.5.1 Implications for Practice

The study brings to light gaps in knowledge and variation in practice. The knowledge gaps likely contributed to the variation in practice which was perhaps guided by beliefs more so than evidence. In theory, knowledge garnered from evidence, tested by study, and verified in practice should guide care (Baker et al., 2009; Calkin, 1984; El-Naggar & McNamara, 2012). An update of guiding documents could add evidence around the benefits of taste for pre-oral infants and when initiating feeding as well as to address the potentially harmful practices of pairing food taste with pain (Shah et al., 2006) and potential ingestion of cotton fibers from dipped swabs. The ROFG was developed in 2004 and reviewed in 2009 but very few changes were made to the previous version. Therefore, the last update was five years ago and further information could be incorporated based on the latest evidence.

Staff education efforts could be undertaken to coincide with the revisions and to increase staff awareness regarding fetal taste sense development and the fetal history of the amniotic fluid taste experiences. The content could reflect that even the very preterm are capable of taste, along with developmental information. Up to date information could also include, methods, timing, and rationale for delivering taste more in line with current

evidence. This could encourage guideline uptake and standardization of care. Perhaps, by successfully carrying out these steps, taste provision during tube feedings for all infants can be delivered safely and to maximum effect. It is evident that research since this study was conducted concludes that there may be some beneficial effect.

At the time this research was conducted, it was evident that more research was needed to determine if taste could play a role in aiding digestion or reducing time in hospital. Since then, another search of databases with the same terms initially used has returned two publications based on preterm infant sense of taste and the use of EBM. The first of these, a Turkish study by Yildiz, Arikan, Gözüm, Taştekın, and Budancamanak (2011), examined the role that EBM odour might play in assisting tube fed preterm infants to full oral feeds and thus to earlier discharge. This was a prospective experimental study carried out on a total of 80 preterm infants spilt to 40 infants as the study group and 40 as the control group. The findings were that the study infants who were stimulated with breast milk odour during tube feeds transitioned to oral feeding three days earlier than control subjects and their mean hospitalization time was four days shorter (Yildiz et al., 2011). While taste was not used as an intervention, it is known that smell and taste are linked, with the greater part of taste coming from food smell (Beauchamp & Mennella, 2011; Buck, 2000). Hence, this study potentially demonstrates the efficacy of taste. It certainly suggests that sensing food prior to consumption plays a role assisting development.

The second of the newer publications is a description of the taste sense, its functional units comprised of smell receptors and taste buds, and proposes that taste of food is critical to normal feeding development (Negri, Morini, & Greco, 2011). The authors

describe the placement of taste receptors throughout the upper digestive tract and right down the esophagus. The authors note the disturbing incidence of OAD in tube fed infants and propose, much like this research does, that lack of taste stimulation might play a critical role as a cause (Negri, 2011).

The remainder of the updated literature search from 2010 to 2014 reveals predominantly studies around the use of EBM to control pain related to procedures like heel lancing. As has been noted earlier, this may be a problematic practice as there is the possibility of associating pain with eating. Pain associated with an activity tends to diminish desire to engage in that activity (Domjan, 2014; Pierce & Cheney, 2013; Skinner, 1953). This may well worsen OAD outcomes. As such, it is both timely and relevant for more research that is focused on taste as an adjunct to digestion, as a means to hasten discharge from hospital, and as a way to ameliorate the onset of OAD.

5.5.2 Implications for Current and Future Research

Once amended to account for the limitations, the revised questionnaire from this study might be of use in Edmonton's multi center NICUs, administered either in person, or electronically, or both. It would be important to see if the results in that municipality are similar to those in Calgary. With translation and accounting for cultural differences, the questionnaire could be used internationally to assess the same traits in staff with respect to neonatal sense of taste.

Ultimately though, the provision of taste as a means to aid digestion and improve preterm infant outcomes needs to be evaluated. Researchers in Edmonton and Calgary are conducting trials with what is termed "Oral Immune Therapy (OIT)" using colostrum drops by mouth in an effort to determine if, by doing so, there is a gut-protective effect

for the naturally immunosupressed preterm neonate. While these researchers do not call this taste stimulation, the process of dripping EBM into the mouths of preterm infants does stimulate the sense of taste. Like the pilot study by Rodriguez et al. (2010) where immunity building was attempted through oral colostrum administration, these studies are couched from medical perspective, and mainly attempt to elicit an immune strengthening response. It may be that this kind of study could be the only way to evaluate taste as an adjunct to feeds. It would be unethical to conduct a randomized control trial using taste and deprive control infants of normal sensory developmental information. However, the results of the OIT study could be examined for advancement of feeds, progression to feeding readiness, and time to discharge. The results could be as attributable to taste stimulation as it would be to immune boosting This last outcome was suggested in the OIT pilot study by Rodriguez et al. (2010).

Additionally, it was reported that since data was gathered on taste practices, there have been education sessions for clinical staff about taste as an adjunct to feeds and how taste is part of the ROFG (Alberta Health Services, 2009) (K. Lasby, personal communication, December 4, 2013). Overall, the use of taste is not only being evaluated, but is being encouraged in the AHS NICUs. What would be interesting to determine is if level of fetal taste development knowledge is greater than it was in 2010, when the data for the Taste Survey was gathered. A re-survey would help determine not only education effectiveness but if the practice of allowing taste was truly increased, and if older, potentially harmful practices like use of a cotton swab to deliver taste, had ceased.

5.6 Conclusion

In general there is a lack of knowledge in NICU staff about the development of fetal sense of taste and this may influence its use to support feeding and digestion. Moreover, practices that use the sense of taste can be either out of order from what is developmentally appropriate or may mainly support pain control. There is an opportunity to incorporate development of taste information and evidence into practice guidelines to potentially increase taste practices in the NICU.

Findings show that staff with less experience relied on practice guidelines for feeding activities more than staff with more experience. Therefore, having up-to-date evidence informed practice guidelines are important for new staff while on-going continuing education for both experienced and inexperienced staff may contribute to increased and more consistent use of taste in the NICU. For both experienced and inexperienced staff alike developmental information would encourage taste prior to commencing the tube feed rather than after it had already been started. This would represent a normal developmental taste and food encounter and support the infant's transition towards oral feeding.

More research is required to determine if pairing taste with painful procedures might have long term negative consequences. If sweet taste for pain is going to continue as a practice then perhaps research into if, by providing EBM taste with food, the pain pairing effect can be counteracted. Overall, there is a need to investigate if pairing taste with tube feeds could shorten the duration the time to oral feeding and shorten hospital stay. Certainly the results of EBM smell study (Yildiz, 2011) indicates that there may be some merit to the idea. With this in mind, it is evident that it is both timely and relevant

to engage in more investigation into the use of taste as a means to support feeding in the very preterm.

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APPENDIX A: QUESTIONNAIRE

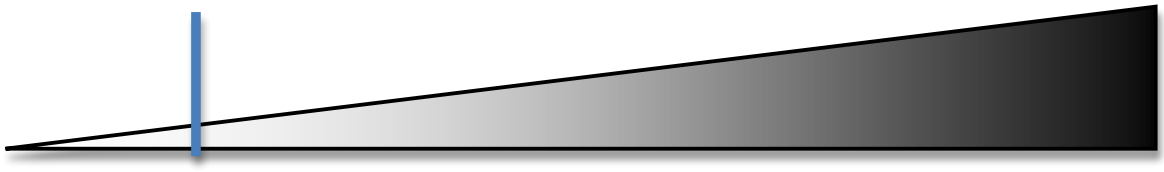
T A S T E I N T H E N I C U

Please do NOT sign or write your name on the questionnaire. Return the folded questionnaire to the BLUE drop box below the poster in the lounge. Please complete ONLY ONE questionnaire.

The purpose of this survey is to determine the knowledge, the practices, and the beliefs that might influence NICU professionals in providing taste experience paired with feeding time for the infants in their care.

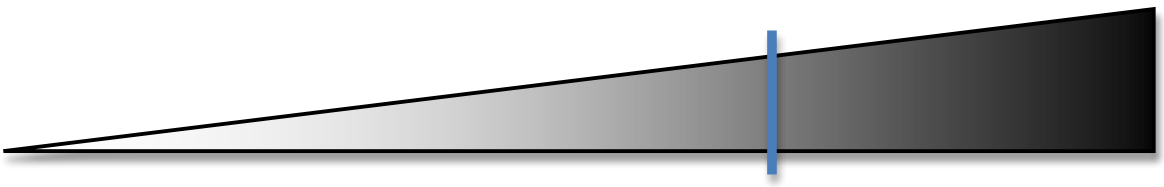
Several questions contain a visual analog scale. The scale is being used to measure how important you think something is. To use the Visual Analog Scale draw a line on the scale to indicate your feelings of the importance. As you feel the importance rises, draw the line more to the right. As you feel the importance decreases, draw the line more to the left.

For example: if you feel what the question is asking about is not very important, place the line closer to the left side,



Not Important Important

Or, somewhat important; place the line closer to the right side



Not Important Important

Provision of Taste Experience is defined as; including drops of milk on tongue, drops of Sweet Ease, plain soother, dipped soother either in EBM, formula or Sweet Ease.

1. At what week of gestation do you think the fetus has a sense of taste?

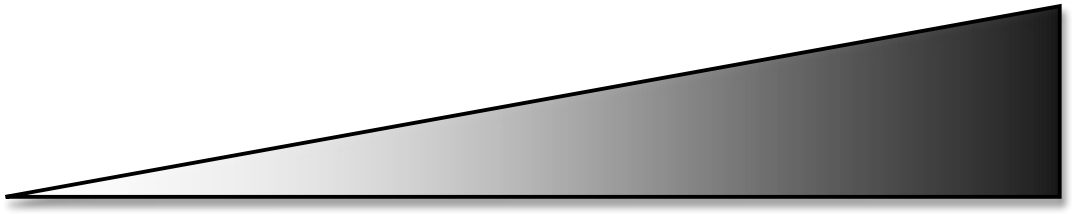
a. _____weeks. b. ☐ I don't know

2. Do you think amniotic fluid carries flavors of maternal diet? Choose only one answer.

a. ☐ Yes b. ☐ No c. ☐ I don't know

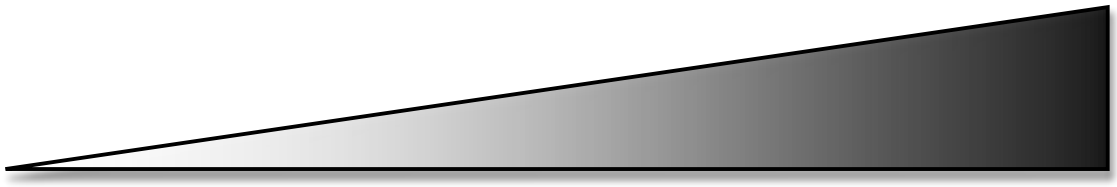
3.On the scale below, draw a line indicating how important you believe the sense of taste is for:

a. the **well being** of the pre-term neonate.



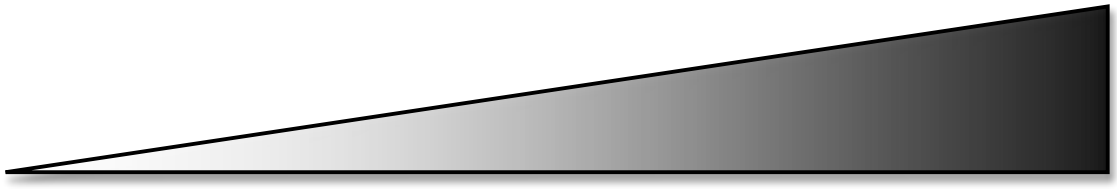
Not Very Important Very Important

b. how important is taste for **pain control**?



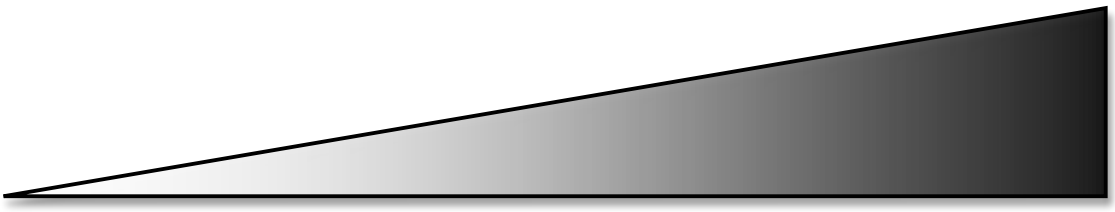
Not Very Important Very Important

c. how important is taste for **soothing**?



Not Very Important Very Important

d. how important is taste for **digestion**?



Not Very Important Very Important

4. The Alberta Health Services, Regional Oral Feeding Guideline (2009) defines Pre-Oral Infants as;

Responds adversely to handling. Poor physiologic, motor & state regulation with or without stimulation. None to very weak oral reflexes (transient). None to very weak non-nutritive skills. Not managing secretions (Neurological infants). (p. 3)

If an infant fits the above definition do you routinely offer taste experience?

a. ☐ Yes b. ☐ No

5a. Alberta Health Services, (2007) defines trophic feeding as:

Feeding which is meant to introduce a small volume of enteral nutrition to promote the maturation of gut function, while simultaneously providing total parenteral nutrition, to meet the very low birth weight infants (less than or equal to 1250 grams) metabolic and nutritional requirements. Initiate trophic feeds at 12 mL/kg/day. (p.1)

In the past six months, when starting a neonate's trophic feeds for the first time, how

often (% of time) did you refer to the Oral Feeding Guideline? Place a check mark in the square that best corresponds to your practice. Please select only one answer.

None (0%)	Some (1-20%)	Moderate (21-40%)	Much (41-60%)	Most (61-80%)	All (81-100%)
☐	☐	☐	☐	☐	☐

5b. When you require guidance with your feeding practice, what or who do you refer to? Please check all that apply.

☐ Mentor

☐ Peers

☐ Educator

☐ Physician

☐ Charge Nurse

☐ Feeding Guidelines

6. For each of the following scenarios, approximately what percent of the time do you provide a taste experience for infants in your care? (Taste experience includes: drops of milk on tongue; drops of Sweet Ease; plain soother; dipped soother either in EBM;

formula; or Sweet Ease.)

a. During painful procedures; _____% of the time

b. As a means to soothe; _____% of the time

c. Before feeds; _____% of the time

d. During feeds; _____% of the time

e. After feeds; _____% of the time

7a.Do you regularly provide a taste experience while tube feeding an infant?

☐ Yes ☐ No

7b. If you selected ***No*** please go on to question 9. If you selected ***Yes*** please select what you mainly use. Please select only one answer. Place a checkmark in the square next to your choice. .

a. Sweet Ease: ☐ Yes ☐ No

b. The Infant's Feed (EBM or Formula): ☐ Yes ☐ No

c. Sterile Water: ☐ Yes ☐ No

d. 0.9% saline: ☐ Yes ☐ No

8.The following methods are used for offering taste experience to preterm infants. Please select all that apply to your practice. Place checkmarks in the squares next to your choices.

a. Finger tip (dipped in saline, sterile water, Sweet Ease, EBM or formula).

☐ Yes ☐ No

b. Cotton swab (dipped in saline, sterile water, Sweet Ease, EBM or formula).

☐ Yes ☐ No

c. Drops from a syringe (either saline, sterile water, Sweet Ease, EBM or formula).

☐ Yes ☐ No

d. Soother (dipped in saline, sterile water, Sweet Ease, EBM or formula)

☐ Yes ☐ No

JOB HISTORY

9.Where do you work more than 50% of your shifts? Please select only one answer. Place a checkmark in the square next to your choice.

☐ FMC ☐ PLC ☐ RGH

10. Please indicate your professional status. Place a checkmark in the square next to your choice. Please select only one choice.

☐ LPN ☐ NNP

Physician:

☐ Neonatologist or Neonatal Fellow

☐ Clinical Associate

☐ Other

☐ RN

11. How many years have you worked:

a. level 2 NICU care? _____years_____months.

b. level 3 NICU care? _____years_____months.

12.What is your primary area of responsibility? Place a checkmark in the square next to your choice. Please select only one choice.

a. ☐ Bedside Care

b. ☐ Management (in charge or educator) level 2 or 3

c. ☐ Diagnosis & Treatment

13. Did you use any resources to answer these questions?

14.Please provide any other thoughts in the space below, about infant sense of taste and your practice.

Thank you for taking the time to complete this questionnaire.

APPENDIX B: CONSENT FORM

CONSENT FORM

TITLE: Health Care Professional's Understanding of the Orosensory Experience of Preterm Infants.

INVESTIGATORS: Rik Mahabeer RN, Dr. Jean Chow RN, Dr. Deb McNeil, RN, Dr. Cynthia Mannion, RN, and Dr. Shahirose Premji, RN, NNP

SPONSORS: University of Calgary.

This information sheet is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more details about something mentioned here, or information not included here, please ask. Take the time to read this carefully and to understand any accompanying information.

BACKGROUND

No data currently exist that directly assesses staff practices in relation to preterm infant sense of taste. While Non-nutritive Sucking and sucrose solutions for pain are encouraged, there are no data on what practices are used. Additionally there is no policy that mandates providing taste sensation for preterm infants during feeding times as a matter of standard practice for the very preterm.

WHAT IS THE PURPOSE OF THE STUDY?

This questionnaire was developed to better understand NICU staff knowledge, beliefs, and practices around the sense of taste in extremely preterm infants. The results of the survey will be used to plan and design further studies around the development and uses of the preterm infants sense of taste.

WHAT WOULD I HAVE TO DO

We are asking you to complete a 14 question survey. The questionnaire will take approximately 10 minutes of your time. You are under no obligation to complete this questionnaire. Your continued employment is not dependent on participating in this study and you will not be jeopardized in anyway by not participating. You can choose to change your mind at any time. We ask that you complete this on your own and not share your answers with others. Please complete only one questionnaire. Please fold your questionnaire and drop in the box provided.

WHAT ARE THE RISKS?

There are no known risks for completing the questionnaire. Names, individual information, and specific responses will not be shared with managers or educators. Please do not put your name anywhere on the questionnaire. If you are a nurse practitioner, LPN or physician there is an increased likelihood of being identified due to the relatively low numbers of your profession on staff. If this is a problem, you may wish to not complete or hand in the questionnaire.

WILL I BENEFIT OF I TAKE PART?

There are no known benefits to your participation.

DO I HAVE TO PARTICIPATE?

Participation in this study is completely voluntary. You may withdraw at any time by not completing or returning the questionnaire. Completion of this questionnaire is not a requirement of your employment. Your job/position will not be affected if you do not wish to participate. There is a possibility that due to unforeseen circumstances the researchers may not be able to complete the study. If this is the case, all questionnaires will be destroyed. We ask that you complete this on your own and not share your answers with others. Please fold your questionnaire and drop in the box provided. Please complete only one questionnaire.

WHAT ELSE DOES MY PARTICIPATION INVOLVE

There is no other participation required.

WILL I BE PAID FOR PARTICIPATING, OR DO I HAVE TO PAY FOR ANYTHING?

You will not be paid for your participation. You will not incur expenses as a result of your participation.

WILL MY RECORDS BE KEPT PRIVATE?

You are asked NOT to put your name on the questionnaire so that your participation remains anonymous. You are only asked for your name when receiving your questionnaire to keep track of who has received one and to prevent a given person from completing more than one questionnaire. The list of names will not be shared with management or your colleagues. The list of names and completed questionnaires will only be available to the investigative team and The University of Calgary Conjoint Health Research Ethics Board. All study information will be stored in a secure office away from the unit and accessed only by the investigative team. Questionnaires and

databases will be destroyed in 7 years following completion of the study. Study data will be presented anonymously in all presentations and publications.

In the case of LPNs, physicians, and NNPs due to the low number of individuals represented it is possible that your identity may be deduced by your profession, answers, and/or handwriting. Please keep this in mind if you choose to complete this survey.

AGREEMENT TO PARTICIPATE

Your decision to complete and return this questionnaire will be interpreted as an indication of your agreement to participate. In no way does this waive your legal rights nor release the investigators, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time.

If you have further questions concerning matters related to this research, please contact:

Rik Mahabeer (403) 714-6784

Dr. Jean Chow (403) 220-4630

Dr. Deb McNeil (403) 955-2385

If you have any questions or concerns about this survey please contact Rik Mahabeer by email; rrmahabeer@ucalgary.ca

APPENDIX C: POSTER

Health Care Professionals Understanding of the Orosensory Experience of Preterm Infants

The Knowledge, Beliefs and Practices of NICU Staff Around Preterm Infant Sense of Taste

APPENDIX D: TABLE OF TESTS

Table D1: Research Questions, Questionnaire Items, and Analysis Approaches

Research Question	Questionnaire Items (Appendix A)	Statistical Analysis
Question 1 Knowledge of preterm infant sense of taste	Items 1 & 2 -Knowledge of gestation and maternal diet	Description of proportions
Question 1 Beliefs that might influence NICU staff	Item 3 -Importance of taste for well being, pain control, soothing, and digestion	Description of proportions
Question 1 Practices of NICU staff	Items 4, 5a &b, 6, 7a & b, & 8 -Providing taste to pre-oral infants; use of AHS Guidelines and other staff in decision making; percent of time providing taste; Use of type and technique of taste provision	Description of proportions
Question 2 Knowledge by NICU hospital site.	Items 1 & 2 by item 9 -Knowledge of gestation and maternal diet	χ^2 or Fisher's Exact Test
Question 2 Beliefs by NICU hospital site.	Item 3 by item 9 -Importance of taste for well being, pain control, soothing and digestion	Mann-Whitney U
Question 2 Practices by NICU hospital site.	Item 4 by item 9 -Offers taste to pre-oral infants by profession	χ^2 or Fisher's Exact Test
	Items 5a &b by item 9 -Frequency of referral to Guidelines	χ^2 or Fisher's Exact Test
	Item 6 by item 9 -Frequency of providing taste experience in different care situations	Mann-Whitney U
	Items 7a & b by item 9 -Frequency of provision and type of taste experience during tube feeding	χ^2 or Fisher's Exact Test
	Item 8 by item 9 -Techniques used in providing taste experience during tube feeding	χ^2 or Fisher's Exact Test
Question 3 Knowledge by months of experience within the level of care	Item 1& 2 by items 11a (Level II experience ranges) & b (Level III experience ranges). -Knowledge of gestation and maternal diet	χ^2 or Fisher's Exact Test
Question 3 Beliefs by months of experience within the level of care	Item 3 by items 11a (Level II experience ranges) & b (Level III experience ranges) -Importance of taste for well being, pain control, soothing, and digestion	Kruskal-Wallis Test

Table D1: Research Questions, Questionnaire Items, and Analysis Approaches (continued)

Research Question	Questionnaire Items (Appendix A)	Statistical Analysis
Question 3 Practices by months of experience within the level of care	Item 4 by items 11a (Level II experience ranges) & b (Level III experience ranges) -Use of Feeding Guideline for pre-oral infants	χ^2 or Fisher's Exact Test
	Items 5a & b by items 11a (Level II experience ranges) & b (Level III experience ranges) -Taste with trophic feeds & Guidance for care practices	χ^2 or Fisher's Exact Test
	Item 6 by items 11a (Level II experience ranges) & b (Level III experience ranges) -Percent of time provide taste in a given situation	Kruskal-Wallis Test
	Items 7a & b by items 11a (Level II experience ranges) & b (Level III experience ranges) -Regularly provide taste with tube feeds and how what used	χ^2 or Fisher's Exact Test
	Item 8 by items 11a (Level II experience ranges) & b (Level III experience ranges) -Method used to provide taste	χ^2 or Fisher's Exact Test
Question 3 Knowledge by profession	Items 1 & 2 by item 10 -Knowledge of gestation and maternal diet	χ^2 or Fisher's Exact Test
Question 3 Beliefs by profession	Item 3 by item 10 -Importance of taste for well being, pain control, soothing and digestion	Mann-Whitney U
Question 3 Practices by profession	Item 4 by Item 10 -Offers taste to pre-oral infants by profession	χ^2 or Fisher's Exact Test
	Items 5a &b by Item 10 -Frequency of referral to Guidelines	χ^2 or Fisher's Exact Test
	Item 6 by Item 10 -Frequency of providing taste experience in different care situations	Mann-Whitney
	Items 7a & b by Item 10 -Frequency of provision and type of taste experience during tube feeding	χ^2 or Fisher's Exact Test
	Item 8 by item 10 -Techniques used in providing taste experience during tube feeding	χ^2 or Fisher's Exact Test

APPENDIX E: QUESTIONAIRE DESCRIPTION

The questionnaire items were designed to extract knowledge, belief, and practice data about staff understanding and use of preterm infant sense of taste. There were two knowledge questions where respondents could answer yes or no. There was a four part belief questions comprised of visual analog scales. There were five practice questions comprised of yes or no, multiple choice, and "best answer" questions. There were four demographic questions. The final two items were open ended short answer questions.

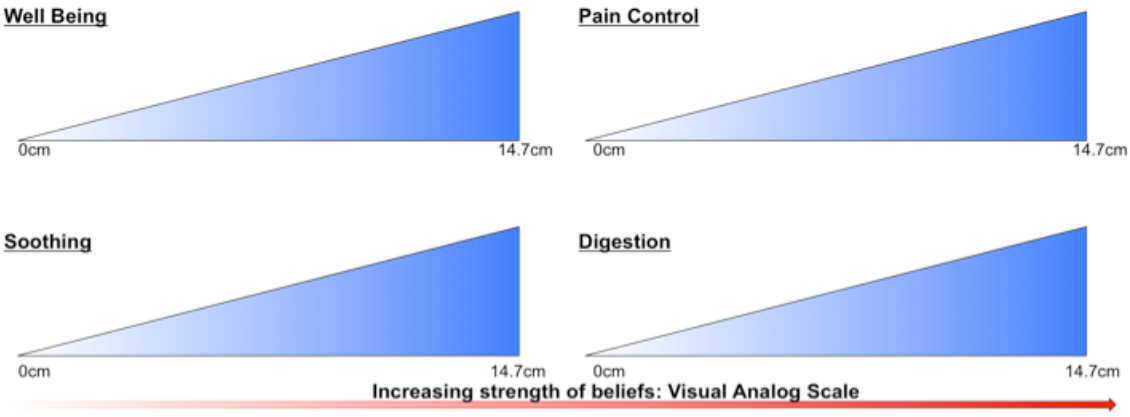
The first question focused on the respondent's knowledge of when a fetus develops the sense of taste. Knowledge surrounding the time a fetus develops a sense of taste might influence staff practice of providing taste experiences. Responses to this question included correct, incorrect and, 'I don't know' answers. Answers were deemed correct if respondents replied with a gestation of between 13 weeks and 16 weeks inclusive. If the respondents replied with an answer outside of this range of gestations the response was considered incorrect. If the responses contained a range of gestations then the mean of the range was used to determine if the respondents were correct or did not know the answer (example: "12 to 18 weeks" = 15 weeks). The answer was given as a point in a trimester in some cases. This was treated as a range of weeks corresponding to where in the trimester was indicated (first trimester = 1 - 13 weeks; second trimester = 14 – 26 weeks; third trimester = 27 – 37 weeks). The mean of the range was used to determine if a correct answer was given.

The second item was about knowledge of maternal diet flavouring amniotic fluid. It was thought that if staff were aware that maternal food tastes were present in amniotic fluid this knowledge might influence whether a staff member offered taste or not. A yes

was considered a correct answer and a no or "I don't know" was considered an incorrect answer and indicated lack of knowledge. Those respondents who indicated that they were guessing were coded as not knowing the answer.

The third item was a belief question. It was comprised of four parts and was designed to determine strength of beliefs using visual analog scales (VAS). See Figure 1. The belief inquiries were if the respondents felt that taste was useful for a) well being; b) pain control; c) soothing; d) digestion. The respondent was instructed to mark where on the VAS they felt their strength of belief was best represented. The VAS was a color gradated, elongated right- angle triangle with the narrow end to the left of the page. As the respondents moved down the scale, to the right, strength of belief is represented as increased. To the left, it is decreased (figure E1). The respondents placed a vertical line on the scale that indicated a specific length that corresponded to intensity of a response.

Figure E1: Visual Analog Scales



Answers were collected as length in millimeters from left edge to where the vertical line was drawn on the scale. When the line drawn was at an angle, the measurement was the approximate midline between where the top of the line and the

bottom of the line crossed their respective parts of the scale. Due to a transcription error the Well Being scale was slightly shorter in length (14.3 cm) than the other three (14.7 cm). All measurements from the Well Being scale were standardized to the other three scales. This was done by dividing the measurements by the length of the Well Being scale and multiplying that against the length of the others.

Questions four through eight were practice questions. The fourth was an inquiry into how staff interpreted instruction for provision of taste during tube feeding from the ROFG (Alberta Health Services, 2009). Respondents were given the choice of either "Yes" (meaning that staff members perceived that the Guideline supported provision of taste experience for infants identified as pre-oral) or "No" (meaning that staff interpreted taste experience for these infants was not supported).

The fifth item was in two parts and based on the ROFG (Alberta Health Services, 2009). Trophic feeds are non – nutritive and consist of very small amounts of breast milk or formula (<12 ml/kg/day) designed to ready the GI track for receiving greater volumes that meet nutritional requirements (*TFG, 2004*). In the first part respondents were instructed to indicate what percent of the time they provided taste during tube feeding of an infant who was just starting feeds. The categories were a) none (0%); b) some (1-20%); c) moderate (21-40%); d) much (41-60%); e) most (61-80%); and f) all (81-100%). The respondents were asked to select only one answer.

For the second part of item five, respondents were asked to indicate what resources they accessed if they required assistance with their feeding practice. The seven choices include a) mentor; b) educator; c) charge nurse; d) other (parent, dietician, occupational therapist, etc); e) peers; f) physician; e) feeding guidelines. The respondents

were instructed to select either yes or no for each choice. If the box next to the selection was left unchecked this was deemed a "no" response.

The sixth item was designed to identify practice over the previous six months prior to the respondents completing the questionnaire. Subjects were asked to indicate what percent of the time they offered taste in the four circumstances of a) during painful procedures as a means to soothe; b) before feeding; c) during feeding; d) after feeding. These times were chosen based on the researcher's experience to offer taste when caring for a preterm infant. When a response included a range of percentages the mean of the range was entered into the database. In a number of cases respondents indicated that this item did not apply to their practices and left the item blank. This was treated as missing data.

The seventh item consisted of two parts and pertained to practices of providing taste with tube feeding after feeding was established. In the first part of the item, respondents were asked if they regularly provided taste with tube feeding. The instructions were to select either "yes" or "no".

The second part of item seven contained instructions for respondents to skip to item eight if they responded with a "no" answer to the first part of the question. If they responded with a "yes" they were instructed to select what they mainly used to offer taste choices. Responses include a) Sweet Ease™; b) EBM or formula; c) sterile water; d) 0.9% saline. However, a number of respondents chose a "no" to the first part of this item but also indicated an answer to the second part. In these cases, both responses were considered invalid and coded as missing.

Other participants provided more than one answer to the second part of item seven. In these cases the responses were treated as missing unless the respondent indicated a reason for using taste for a particular intervention other than feeding (e.g. pain control), and also indicated what they used for feeding. In these cases only the feeding intervention was included in the database. Otherwise the respondent was deemed to have misread the item and the responses were treated as missing data.

The eighth item was constructed to identify what methods were utilized when care givers offered taste to preterm infants. Respondents were instructed to select either yes or no to all methods that applied to their practice from a list that was comprised of a) finger tip; b) cotton swab; c) drops from a syringe; d) soother. All suggestions were prefaced with the statement that the taste sensation being offered was either saline, sterile water, Sweet Ease™, EBM, or formula. For instances where respondents consistently left the item blank a "no" was deemed to be the answer.

Item eight was the last practice question. The remainder were demographic questions. Item nine was the first question in this section, and required the respondents to indicate where they worked more than 50% of their shifts. They were given a choice of selecting the FMC, the RGH, or the PLC. Item 10 was an inquiry as to job description. This was broken down to LPN, NNP, Neonatologist, Clinical Associate, Other Physician, and RN.

Item eleven required respondents to indicate how many years and months they had worked in Level II NICU and Level III NICU. The results of this item were not normally distributed. Parametric testing would require transforming the data to a normally distributed data set. Testing would then involve having continuous data as the

independent variable. Data transformation and parametric tests of this sort are very involved and potentially controversial. Thus the months of service data was categorized to allow the use of non-parametric tests and to preserve the data without transformation. Months of service responses were coded as a) less than 24 months; b) 24 to 60 months; c) greater than 60 months.

For the twelfth item, the respondent was required to select the kind of care that they spent more than 50% of the time delivering. The choices were a) bedside care; b) charge nurse; d) educator or management; e) diagnosis and treatment. If respondents answered both bedside care and charge nurse to this category it was assumed they split their time equally between the two kinds of care. As such they were deemed to be providing care from the aspect of charge nurse, educator, or management. From my experience this is how these individuals are generally viewed and collaborated with, regardless of their assigned role for the shift.

The final two items were open-ended questions. The first of these required staff to list any resources accessed to answer the first two items, which were about knowledge of fetal development. The final item was for staff to include any additional thoughts they might have on preterm infant sense of taste.