Feeding infants on high flow nasal cannula oxygen therapy (HFNC): An exploration of speech-language pathologists' decision –making processes.

Abstract

There are currently no clear protocols to inform whether or not to orally feed premature infants receiving high flow nasal cannula oxygen therapy (HFNC). There is also a paucity of literature describing how speech-language pathologists (SLPs) decide when and how to feed and infant on HFNC, in the absence of clear guidelines. A qualitative research study was therefore conducted to explore the views and experiences of nine SLP participants about the decision making processes undertaken around feeding infants on HFNC. Participants worked in UK level 3 or level 2 neonatal units. Data were collected via semi-structured interviews and analysed thematically (Ritchie & Spencer, 1994).

Five themes and fifteen subthemes were identified. Themes were: (1) the role of the SLP, (2) factors to be mindful of when considering oral feeding, (3) pre feeding, (4) feeding definitions, and (5) setting dependency. Subthemes included the infants overall presentation, the volume of oral intake and decision-making culture and practice within a multidisciplinary team.

Speech-language pathologists consider a wide range of clinical factors when introducing oral feeding for an infant on HFNC. Judgments made about introducing feeding opportunities appeared to be most aligned with the infant's needs and safety, rather than the level of oxygen support.

Keywords: *neonatal, premature, high-flow nasal cannula oxygen therapy, feeding, speech-language pathology*

Introduction

Premature infants are at risk of respiratory problems, with 92% of infants born between 24 -25 weeks gestational age, and 88% of infants born at 26 -27 weeks gestational age requiring some form of respiratory support (EuroNeoNet, 2013). Respiratory support is usually provided by nasal continuous positive airway pressure (nCPAP), or use of non-invasive respiratory support (NIV), such as high flow nasal cannula oxygen therapy (HFNC) (Reynolds & Soliman, 2013; Yoder et al., 2016). Nasal CPAP has been described as causing increased agitation, an increased need for suctioning, and overall discomfort and nasal trauma caused by the fixation of prongs (Shanmugananda & Rawal, 2007). Anecdotally, many practitioners have concerns that nCPAP, unlike HFNC, forces open the epiglottis and increases the risk of aspiration. However, it remains unclear as to whether nCPAP can reduce the risk of chronic lung problems compared with other methods of providing ventilation (Diblasi 2009).

In contrast to nCPAP, HFNC is a form of non- invasive respiratory support whereby the work of breathing is reduced as gas is set at a flow rate that exceeds an infant's inspiratory demand. Oxygen is delivered through a loose fitting cannula which offers increased ease of application and safety (Testa et al, 2014). Both nCPAP, and HFNC can impact aerodigestive reflexes, specifically sensory motor characteristics, which can influence later oral feeding efficiency (Jadcherla et al, 2016). Perceived benefits of HFNC are considered to be reduced risk of respiratory distress and increased opportunities to support the introduction of oral feeding (Armfield & West, 2009; Leder et al., 2016). Parents additionally report preference for HFNC as they can observe facial expressions and engage with their infant more easily compared to when nCPAP is used (Ojha et al, 2013; Reynolds & Soliman, 2013).

Evidence comparing infant development of full oral feeding when on nCPAP as compared with HFNC is variable, with many large randomized controlled trials

demonstrating no significant differences between each group of infants (e.g., Glackin et al., 2017; Kugelman et al, 2015; Collins et al, 2013; Campbell et al, 2006). Yoon et al (2011) compared 17 infants receiving nCPAP with 34 infants on HFNC and in contrast to the previously mentioned studies, found that days to develop full oral feeding tolerance and to regain birth weight took longer for HFNC infants compared with infants on nCPAP. Ferrara et al (2017) investigated infants bottle feeding whilst both on and off nCPAP. Results showed that the incidence of deep penetration and aspiration decreased significantly when infants were off nCPAP, although mild penetration and nasopharyngeal reflux remained the same under both conditions. Success with developing oral feeding skills for infants on HFNC has been reported in other studies. For example Hanin et al. (2015) compared two groups of infants receiving nCPAP. One group received some oral feeds while on nCPAP whilst a second group of infants received only gavage feeds (i.e., nasogastric feeding tube). Infants receiving oral feeds developed earlier acquisition of feeding skills, but there were no clinically significant incidences of aspiration pneumonia between the two groups. Shetty et al, (2016) evaluated 116 infants receiving either HFNC or nCPAP. In this study, infants receiving HFNC achieved oral feeding significantly earlier than those on nCPAP.

The evidence base remains small and findings are disparate, but some authors advocate that a cautious approach to introducing oral feeding for infants on all forms of respiratory support can have long term benefits, specifically in reducing oral aversions (Jadcherla et al, 2016; Shetty et al, 2016). Infants with respiratory difficulties are at risk of developing persistent oral feeding problems (Hawdon et al, 2000), and potentially, some of these problems can be minimised by early positive oral – sensory experiences, in combination with the introduction of some oral intake (Mason et al, 2005). The typical approaches used to encourage positive early oral experiences such as non-nutritive sucking, sensory approaches, interpreting infant early communication signs and states and cue based approaches could help

to ameliorate some of the longer term feeding problems infants may experience (Gennattasio et al, 2015; Harding et al, 2014, 2018). Jadcherla et al (2016) specifically recommends consideration is given to carefully managed, individualised programmes which encourage oral feeding for this population.

Feeding development of infants receiving HFNC requires further study and a greater degree of understanding. The paucity of research and variable outcomes mean that SLPs in clinical practice do not yet have clear evidence to guide their decisions about feeding infants on HFNC. There has been no research on clinical decision making for SLPs within this area. Hence the aim of this study was to: (1) explore how SLPs perceive their role when working with infants on HFNC, and (2) identify which factors SLPs consider when planning oral feeding trials for infants in this context.

Method

The study protocol was approved by the City, University of London Ethics Committee. Written consent was obtained from participants prior to data collection.

Study Design

A qualitative approach was used to understand the nature of participants' current working practices. Data were collected through qualitative interviews using open-ended questions. A semi-structured topic guide consisting of 4 questions was designed using information obtained from the literature and expert advice. One initial interview was recorded for feedback and refinement of the questions used. This interview was not included in the final data analysis. An independent researcher provided feedback on question saliency, and accuracy of transcription.

Participants

A purposive sample of nine SLP participants was recruited via the UK Royal College of Speech and Language Therapists' Neonatal Network discussion board. Participants were eligible to participate in the study if they met the following inclusion criteria:

1. Were qualified SLPs currently working with a neonatal caseload
2. Were actively involved in decision-making regarding feeding infants on HFNC
3. Were not currently participating in another project about dysphagia

Fifty two SLPs were contacted and nine SLPs responded. There was no follow up of non-responders as this was a time limited study. The nine participants were practitioners in the UK in either a level 3 (for infants born less than 27 weeks gestation; high risk) or level 2 (for infants at 28 weeks gestation and above; medium risk) neonatal unit, and all had experience of working with infants receiving HFNC. All were female and had worked between 5 - 40 years (mean 19.6 years). Five participants worked as full time SLPs, and four participants worked part time. All participants had a caseload comprising up to 80% preterm infants in an acute setting.

Participants were given 48 hours to decide to take part in the study and written consent was obtained prior to the interviews. Each participant was assigned a code so that details of individuals could not be identified in the data.

Data Collection

The interviews were of approximately 30 minutes duration and were conducted in person or over the telephone. A Tascam DR – 40 portable digital recorder was used to record face to face interviews, with the addition of a Retell 156 for telephone interviews. Demographic questions included those regarding the participants' place of work, hours worked and number of years working as a SLP. Further open ended questions included (i)

the nature of SLP's role when treating an infant on HFNC; ii) what factors the SLP considered prior to feeding an infant on HFNC; iii) how the term 'feeding' was interpreted by the SLP; and iv) the role of the multidisciplinary team in deciding to feed an infant on HFNC. The same researcher carried out all of the interviews; this researcher had limited experience of reviewing interview schedules.

Analysis

Data were anonymised, transcribed orthographically and thematically analysed using the Framework Approach (Ritchie & Spencer, 1994). NVivo (NVivo for Windows, 2012) software was used to manage data and assist with the analytical process.

The lead researcher became familiar with the data through repeated readings of the transcripts. Topics of interest and recurrent ideas across the data were sorted into a set of preliminary themes and subthemes. To corroborate the saliency of themes and to increase reliability and consistency in the coding procedure, a co-author re-coded a sample (22%) of interview transcripts selected at random. There was a high level of agreement in coding and final themes were agreed by consensus. This thematic framework was then systematically applied to the remaining data. The Nvivo software programme was used for this indexing. The number of times each category was mentioned were recorded as well as the number of participants who mentioned it. The data were then rechecked and the relationship between themes was considered in order to assist interpretation of the whole data set.

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Results

Five themes and fifteen subthemes were identified in the analysis of the interviews. These are presented in Table 1 and appear again in the headings used to structure the section that follows. Excerpts (in italics) from the transcripts are provided, exemplifying content of most themes / subthemes.

Insert Table 1 about here

Table 1: Themes and subthemes

Theme	**Subthemes**
Role of the speech-language pathologist	Feeding assessment Communication intervention Education of parents and professionals
Factors to be mindful of when considering oral feeding	Gestational age Respiratory skills Infant's presentation overall Planning Instinct
Pre-feeding	Non-nutritive sucking Oral readiness De-sensitisation
Feeding definitions	Oral feeding and enteral feeding Volume of oral intake
Setting dependency	Culture Decision making in the multidisciplinary team

Theme 1 - The Role of the SLP

Participants discussed a range of areas within the role of the SLP. These included feeding and swallowing assessment, pre-feeding communication and the education of others involved in the management and care of the infant; both parents, and members of the multidisciplinary team (See Table 2).

Feeding assessment was mentioned by all participants. Within assessment, participants mentioned the importance of considering; (a) opportunities for non – nutritive sucking, (b) swallow efficiency (in terms of the suck –swallow-breathe cycle), (c) swallow safety, (d) oral readiness, and (e) feeding efficiency.

Only two of the nine participants reflected on their role in developing early communication when managing infants on the neonatal unit. One participant, mentioned the importance of facilitating early communication development within the feeding context. The other participant stated that they did not focus on communication at all.

Insert Table 2 about here

Table 2: Quotes illustrating Theme 1 - The role of the SLP

Sub theme	N	Example quotes
Assessment	9	*"assess their safety for oral feeds" (participant 2)* *" we assess safety and see if we can increase the efficiency of their feeding "(participant 1)*
Communication	2	*" its all to do with feeding no communication at all" (participant 8)* *"a lot of social and communication development happens during feeding. (participant 6)*
Education	2	*"education as well for parents and the medical team (participant 8)*

N= number of participants who commented on subtheme.

Theme 2 - Factors to be mindful of when considering feeding

A number of factors were considered before feeding an infant on HFNC. Participants reported regularly considering gestational birth age, respiratory skills, flow rate, overall presentation of the infant, planning and instinct. Participants frequently mentioned respiratory factors as influencing their decision making processes, explaining that they would consider the amount of high flow, the flow rate, pressures, weaning, work of breathing and additional respiratory diagnoses (e.g., chronic lung disease) prior to feeding an infant on HFNC.

Five participants mentioned flow rate as a factor to consider, however there were conflicting opinions about the precise flow rate level important for introducing oral feeding. One participant did not consider this a relevant factor at all.

All participants acknowledged that the treatment of infants with signs and symptoms of feeding and/or swallowing disorder was likely to be influenced by many different factors, namely, diagnosis, physiological factors such as heart rate and saturation levels, information about previous feeding trials, infant responsiveness to being held and oral-sensory development. Two participants acknowledged implicit clinical knowledge and reasoning as a critical aspect of their decision making process, referring to this as 'instinct' developed over time. Five SLPs further identified the expectations of the parents and the medical team prior to feeding an infant on HFNC as additional important considerations.

Insert Table 3 about here

Table 3. Quotes illustrating Theme 2 - Factors to be mindful of when considering feeding

Sub themes	N	Example quote
Gestational age	9	*"I would align that probably a little bit in my mind with what gestational age they were at, so when they're reaching 31-32 weeks are they starting to show some feeding readiness cues" (participant 5)*

		"They're thinking about gestational age and this baby is 38 weeks and they need to be feeding. "(participant 2)
Respiratory skills	9	*What's their work of breathing like? How much-what are their pressures like? What is their ….amount of oxygen" So is this what, I guess how severe is the chronic lung disease that's underlying the need for on-going high flow or is this a pretty straight forward ….baby …..who is … preterm …..just weaning off high flow as part of its pattern". (participant 5)*
Flow rate	5	*"we usually wait until the baby is on a flow of around 5. ….. …..the baby would start to nuzzle at an expressed breast at around 6 but as well as looking at numbers you know we look at the baby"(participant 9)* *"There is no right or wrong answer to that and actually I tend to not get so stuck on the specific numbers". (participant 2_* *"You know once they get towards term and they're on maybe 2 litres whatever ……...We might consider it, but only under discussion once we know what their chest status is like". (participant 7)*
Infants presentation overall	9	*"If they can handle being taken out of their cot or incubator and held for a tube feed and …. cope ok with that in terms of physiology" (participant 2)* *"How the baby regulates its state-all of those things"* (participant 6) *"So ……the way that the baby presents. Both physiologically and in terms of their ……state if*

		you like as manifested by their posture and their tone and their movement". (participant 9)
Feeding plan	5	*"What their goals are with regards to feeding. Are we looking at, we want this child-baby to be feeding orally or is it erm, just to have something" (participant 1)* *"I guess thinking about parents' expectations, the medical teams' expectations as well comes into play". (participant 3)* *I guess it's getting everyone's opinions and arriving at what's the most sensible thing to do if that makes sense" (participant(5)* *"our model is that it is a multidisciplinary decision, it's not specifically a speech and language therapy decision" (participant 2)*
Instinct	2	*"I think every therapist who does this kind of work has got an idea in their head of kind of when a baby might be ready or not." (participant 6)* *"I guess I'm very aware about the fact that there is quite a bit of instinct going on. "(participant 8)*

N= number of participants who commented on subtheme.

Theme 3 - Pre feeding

Participants discussed pre-feeding approaches such as non-nutritive sucking programmes, developing oral readiness and oral stimulation when describing what they would do if an infant was not ready for oral feeds. Again, the perspectives and collaboration of the multidisciplinary team members were highly valued and considered a critical element of the decision making process. The majority of participants alluded to the need to follow the

cues of the baby in terms of their development readiness to begin oral feeding, suggesting the need for highly attuned observational skills and careful analysis of various sources of information.

Insert Table 4 about here

Table 4. Quotes illustrating Theme 3 - Pre feeding

Sub theme	N		Example quote
Non-nutritive sucking	3		*"They might consider kind of doing some more non-nutritive stuff …..and using, ……expressed breast and time at the breast ……."(participant 2)*
Oral readiness/state	7		*"as an MDT that we consider all the factors within the baby's development. And readiness. So that might be gut, neurological state, erm feeding readiness cues"*.(*participant* 7)
Desensitisation/oral stimulation	3		*"I would say if they're on ….. 2 litres or more then we would do oral stimulation with them" (participant 7)*

N= number of participants who commented on subtheme

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Theme 4 - Feeding definitions

When asked to consider the meaning of the term 'feeding' SLPs discussed both oral feeding and enteral feeding. Some participants suggested that a person's profession could influence how they understood and used the term 'feeding' and several mentioned that there was confusion in the use of the term. For example, two participants discussed the term 'feeding' in relation to volume of oral intake. Whereas one of these participants felt the term was dependant on a specific volume being taken by an infant, the other participant felt any amount justified the use of the term.

Insert Table 5 about here

Table 5. Quotes illustrating Theme 4 - Feeding definitions

Sub theme	N		Example quote
Oral feeding and enteral feeding	9		*"If you're talking about neonates, feeding to me always means oral feeding"(participant 7)* *"To me it initially means orally feeding. ……..and then I guess when I think about it more it can be like enteral feeding as well ". (participant 3)* *"To me feeding is orally feeding but I'm very aware that it's used in other ways by, depending who's saying it". (participant 1)* *"We include ….. trials, oral trials or orally tastes under the umbrella of feeding, which is a bit confusing"(participant 4)*
Volume of oral intake	2		*"I think I would specifically say fully orally feeding if they are fully orally…I would say that even if it's a small quantity like 10 mls, I would say feeding. Hmm, actually wait let me rethink that. Hmm. Yeah I think I would use it for a small quantity. Maybe not 5mls but I, I would still use it yeah. "(participant 1)* *"I think that you know with a baby that is only having dips of milk on a dummy or a finger and having an NG tube at the same time…is still feeding because they're learning that experience as well as a baby fully breast-feeding or fully bottle-feeding".(participant 6)*

N= number of participants who commented on subtheme .

Theme 5 - Setting dependency

The culture and environment within hospital teams was considered to be a strong influence on the decision to feed an infant on HFNC. Participants discussed the fact that hospitals and neonatal units take different approaches to feeding on HFNC. In some cases SLPs were integral to that process but in others factors such as funding could dictate involvement. For example, one participant said,

"I think in some hospitals it's very well recognised that we have an input….. and sometimes it's just down to funding and resources that you're not more involved "(participant 4)

When asked about the role of the multi-disciplinary team the majority of participants said the decision to feed an infant on HFNC was a collaborative decision. Other professions routinely involved in the decision-making process included the breast feeding advisor, consultant neonatologist, dietitian, nursing staff, occupational therapist, physiotherapist and parents. However, participants did not wholly agree as which disciplines should be part of the MDT, and the availability of professionals differed depending on context.

Insert Table 6 about here

Table 6. Quotes illustrating Theme 5 - Setting dependency

Sub theme	N		Example quote
Culture	9		*"I can say between the two units that I work in that I probably work quite differently with high flow babies". (participant 2)* *"I think it's always been one of those….topics that depends……. on which hospital you work in. ……people have different opinions". (participant 4)* *"There is a real polarisation of practice currently. ……you have units that absolutely will not do it. And then you have other units that are doing it with various levels of …..assessment and caution or whatever"(participant 5)*
Decision making within the	9		*the consultants ……focus on different things when feeding ……..…the amount of high flow that a baby is on is not*

multidisciplinary team			*necessarily something that they're thinking about. They're thinking about gestational age and this baby is 38 weeks and they need to be feeding"..(participant 2)* *"I think we have good respect and that there are good joint decision-making processes"(participant 9)* *"Obviously the dietitian is …. important …..in supporting the nutrition and underpin(sic) the feeding". (participant 5)* *"I don't know whether the dietitian's involved at that stage? …..actually on the team"(participant 4)*

N= number of participants who commented on subtheme

Discussion

The results of this small study indicate that currently there are no set protocols to guide the process of early oral feeding with infants on HFNC. However, participants consistently identified assessment of swallow safety, oral readiness and feeding efficiency as important areas to consider when treating an infant on HFNC. All SLPs clearly distinguished between pre-feeding and direct feeding support. A number of pre-feeding interventions including time at an empty breast, non-nutritive sucking and oral stimulation were mentioned by all participants and considered an important experience to offer where possible. When discussing the term "feeding", participants appeared to divide it into two categories; (i) oral feeding and, (ii) enteral feeding. There were conflicting opinions surrounding the term 'oral feeding' and whether using the term suggests a specific volume had been taken. This suggests that a future study investigating participant understanding of core neonatal terminology in relation to early feeding may be useful.

Despite participants discussing flow rate as a factor to consider, there were conflicting opinions about the precise flow rate level when using HFNC for introducing oral feeding. This may be driven by recent studies stating that airway safety is compromised when infants swallow in the presence of continuous pressurised airflow such as nCPAP (Ferrara et al., 2017). However, the lack of evidence surrounding oral feeding on any form of respiratory support means that clinicians need to make decisions about oral feeding when the impact of flow rates is, to date, unknown.

The work place setting, team culture and parent expectations were noted to impact on the decision to feed an infant. Of the nine SLPs interviewed, 44% (n=4) commented that their work place in some way influenced the decision-making process, whether it was the hospital culture, neonatal unit or ward on which they worked. One participant felt the amount of funding and resources available to provide speech-language pathology services impacted the decision-making process such that if SLPs were only available on an ad hoc basis to deal with specific cases, then collaboration on other issues related to introducing oral feeding might not take place, potentially affecting patient care.

It was surprising and somewhat disconcerting that only one participant discussed the importance of sociall, communication and interaction development, despite the fact that it is well documented that the neonatal environment can impair infant-parent interaction during every day routines, including feeding, and contribute to increased long term parental anxiety and mental health problems (Muller-Nix, 2004). It could be that participants were limited by the interviewer's focus on questions related to aspects of feeding, rather than communication development at this early stage. Given the possible risks of longer term poor parent – child interaction, and poor communication outcomes for infants, it is concerning that SLPs did not spontaneously discuss early communication more.

Limitations

This paper reports findings from a small study of nine of SLPs, all of whom were women and recruited from the same neonatal network. Consequently, the perceptions of the participants may not have been typical of practice across the UK, or elsewhere in the world and may therefore not be transferrable to other contexts. As the interviews were conducted using different methods (i.e. either face to face or telephone), the researcher was not always able to respond to non-verbal cues and may have impacted the depth of the data collected. Future research should include a larger sample of participants and consistent interview conditions with attention paid to exploring both depth and breadth of issues.

Clinical Implications and Conclusion

The information gained in this study about the processes used by SLPs when deciding to feed an infant on HFNC highlighted the importance of employing strategies to support oral and enteral feeding, as well as non-nutritive feeding opportunities. Collaboration with multidisciplinary team members in addition to highly refined clinical observation skills were identified as critical in the process. Factors influencing the introduction of feeding opportunities for infants on HFNC appeared to be most associated with the infant's needs and safety, rather than level of HFNC support. In this regard, the decision-making processes utilised by SLPs for this population were more similar than different to those used with any other infant on the neonatal ward, irrespective of the need for supplemental oxygen.

While asking SLPs about their clinical decision-making practises within a neonatal care context was enlightening and yielded important insights, the findings confirmed widely varying perceptions and practices amongst the SLPs interviewed, indicating there is still lack of consensus about best practice in this setting. As this area of clinical practice is continually developing, future studies are warranted, perhaps with a focus on a wider range of evidence-

based strategies used to support the introduction of oral feeding for premature infants, and the relative advantages, disadvantages, considerations and contraindications for each. Specifically, in light of the comments of Jadcherla et al (2016) regarding oral intake with premature infants receiving a wider variety of respiratory support, and developing individualised methods of oral feeding, considering SLPs views of feeding infants on other methods of respiratory support (i.e., nCPAP), would be warranted. Ongoing research, in particular large scale multi –site studies both into specific techniques which support the development of oral feeding and communication for infants on neonatal units, as well as SLP perceptions of their role and how decisions regarding introducing oral feeding is recommended.

References

Campbell, D. M., Shah, P. S., Shah, V., & Kelly, E. N. (2006). Nasal continuous positive airway pressure from high flow cannula versus infant flow for preterm infants. *Journal of Perinatology*, *26*(9), 546.

Collins, C. L., Holberton, J. R., Barfield, C., & Davis, P. G. (2013). A randomized controlled trial to compare heated humidified high-flow nasal cannulae with nasal continuous positive airway pressure postextubation in premature infants. *The Journal of pediatrics*, *162*(5), 949-954.

Diblasi RM (2009) Nasal continuous positive airway pressure (CPAP) for the respiratory care of the newborn infant. *Respiratory Care 54: 1209-35.*

EuroNeoNet, (2013). 2013 EuroNeoNet Annual Report for VLGAI, Spain.

Ferrara, L., Bidiwala, A., Sher, I., Pirzada, M., Barlev, D., Islam, S& Hanna, N. (2017). Effect of nasal continuous positive airway pressure on the pharyngeal swallow in neonates. *Journal of Perinatology*, *37*(4), 398.

Gennattasio, A., Perri, E. A., Baranek, D., & Rohan, A. (2015). Oral feeding readiness assessment in premature infants. *MCN: The American Journal of Maternal/Child Nursing*, *40*(2), 96-104.

Glackin, S. J., O'Sullivan, A., George, S., Semberova, J., & Miletin, J. (2017). High flow nasal cannula versus NCPAP, duration to full oral feeds in preterm infants: a randomised controlled trial. *Archives of Disease in Childhood-Fetal and Neonatal Edition*, *102*(4), F329-F332.

Hanin, M., Nuthakki, S., Malkar, M.B. & Jadcherla, S.R. (2015). Safety and Efficacy of Oral Feeding in Infants with BPD on Nasal CPAP, *Dysphagia,* (30) 2, 121-127.

Harding, C., Frank, L., Van Someren, V., Hilari, K., & Botting, N. (2014). How does non-nutritive sucking support infant feeding?. *Infant Behavior and Development*, *37*(4), 457-464.

Harding, C., Mynard, A., & Hills, E. (2018). Identification of premature infant states in relation to introducing oral feeding. *Journal of Neonatal Nursing*. 24(2),104-110.

Hawdon, J. M., Beauregard, N., Slattery, J., & Kennedy, G. (2000). Identification of neonates at risk of developing feeding problems in infancy. *Developmental medicine and child neurology*, *42*(4), 235-239.

Hernández, G., Vaquero, C., Colinas, L., Cuena, R., González, P., Canabal, A., Sanchez, S., Rodriguez, M.L., Villasclaras, A. & Fernández, R. (2016).Effect of Postextubation High-Flow Nasal Cannula vs Noninvasive Ventilation on Reintubation and Postextubation Respiratory Failure in High-Risk Patients: A Randomized Clinical Trial, *Journal of the American Medical Association*, 316, (15), 1565-1574.

Jadcherla, S. R., Hasenstab, K. A., Sitaram, S., Clouse, B. J., Slaughter, J. L., & Shaker, R. (2016). Effect of nasal noninvasive respiratory support methods on pharyngeal provocation-induced aerodigestive reflexes in infants. *American Journal of Physiology-Gastrointestinal and Liver Physiology*, *310*(11), G1006-G1014.

Kirk, A. T., Alder, S. C., & King, J. D. (2007). Cue-based oral feeding clinical pathway results in earlier attainment of full oral feeding in premature infants. *Journal of Perinatology*, *27*(9), 572.

Kugelman, A., Riskin, A., Said, W., Shoris, I., Mor, F., & Bader, D. (2015). A randomized pilot study comparing heated humidified high-flow nasal cannulae with NIPPV for RDS. *Pediatric pulmonology*, *50*(6), 576-583.

Leder, S. B., Siner, J. M., Bizzarro, M. J., McGinley, B. M., & Lefton-Greif, M. A. (2016). Oral alimentation in neonatal and adult populations requiring high-flow oxygen via nasal cannula. *Dysphagia*, *31*(2), 154-159.

Mason, S.J., Harris, G. & Blissett, J. (2005).Tube feeding in infancy: implications for the development of normal eating and drinking skills, *Dysphagia,* 20 (1), 46-61.

Muller-Nix, C., Forcada-Guex, M., Pierrehumbert, B., Jaunin, L., Borghini, A. & Ansermet, F. (2004).Prematurity, maternal stress and mother–child interactions, *Early human development*, 79 (2), 145-158.

Nvivo for Windows (2012). Qualitative data analysis Software; QSR International Pty Ltd. Version 10, 2012.

Ojha, S., Gridley, E., & Dorling, J. (2013). Use of heated humidified high-flow nasal cannula oxygen in neonates: a UK wide survey. *Acta Paediatrica*, *102*(3), 249-253.

Reynolds, P. & Soliman, M. (2013). Using nasal high flow instead of nasal continuous positive airway pressure on the NICU, *Infant,* 9 (2), 45 - 49

Ritchie, J. & Spencer, L. (1994) “Qualitative data analysis for applied policy research”, in Bryman, A. & Burgess, R. (eds), *Analyzing qualitative data*, London: Routledge, 173-194.

Yoder, B.A., Albertine, K.H. & Null, D. (2016).High-frequency ventilation for non-invasive respiratory support of neonates, *Seminars in Fetal and Neonatal Medicine,* 21 (3),162 - 173.