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Running head: PACIFIERS AND BREASTFEEDING

Relationships between Pacifiers and Breastfeeding

By

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A thesis

submitted in partial fulfillment

of the requirements for the degree of

Master of Science in the

Department of Communication Sciences and Disorders

Idaho State University

May 2014

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## **ABSTRACT**

**Purpose:** The purpose of this research project was to survey mothers of infants born at 33 weeks gestational age or later who used pacifiers and breastfed to determine breastfeeding exclusivity and longevity and its relation to pacifier use. **Methods:** Mother's Haven, a retail facility in Kootenai County, Idaho, provided an opportunity to gain a large sample of maternal behavior through a survey emailed to their contact list of customers. Participants who took the survey numbered 479. The sample size was reduced to 302 after qualifying factors were considered. Case history was obtained from mothers regarding their youngest child. The survey consisted of 22 questions, with 20 of the questions having relative content to the study. The strength and direction of relationships between pacifier intensity and longevity of use and breastfeeding exclusivity and longevity were measured using Spearman's Rank Correlation Coefficients. **Results:** Data indicated that there was a weak, yet statistically significant negative relationship between pacifier intensity of use and breastfeeding exclusivity, pacifier intensity of use and breastfeeding longevity, pacifier longevity of use and breastfeeding exclusivity, and pacifier longevity of use and breastfeeding longevity. Other relationships are delineated in the results section.

**Key Words:** Pacifier, non-nutritive sucking device, dummy, breastfeeding, nursing, feeding, oromyofunctional disorders, dental development, language delay, speech impairment, otitis media, tongue thrust, open mouth posture, immature swallow, infantile swallow.

## Chapter 1: Review of Literature

### Introduction

Breastfeeding is widely known to provide irreplaceable health and developmental benefits to infants. Breastfeeding promotes mother-infant bonding (Howard et al., 1999), a platform for communication, and healthy biological systems. The World Health Organization (WHO) advises mothers against using artificial nipples (pacifiers and bottle nipples), with the goal of successful breastfeeding, but scientific research on the effects of artificial nipples on breastfeeding longevity and exclusivity is still in its infancy (Howard et al., 2003).

Pacifiers or objects used to pacify infant sucking behaviors have been traced back to the late 15<sup>th</sup> century (Ravn, 1976). The first patent on a pacifier was recorded in 1845 (Winter, 1980). In a randomized clinical trial on the effects of artificial nipples on breastfeeding (Howard et al., 2003) it was found that 94 percent of 700 parents introduced a pacifier to their infant by 6 weeks postpartum and 97 percent had presented it by 6 months postpartum. Because the use of pacifiers is so dominant, the positive or negative effect of pacifiers on the proven healthy practice of breastfeeding is a foremost concern. It is possible that use of pacifiers may reduce breastfeeding or nursing time (Victora et al., 1997). This could in turn result in negative factors related to bottle feeding: otitis media (Natale & Sexton, 2009) and subsequent language delays, dental malocclusion leading to oromyofunctional disorders (Natale & Sexton, 2009), and gastro-intestinal problems (Pinelli & Symington, 2010). This study was an attempt to examine the extent to which mothers in Kootenai County in northern Idaho utilized

pacifiers and how these practices affected breastfeeding longevity and exclusivity. Relationships were measured between intensity and longevity of pacifier use with breastfeeding longevity and exclusivity.

Breastfeeding has many known positive benefits on the health and wellbeing of the developing infant. According to the American Academy of Pediatrics' (AAP) Policy Statement (2012) on breastfeeding, increased breastfeeding longevity and exclusivity reduces the risk for respiratory tract infections, otitis media, gastrointestinal tract infections, necrotizing enterocolitis (NEC), sudden infant death syndrome (SIDS), infant mortality, allergic diseases, celiac disease, inflammatory bowel disease, obesity, and diabetes. The AAP policy statement also linked decreased breastfeeding longevity to decreased neurodevelopment outcomes. The statement went on to list unique benefits for breastfed pre-term infants. Increased breastfeeding longevity and exclusivity for pre-term infants decreases rates of sepsis, NEC, hospital readmissions one-year post-NICU discharge, mortality, long-term growth failure, and neurodevelopment disease. It also increases scores for mental, motor and behavioral measures, according to the AAP policy statement (2012).

Pacifiers are commonly used by infants world-wide, including under-developed countries (Victora, et al., 1997), which sometimes leads to decreased breastfeeding time and a relationship with increased mortality rates due to infectious diseases. An epidemiological link between pacifier use and breastfeeding duration has been made by several studies (Barros et al., 1995; Ford et al., 1994; Gale & Martyn, 1996; Victora et al.,

1993). These articles addressed the need for a design to test the relationships between pacifier use and breastfeeding exclusivity and longevity.

While the benefits of breastfeeding are well established, the use of pacifiers to aid in care of the infant continues to increase. The reasons for pacifier use most likely lie in the calming effect they have for pain and anxiety prevention (Natale & Sexton, 2009). This review examines the theoretical effects of pacifier use on (a) development of otitis media, (b) nursing patterns, (c) sudden infant death syndrome (SID), (d) digestive function in pre-term infants, and (e) dental development.

### **Chronic Otitis Media and Pacifier Use**

Use of pacifiers has been implicated in increased incidences of chronic otitis media in infants. Two research reviews, Natale and Sexton (2009), and Hauck et al. (2009) found differing implications, risks and benefits of pacifier use relating to breastfeeding in infancy. There are two proposed concerns for the use of pacifiers resulting in otitis media: nasopharyngeal secretion reflux in the middle ear from sucking, and Eustachian tube dysfunction from malformed dental structures (Hauck et al., 2009). Acute otitis media (AOM) was recorded in the United States as one of the most common causes for doctor visits due to infectious diseases in childhood. According to Uhari et al. (1996), the number of pediatric cases was on the rise, increasing from 9.91 million in 1975 to 24.5 million in 1990. If AOM is recurrent in childhood, it may lead to hearing difficulties, speech delays, as well as eventual difficulty in school and literacy

development. Various risk factors have been linked to AOM, but evidence from studies has shown conflicting information (Uhari et al., 1996).

Information from 22 studies comprising the meta-analysis by Uhari et al. (1996) showed pacifiers to increase the risk of otitis media (OM). There was a risk ratio (RR) of 1.24 for infants who used a pacifier and developed OM. Other risk ratios measured in the same study showed a correlation of higher risk for developing OM in day care (2.45 RR) versus breastfed care (0.87 RR). A widely cited study (Niemela et al., 2000) and a more recent study (Rovers et al., 2008) were summarized as linking continuous pacifier use to higher rates of otitis media. According to Uhari et al. (1996), breastfed infants had a lower RR of OM (0.87) than infants who were fed by other means. Research has demonstrated undeniable benefits of breastfeeding infants; therefore, it is important to examine the relationship of widely-used pacifiers on breastfeeding habits.

In the Uhari et al. meta-analysis (1996), the risk for recurrent AOM was directly linked to amount of exposure to other children. Situations where more children were present (daycare>familycare>homecare) increased the likelihood of developing AOM. It is likely, according to Uhari et al. (1996), that women's increased presence in the workforce may explain the growing rate of recurrent AOM in today's healthcare system. Daycare size was listed as the single most influential factor increasing infection risk and should be examined to limit the risk of infectious disease as much as possible, according to their study.

Natale and Sexton (2009) reviewed several studies that unveiled links between bacterial colonization on pacifiers and increased incidences of otitis media. They

cautioned, however, that the cause for the link between bacteria and infection could have been secondary to the fact that pacifiers were offered to ill infants for a calming effect. Their systematic review of literature also showed associations between increased incidences of otitis media, dental infection, and respiratory and gastrointestinal symptoms with pacifier use. The American Academy of Pediatrics recommended reducing or discontinuing pacifier use from 6-12 months of age for reduced risk of otitis media (2004).

The benefits of breastfeeding to reduce gastrointestinal infections have been evidenced in research, but its effect on AOM has been represented both positively and indifferently in the current research. A 1994 study by Paradise, Elster, and Tan (1994) reported benefits of breast milk in infants with cleft palate to protect against otitis media. In this review, breastfeeding for as little as 3 months was beneficial in decreasing risk for AOM; but the study indicated it was difficult to differentiate between the breast milk or cow's milk as the extraneous factor. Parental smoking and childcare outside of the home are the most significant risk factors for AOM, according to Paradise et al. (1994).

#### **Effect of Pacifier Use on Nursing Patterns:**

A randomized control trial (RCT) of Victora et al. (1997) recorded visits of five Pelotas, Brazil, hospitals daily from January through December of 1993 to interview women who gave birth during their visit. Out of 5,304 interviews, a sample of 655 was chosen for follow-up information at 1, 3, and 6 months of age. The sample consisted of

329 boys and 326 girls. The study was combined epidemiologic and ethnographic, utilizing questionnaires, semi-structure interviews and observation. The authors claimed that the ethnographic information collected was rich in understanding the dynamic association between pacifier use and breastfeeding exclusivity and longevity. Information collected suggested that mothers who were knowledgeable of pacifiers' effect on breastfeeding were more likely to breastfeed longer and use pacifiers less frequently. The authors found that pacifier users had less time and instances at the breast, which may reduce the child's caloric and fat intake since hindmilk (offered when the breast is almost emptied) is richest in nutrients. They also found that interruptions in breastfeeding, such as bottle feeding, may fuel the need for a more intense pacifier suck that meets the infant's oral stimulation and comfort needs.

The Victora et al. RCT (1997) outlined behavioral and sociocultural traits of mothers who promoted pacifier use that were also found to be related to shorter breastfeeding time including: rigid breastfeeding, large expectations for growth/development, and anxious reactions to infant crying. The authors found that mothers who were more likely to breastfeed longer were nonwhite mothers, those who gave birth vaginally, and mothers of girls. Other studies in that area (Brazil) made the associations between infants who were born via cesarean section (Victora et al, 1990), and between breastfeeding among skin color and baby gender (Martines et al, 1989). Victora et al. (1997) concluded that the issue of pacifiers' effects on breastfeeding was not whether or not they contributed to the decline, but if the mothers would have stopped or decreased breastfeeding anyway. Victora et al. (1997) found from their

variable associations that simply educating women of the risks of pacifier use is not a strong enough campaign in itself. Support should also be offered for women who have difficulties breastfeeding or may be predisposed to a negative view of breastfeeding. The authors narrowed down their findings into an overall observation that mothers who seem uncomfortable breastfeeding are susceptible to pacifiers contributing to early weaning, whereas mothers who are comfortable are not affected by the use of pacifiers. Victora et al. (1997) called for additional research in other geographical areas to confirm their findings.

A systematic review by the Joanna Briggs Institute (2006) found that out of the 10 studies that met inclusion criteria for their review reported negative effects of pacifier use on breastfeeding duration or exclusivity. It was noted that the relationship had not been irrefutably proven and should be examined further. The review (2006) postulated that pacifiers meet infants' sucking needs and decrease their desire to breastfeed; or that the pacifier is simply a marker of extraneous factors, which cause reduction of breastfeeding, including socio-economic, demographic, psychosocial and cultural factors. The authors concluded that the benefits of breastfeeding are across-the-board.

Two more recent randomized clinical trials (RCT) offered differing results. Kramer et al. (2001) found strong observational associations between pacifier use and early weaning, but no significant randomized results. In this study, pacifiers were viewed as possible "markers" of breastfeeding difficulties or a mother's reduced desire to breastfeed (Kramer et al., 2001), similar to the RCT interpretation of findings by Victora



et al. (1997) overviewed earlier. Kramer et al. (2001) cited several observational studies that determined a strong association between pacifier use and early weaning, including: United States: Howard et al., 1999; Brazil: Barros et al., 1995, Victora et al., 1993, Victora et al., 1997; Sweden: Aarts et al., 1999, Richard & Alade, 1992; England: Clements et al., 1997; Gale & Martyn, 1995; New Zealand: Ford et al., 1994. One of the listed studies (Howard et al., 1999) is another RCT that reported a detrimental effect of pacifier use on exclusivity and duration of breastfeeding.

Howard et al. (2003) had 700 breastfed infants divided into four intervention groups: bottle/early pacifier (n=169), bottle/late pacifier (n=167), cup/early pacifier (n=185), or cup/late pacifier (n=179). This method was to account for infants who needed supplemental feedings and to measure bottle versus cup media. Follow-up was carried out until infants were 52 weeks old. This RCT was the first out of the three RCTs to demonstrate an impact of pacifier use on breastfeeding. The early pacifier group odds ratio was 1.5 with a 95% confidence interval: 1.0-2.0 (Howard et al., 2003). This meant that at 1 month post-partum, infants who were exposed to pacifier use in their first 4 weeks were less likely to be breastfeeding exclusively. Early pacifier use was correlated with shortened breastfeeding time more than late pacifier exposure. In summary, this RCT found pacifier use in the neonatal period to be detrimental to both breastfeeding exclusively and overall breastfeeding (Howard et al. 2003). Due to conflicting studies of whether pacifiers interfere with breastfeeding attempts, the American Academy of Pediatrics recommended pacifiers be offered at the age of 1 month, after breastfeeding has been established, and to wean usage in the 2nd half of the infant's 1st year (Natale

& Sexton, 2009). Prolonged use, a time defined differently by different sources, may have adverse affects on the infant's breastfeeding, dentition, and risk of otitis media, according to Natale and Sexton's study.

Natale and Sexton (2009) did not recommend active discouragement of pacifier use in the first 6 months after birth, and posed that pacifier use may be beneficial until risks start to outweigh the benefits between 6 and 10 months. Research has shown that after 6 months of age, a pacifier transfers from a nonnutritive sucking device to a security object of affection (Niemela et al., 2000). Recommended alternatives to the pacifier at the time of weaning include swaddling, rocking, music, singing, and infant massage (JAMA, 2001). Natale and Sexton recommended that physicians counsel parents in the post-partum period regarding the above parameters.

Both reviews of literature cited (Hauck et al., 2009; Natale & Sexton, 2009) laid out discrepancies in the studies available defining the risks and benefits of pacifier use in association with breastfeeding longevity and exclusivity. Each called for further research in several areas surrounding the effects between breastfeeding and pacifier use. Victora et al., 1997, specifically called for similar research regarding the areas addressed in their study in other geographical areas. All of the four RCT studies pointed out the need to differentiate the cause and effect association between pacifier use and breastfeeding versus extraneous effects.

Four RCTs reviewed by Hauck et al. (2009) provided the highest level of evidence in their meta-analysis. They are also the studies that showed no relation between breastfeeding duration / exclusivity and pacifier use. Hauck et al. stated in their

conclusion of the literature review that the majority of observational studies that found associations between pacifier use and shortened duration of breastfeeding were probably due to extraneous factors not documented, such as breastfeeding difficulties and mothers' intentions. The authors called for ongoing quantitative and qualitative research to further understanding of the relationship between pacifier use and breastfeeding.

### **Relationship between Pacifiers and Sudden Infant Death Syndrome**

Discouraging pacifiers was listed in the Ten Steps to Successful Breastfeeding (World Health Organization; United Nations Children's Fund, 1990), which was used in creation of the Baby Friendly Hospital Initiative – a worldwide program to promote breastfeeding medically and nationally. Around the same time, studies were published linking increased pacifier use to a decrease in SIDS incidences (Hauck et al., 2005; Mitchell et al., 2006). Further evidence over the years led the American Academy of Pediatrics to recommend pacifier use at only nap and bedtime, and to delay the introduction of a pacifier until 1 month of age to breastfed infants (Task Force on Sudden Infant Death Syndrome, 2005) and to wean usage in the 2nd half of the infant's 1st year (Natale & Sexton, 2009).

Natale and Sexton (2009) examined both benefits and risks of young children's pacifier use in their study. They cite benefits to include soothing effects, pain relief, shorter hospital stays of preterm infants, and a reduction of risk for SIDS. A meta-analysis of seven case-control studies indicated that increased pacifier use could reduce

the occurrence of SIDS by 61% (Hauck, et al., 2005). Other factors reported to reduce SIDS are breastfeeding (McVea et al., 2000) and room-sharing (Scragg et al., 1996).

### **Relationship between use of Pacifiers and Digestive Function in Pre-term Infants**

The use of pacifiers in the pre-term infant population has been linked to several benefits for various factors related to feeding. In a Cochrane review (Pinelli & Symington, 2010), non-nutritive sucking was correlated with decreased hospital stays, improved digestion, and calming affects. When using the definition of 33 weeks or less gestational age, pre-term infants are at risk for not having full suck and swallow mechanisms functioning, depending on individual development and gestational age. Generally, sucking reflexes appear at 24 weeks post-conception and sucking with swallowing becomes functional at between 32-34 weeks (Pinelli & Symington, 2010). It is evident in the Cochrane review that pacifiers aid pre-term infants in increasing physiologic stability and nutrition through use during gavage feeding and in transition to bottle or breast feeding. The review also concluded that pacifiers given to infants decrease instances of oral aversion during tube feedings. Conversely, the review cites the potential for pacifier use in pre-term infants to have a negative effect on breastfeeding. Another study by Collins et al. (2004) determined that pacifier use did not negatively affect breastfeeding longevity and exclusivity for pre-term infants; whereas Nelson et al. (2005) found that pacifier use did negatively affect breastfeeding rates of pre-term infants.

### **Effects of Pacifiers on Dental Development**

In the discipline of speech-language pathology, an increased knowledge of the relationship between pacifier use and breastfeeding rates of pre-term and full-term infants could potentially assist clinicians in an effort to reduce the risk of otitis media and dental malocclusions in young children, in turn reducing the occurrences of hearing-related language delay and speech impairments due to orofunctional disorders, respectively. According to Natale and Sexton (2009), a meta-analysis found that dental malocclusion occurs with a higher incidence with pacifier use after the age of 3 years old. The review concluded that adverse effects are possible after only 24 months of pacifier use, but that effects worsen after 48 months. Rates of malocclusion incidences increase significantly with consistent use over time. Warren et al. (2001) reported that about 71% of children who used a pacifier or sucked a finger for more than 4 years had a form of dental malocclusion. This is compared with the incidence of malocclusion at 32% of the children who stopped sucking either a pacifier or digit between 3 and 4 years of age, and 14% for those who stopped sucking before 2 years of age. Although negative dental effects are more severe after 4 years of age, the study showed that malocclusions are notable after just 2 years of consistent sucking on either a pacifier or a digit. It is recommended by the American Academy of Pediatric Dentistry (AAPD) to discourage pacifier use when the child is old enough to understand how the sucking habit may affect dentition (American Academy of Pediatric Dentistry, 2013). Further, a

child with a sucking habit that persists past 3 years of age may require intervention, according to the AAPD.

Non-nutritive sucking may lead to an oral myofunctional disorder called tongue thrust (Flipsen et al., 2009). This disorder is closely associated with open bite, tongue forward posture, and open mouth posture secondary to dental and oral structure abnormalities. According to Flipsen et al. (2009), tongue thrust swallow refers to the direction of the tongue activity during swallow. The authors include other terms that refer to this action, including reverse swallow, deviant swallow, and infantile swallow. Tongue thrust swallow is an appropriate direction of the tongue activity for infants; but in normal swallow development the tongue movement changes to an adult swallow pattern (American Speech-Language Hearing Association, 1989). Tongue thrust and tongue forward resting posture together produce a concomitant effect on anterior open bite and impedance of natural dentition eruption, according to Flipsen et al. (2009). Studies have found that children with tongue thrust have a higher incidence of speech sound errors than children without tongue thrust (Flipsen et al., 2009). The sibilant errors that children with tongue thrust have difficulty with are speech sound errors that Speech Language Pathologists (SLPs) treat with articulation therapy.

This knowledge may give clinicians the tools to answer a mother's inquiries to make an evidence-based decision about her desire to breastfeed or not to breastfeed, whether to use a pacifier, how often to use a pacifier, and the possible implications of those decisions. Educating mothers about the benefits of breastfeeding exclusivity and longevity could help them create a stronger communication and bonding platform for

mother-baby dyads to develop from, in addition to other benefits related to speech and language development.

Increased breastfeeding exclusivity and longevity could decrease pacifier use, which has been linked to increased incidences of chronic otitis media and dental malocclusion (Howard et al., 2003; Natale & Sexton, 2009). Both otitis media and malocclusion have the potential to lead to speech and language delays and disorders. Acute otitis media is linked to hearing impairment and delayed speech development (Uhari et al., 1996). Dental malocclusions are closely related to abnormal bone growth and mandible development (American Academy of Pediatric Dentistry, 2013), which may also lead to open bite, tongue thrust, open mouth posture, and tongue forward posture. These oromyofunctional disorders cause speech and swallowing disorders which are regularly assessed and treated by SLPs. Consequently, research indicates that persistent and continuous pacifier use has potential to lead to hazardous behaviors related to swallow, speech and language development. However, healthy breastfeeding habits reduce hazardous risks related to speech and language development, such as otitis media (Joanna Briggs Institute, 2006; Natale & Sexton, 2009) and promote overall health with species specific milk, host-resistance factors, immunologic protection, allergy protection, mother-baby bonding, semi-upright positioning to help eliminate milk entering the middle ear, and decreased intake of air (Arvedson & Brodsky, 2002).

The purpose of this research project was to survey mothers of infants over 33 weeks gestational age to determine breastfeeding exclusivity and longevity and its relation to pacifier use. Mother's Haven, a retail facility in Kootenai County, Idaho,

provided an opportunity to gain a large sample of maternal behavior, as will be discussed.

It was hypothesized that intensity of pacifier use and longevity of pacifier use would have a negative relationship with breastfeeding exclusivity and longevity among infants in the Kootenai County, Idaho, sample. The following questions were posed:

**H1:** Pacifier use intensity will have a negative relationship with breastfeeding exclusivity.

**H2:** Pacifier use intensity will have a negative relationship with breastfeeding longevity.

**H3:** Pacifier use longevity will have a negative relationship with breastfeeding exclusivity.

**H4:** Pacifier use longevity will have a negative relationship with breastfeeding longevity.



## **Chapter Two: Methodology**

The purpose of this study was to survey mothers in Kootenai County, Idaho who gave birth to full-term infants, breastfed, and whose infant used a pacifier. The study measured the relationship between pacifier intensity and longevity with breastfeeding exclusivity and longevity.

### **Participants**

Participants were mothers who had breastfed their youngest child. Mothers with more than one child used the youngest child's information in the survey. Participants were recruited from the email list of Mother's Haven, a retail store in Kootenai County, Idaho. The facility maintained an active e-mail list of over 5,000 names. Individuals were approached with a short summary of the study in an email accompanied by a request to participate by clicking the link on embedded in the survey (see Appendix B for email wording and format). Participants could choose to enter into a drawing for a gift certificate to Mother's Haven by including their email address in the survey. Once submitted, the individuals' email addresses were immediately separated from their survey responses in order to preserve their anonymity.

By clicking on the link in the email sent by Mother's Haven, subjects accessed a 22-question survey (Appendix A). The subject title of the email read, "Quick Survey for a Chance to Win \$50 Mother's Haven Gift Card." The first two questions included opt-in information, with the first question containing the following opt-in paragraph: "Thank you for your willingness to participate in this study. The purpose of the study is to describe the effects of pacifier use on breastfeeding. Participation is completely voluntary and anonymous. Participants may choose to

be entered to win a \$50 gift certificate to Mother's Haven by typing in your email address in the space provided. Please fill out the survey regarding your youngest child.” The second question offered a space for the participants to enter the drawing for a \$50 gift certificate and read: “Please enter your email address if you would like to enter the drawing for a \$50 gift certificate to Mother's Haven in Coeur d'Alene, ID. After your email address is entered into the drawing, this information will be stripped from your data so your anonymity will be protected.”

The maternity store's clientele and email list included mothers predominantly geographically-based in Kootenai County, Idaho. The store itself is located in Coeur d'Alene, Idaho. The goal for purposive sampling was originally set at 50 mothers to participate in the study. The survey was open for two weeks, from October 9 through October 23, 2013. The final number of participants was 479. From the available population of over 5,000 email contacts in the Mother's Haven marketing database, there was an approximately 10% response rate. Seven surveys were eliminated because they were not completed. Five surveys were eliminated for invalid age values entered. Fourteen surveys were eliminated because the participants stopped answering after “Question 7,” which reduced participants to 453. There were 39 eliminated because they answered “no” for “Question 15” on whether their child used a pacifier, as well as one that was missing (who did not answer the question). Then 83 surveys were removed from the sample in order to include only children 6 months of age and older. This benchmark of including children 6 months and older was chosen in an attempt to eliminate infants who were still breastfeeding and for which the mothers didn't have sufficient information to answer the case history inquiries regarding time. This resulted in 330 surveys. There were 23 children with complicating factors who were removed

from the sample to eliminate factors that could interfere with linear relationships between variables, such as tube feedings, syndromes, and developmental disorders. This reduced the sample size to 307. Finally, five children who were born premature were eliminated to preclude other feeding and swallowing issues that may interfere with typical relationships between pacifier use and breastfeeding in the normal developing infant. This brought the final sample size to 302 participants.

### **Instruments**

Few instruments were used to collect case history data from mothers of children who breastfed and used a pacifier. An introduction to the study was included in an email made by the marketing department for Mother's Haven to imply informed consent when an individual clicked on the survey link (Appendix B). A second, similar introduction including informed consent took up the first question in the survey. The study designer offered a \$50 gift certificate to a random drawing winner as an incentive to participate in the study. The survey itself may be viewed in Appendix A.

### **Survey Design**

The survey consisted of 22 questions for mothers to answer and submit to Qualtrics.com, a survey software database for quantitative analysis (see Appendix A). Survey questions included an introductory implied consent paragraph for #1, a question to enter the drawing for #2, and a question at the end of the survey for mothers to enter any additional information that was not included in the survey questions. In all,

there were 20 content questions related to data gathering for the purpose of analysis. Terminology was defined on the questionnaire in the context of each question for clarity, including terms such as breastfeeding longevity and exclusivity, pacifier use, liquid supplements, alternative tube feedings, etc. (for more detailed information, see survey in Appendix A). For the purposes of this study, breastfeeding duration referred to total duration of any breastfeeding. Pre-term infants were defined as infants birthed before 33 weeks gestation.

### **Procedure**

Participants clicked on a link in the body of a Mother's Haven email and were directed to the electronic survey hosted on the Website Qualtrics.com. A brief explanation was provided on Mother Haven's email with a link to the survey. Consent to participate was indicated by participating in the survey. Responses were tracked on the survey database, which also made it possible to track how many subjects completed the survey and if the purposive sampling numbers were met. The goal number of 50 was surpassed quickly and a second campaign to build up participant numbers using the business' Facebook page with over 2,000 contacts was not needed. Once the desired number of participants was reached, data were grouped and evaluated using descriptive statistics. After the survey was closed following the two-week data-gathering period, a winner of the \$50 Mother's Haven gift certificate was chosen using a random number table from a statistics textbook. The winner was notified via email and she picked up her gift certificate at the retail store.

**Reliability**

The survey was emailed twice to five personal acquaintances of the investigator in this study prior to sending the survey to potential participants. A period of five days separated the emails of the test-retest surveys. All five individuals completed the first survey. Four of the five individuals completed the second survey. Of the 22 questions in the survey, 20 questions had complete agreement (100%) between the test and retest. Two of the questions had 75% agreement between test and retest. The overall reliability for the test-retest was calculated to be 98%.

**Statistical Methods**

Since the variables measuring intensity, exclusivity, and longevity were measured using ordinal scales the relationships were analyzed using Spearman's Rank Correlation Coefficients. This statistic measures the strength and direction of the relationships between pacifier intensity and longevity of use and breastfeeding exclusivity and longevity.

### **Chapter Three: Results**

The case histories analyzed included 302 case histories of children between 6 months old and 7 years 11 months old who breastfed and used a pacifier. The case histories were obtained by surveys filled out by the children's biological mothers. Spearman's Rank Correlation Coefficients revealed agreement between the results and all hypotheses posed. There was a weak, yet statistically significant negative relationship between pacifier intensity of use and breastfeeding exclusivity, between pacifier intensity of use and breastfeeding longevity, between pacifier longevity of use and breastfeeding exclusivity, and between pacifier longevity of use and breastfeeding longevity.

#### **Participants**

The sample subject to analysis for this study included mothers who participated in the survey and who were not eliminated from the pool due to factors listed above in the Methods section. Mothers included for analysis ranged in age from 19 to 47 years old. The mean age was 31.6 years old with a standard deviation of 4.7 years. There was only one participant younger than 20 years old and 32% were in their 20s. Most of the women were under 40 years old (94%). There were 17 participants who were in their 40s (6%).

**Table 1** Survey Sample by Age and Percentage of Decade Populations

<b>Age Groups</b>	<b>Number of females per age group</b>	<b>Percent of total population</b>
20-49 year population	302	100%
15 to 19	1	.3%
20 to 29	93	31.6%
30 to 39	183	62.2%
40 to 49	17	5.8%
Missing	8	3%
Median age	32	X

Data from this study's survey results.

**Table 2** Idaho 2010 Census Demographics for Females 20-49

<b>Age Groups</b>	<b>Number of females per age group</b>	<b>Percent of total population</b>
Total Idaho female population	782,258	49.9%
20-49 years	301,894	100%
20 to 29	105,343	35%
30 to 39	97,721	32%
40 to 49	98,830	33%
Median	35.4	X

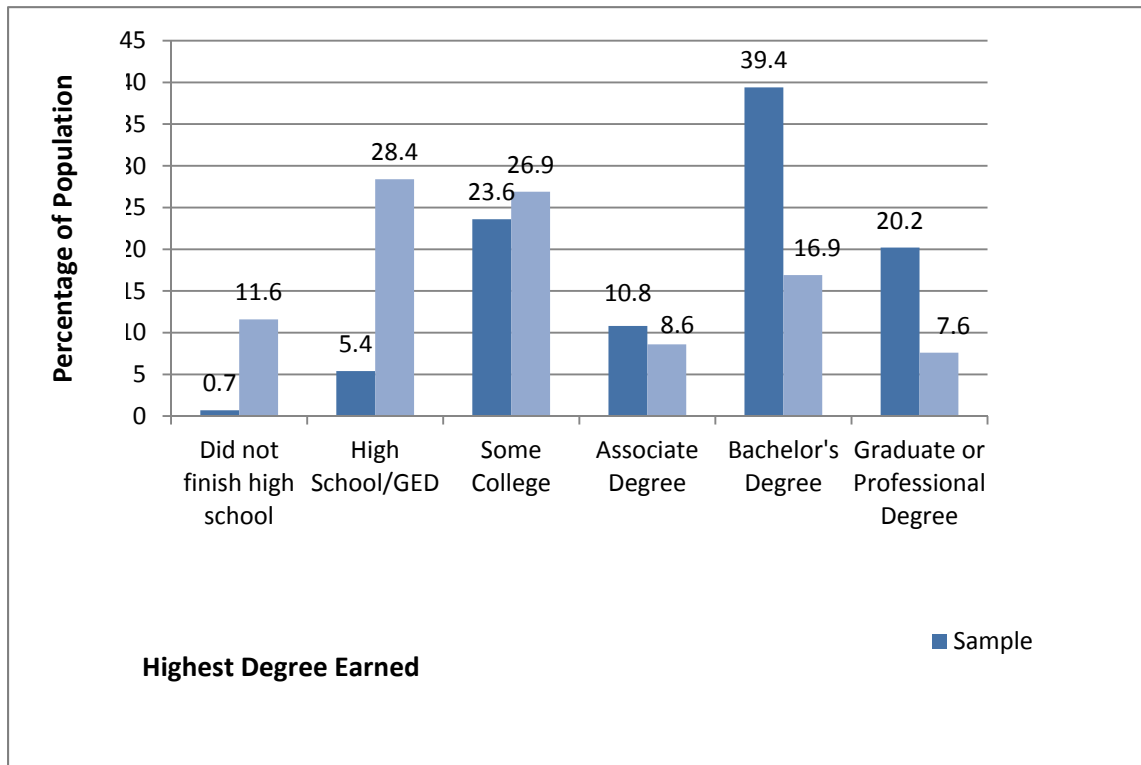
Data from 2010 U.S. Census Bureau (2012).

Table 1 shows the survey sample broken into age groups and Table 2 represents Idaho demographics according to the 2010 Census. It is evident that our survey sample is not representative of the general population. The differences in age ratios may be explained by the unique attributes of the target sample for the purpose of this study. The survey was sent to women who have at least one biological baby who they have breastfed and given a pacifier. The predominant age category included women in their 30s, with 62.2%, as compared to the same population from the Idaho 2010 Census, represented at only 32% of the population between 20-49 years old. The second largest age group of the survey sample included women in their 20s with 31.6%. This percentage is closer to the state percentage of 35% of women in the same category. It may be surmised that the study sample is rationally skewed to favor women of child-bearing age since that is the category the retail store that sent out the survey caters to as a target demographic for sales purposes. The sample of this survey would not be expected to match the general population age group percentages due to the specificity of contributing factors that made up the study sample.

Of the sample, most of the mothers had received at least some college education, with less than 1% who did not finish high school and 6% who completed a high school diploma / GED and did not attend any college. There were 70 (24%) women who had some college, 32 (11%) who acquired an associate degree, 117 (39%) who had a bachelor's degree, 48 (16%) with a master's degree, and 12 (4%) with a doctoral degree.



### Sample vs. State Education



**Figure 1** Idaho state general population (male and female) education levels (n = 1,567,582) compared to education levels of this study's sample participants (n = 302). From U.S. Census Bureau (2012). *American Community Survey*. Washington, DC: Author.

According to the U.S. Census Bureau 2007-2011 American Community Survey (2012), the study's sample (all female) had a higher percentage of individuals who held higher education degrees than the general male and female state population aged 25 years old and higher. Beginning with the associate degree, more mothers surveyed received higher education than the general population with the highest difference shown at the bachelor degree level. There were 23.2 percent more women who had their bachelor degree who took part in the study as compared with the general Idaho

population aged 25 years old and higher. There were 12.6% more graduate/doctoral degree earners in the sample population versus the state statistics. In general, this study appears to not represent the general population for educational purposes due to the higher degree level acquisition.

Mothers in the survey reported having between one and seven biological children. They were instructed to fill the survey out about their youngest biological child. There were 144 or 47.8% women who reported they had one child. Ninety-six mothers (31.9%) had two children, 36 (12%) had three children, 15 (5%) had four children, one mother (.3%) had five children, six (2%) had six children, and three (1%) had seven children. Just fewer than 80% of the mothers indicated they had two children or fewer. Over 91% had three children or fewer. The number of children per family is dramatically right skewed with a median of two children in a range of one to seven children.

The age range of the children for the survey was 6 months to 7 years and 11 months. The median age was 1 year, 6 months old, which reflected a right skew in age. Of the total children, 26% were younger than 1 year old, 70% were younger than 2 years old, 85% were younger than 3 years old, 91% were younger than 4 years old, 95% were under 5, 97% were under 6 years old, 98% were under 7 years old, and there were five children over 7 for the total 100%. The children's young age is attributable to the retail store's target clientele. Mother's Haven carries goods for maternity and post-natal care for mothers, infants, and toddlers. They hold classes and advertise their offerings on

subjects that would be of interest to new or young mothers seeking advice or networking.

To summarize, the mothers included in this study were predominantly in their 20s and 30s with higher education levels and only one or two children in the age range of 6 months to 3 years old. The greatest percentage of subjects was in their 30s. Nearly 60% of the mothers had obtained a bachelor's degree or higher in comparison to the 24.5% in the general male/female population of Idaho. The mothers who answered survey questions have relatively small families with a median of two biological children.

All infants who were born prematurely (before reaching 33 weeks gestation) were taken out of the study in an attempt to eliminate factors that might inappropriately affect results of the relationships examined. The age of the child was related to the length of breastfeeding and pacifier use, thus the very young (6 months or less) were eliminated since this population would not accurately reflect breastfeeding longevity in its entirety. Babies with complicating factors such as syndromes, severe feeding difficulties or developmental disorders were also removed from the sample. There were 22 children left, 7 of whom were indicated to have "complicating factors associated with feeding." Factors listed included colic, reflux, difficulty feeding, tongue tie, jaundice, latching issues, trouble feeding, dairy allergy, torticollis, food aversion when starting solids, and weak suckling. The other 93% of the sample did not report complicating factors associated with feeding.

**Feeding**

Of the 302 mothers whose surveys met inclusion criteria, 276 answered that their child only received food by mouth (see Table 3). Three children had received food through a nasogastric tube and one child had received food through a tube directly into the stomach. Only 83 of the 302 mothers (28%) never gave their child supplemental feedings with a bottle (containing breastmilk and/or formula). This topic was recorded with an ordinal scale translated to a scale of 1 to 5, where 1 = never and 5 = all the time, and a median of 2. Another 26% rarely offered a bottle supplement, 25% did sometimes, 18% often and 5% did all of the time. Similar frequencies were reported in pumping breastmilk to feed with a bottle with an ordinal range from 1 to 5 and a median of 3. Thirty-four percent of the women experienced no difficulties breastfeeding, while 38% experienced little difficulty, 16% experienced moderate difficulty, and 12% had frequent difficulty. The range for difficulty breastfeeding was 1 to 4 with a median of 2.

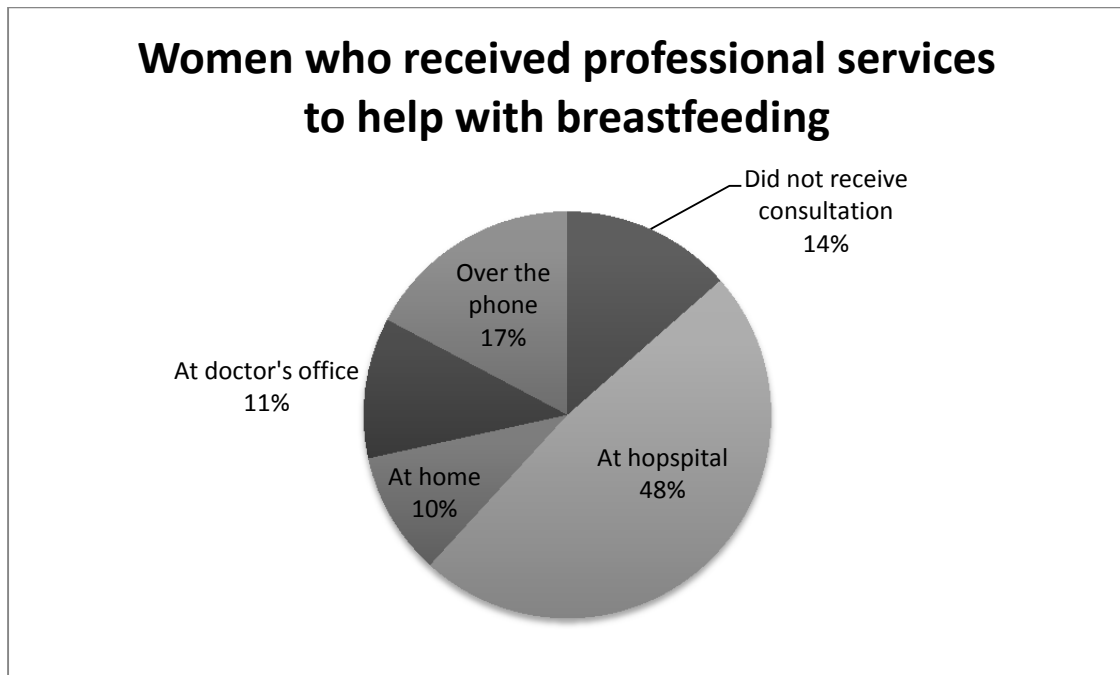
**Table 3***Sample Feeding Habits*

	Did your child have supplemental feedings with a bottle (breastmilk and/or formula)?	Did you pump breastmilk to feed with a bottle?	Did you experience difficulties breastfeeding?
Mean	2.47	2.98	2.07
Median	2.00	3.00	2.00
Minimum	1	1	1
Maximum	5	5	4

Note: Data from this study's survey frequencies.

Two hundred ninety-seven mothers or 98% of the sample answered the survey question regarding receiving professional services to help with breastfeeding (see Figure 2). Only 20% did not receive any services to assist with breastfeeding. The mothers were instructed to check all answers that applied to them. There were 207 who received professional services at the hospital, which equaled 69% of the total sample size. It is possible that this high frequency is secondary to the local hospital, Kootenai Medical Center, being accredited as a Baby Friendly Hospital that offers lactation specialist services in their routine inpatient and outpatient care. Forty-two mothers (14%)

received in-home help from professional services for breastfeeding, 48 (16%) received help at the doctor's office, and 74 (25%) received help over the phone.



**Figure 2** Women from this study (n = 297) who received professional services to help with breastfeeding, categorized into type of service.

### Data Analysis

The hypotheses posed by this study were as follows:

**H1:** Pacifier use intensity will have a negative relationship with breastfeeding exclusivity.

**H2:** Pacifier use intensity will have a negative relationship with breastfeeding longevity.

**H3:** Pacifier use longevity will have a negative relationship with breastfeeding exclusivity.

**H4:** Pacifier use longevity will have a negative relationship with breastfeeding longevity.

See Table 3 for the variables examined during analysis. See Appendix A for a full listing of the survey questions.

**Table 4**

*Hypotheses Variables of Interest*

Variable	Measurement
Breastfeeding Exclusivity	Measured by survey question 9, "Did your child have supplemental feedings with a bottle (breastmilk and/or formula?" This was coded with "1" equal to "never," to "5" equal to "all of the time."
Breastfeeding Longevity	Measured by survey question 13, "How long did you breastfeed altogether (including weaning period when transitioning baby to formula)?" This was coded with "1" equal to "less than 1 month," to "16" equal to "more than 2 years."
Pacifier Intensity	Measured by survey question 17, "During any given day, how much did your baby suck on a pacifier?" This was coded with

Pacifier Longevity	<p>“1” equal to “never,” to “6” equal to “almost all of the time.”</p> <p>Measured by survey question 18, “How old was your child when he/she ended pacifier use?” This was coded with “1” equal to “never used pacifier,” to “20” equal to “over 4 years old,” and “21” equal to “still using pacifier.”</p>
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*Note.* See Appendix A for full list of survey questions with types of responses available to participants in this study.

Table 4 shows results of statistical analysis was accomplished by using a Spearman’s Rank Correlation Coefficient to measure strength and direction of relationships between pacifier longevity and intensity of use with breastfeeding exclusivity and longevity. There were several interesting and statistically significant relationships that occurred not only between pacifier use and breastfeeding habits, but within breastfeeding habits and within pacifier habits, as well as several other factors.



**Table 5***Spearman's Rank Correlation Coefficients*

Variables	Spearman's Rho	Did your child have supplemental feedings with a bottle?	Did you pump breastmilk to feed with a bottle?	How much did your baby suck on a pacifier?	How old was your child when he/she ended pacifier use?	Please enter your age in years.	What is your highest education completed?	How long did you breastfeed altogether?
Did your child have supplemental feedings with a bottle?	Correlation Coefficient	1.0000	.677	.123	.151	.040	.104	-.261
Did you pump breastmilk to feed with a bottle?	Correlation Coefficient	.677	1.000	.160	.232	.030	.190	-.183
How long did you breastfeed altogether?	Correlation Coefficient	-.261	-.183	-.148	-.220	.269	.121	1.000
<b>During any given day, how much did your baby suck on a pacifier?</b>	Correlation Coefficient	<b>.123</b>	.160	1.000	.767	-.074	.046	<b>-.148</b>
<b>How old was your child when he/she ended pacifier use?</b>	Correlation Coefficient	<b>.151</b>	.232	<b>.767</b>	1.000	-.087	<b>.055</b>	<b>-.220</b>
Your age in years.	Correlation Coefficient	.040	.030	-.074	-.087	1.000	.316	.269
Highest education completed?	Correlation Coefficient	.104	.190	.046	.055	.316	1.000	.121

Note: Spearman's Rank Correlation Coefficients were calculated between variables listed in the table matrix. Variables of interest for the hypotheses are in bold.

### **Breastfeeding Exclusivity**

According to Spearman's Rank Correlation Coefficient, there is a weak, yet statistically significant positive correlation between intensity of pacifier use and breastfeeding exclusivity ( $r_s=.123$ ,  $p=.034$ ,  $n=298$ ). This correlation was between the questions, "Did your child have supplemental feedings with a bottle?" and "During any given day, how much did your baby suck on a pacifier?" This relationship indicates that the more a child was bottle-fed, the more the child used a pacifier (pacifier intensity increased). Conversely, the more a mother breastfed her infant, the less the infant used a pacifier (pacifier intensity decreased).

The relationship between pacifier use longevity and breastfeeding exclusivity has a weak, yet statistically significant positive correlation ( $r_s=.151$ ,  $p=.009$ ,  $n=295$ ). The correlation was between the questions, "How old was your child when he/she ended pacifier use?" and "Did your child have supplemental feedings with a bottle (breastmilk and/or formula)?" This indicates that more bottle feeding is directly related to a longer period of sucking on a pacifier. Conversely, the more exclusive the breastfeeding was, the shorter was the pacifier use duration.

### **Breastfeeding Longevity**

A weak negative, yet statistically significant correlation between breastfeeding longevity and pacifier intensity was found ( $r_s=-.148$ ,  $p=.010$ ,  $n=297$ ). The relationship was measured between the questions, "During any given day, how much did your baby suck on a pacifier?" and "How long did you breastfeed altogether (including weaning

period when transitioning baby to formula, pumped milk, and/or solid food?" The direction of the relationship indicates that the more times a child used the pacifier during any given day (pacifier intensity), the younger the child was when the mother and child ended breastfeeding.

The last statistically significant correlation found regarding the hypotheses of the relationship between pacifier use and breastfeeding longevity and exclusivity is that of pacifier use longevity and breastfeeding longevity. A weak negative correlation was found between these two variables ( $r_s = -.220$ ,  $p < .001$ ,  $n = 294$ ). This relationship indicates that the more long-term a child used a pacifier, the younger the child was when he/she stopped breastfeeding. The two variables were measured in regards to the questions, "How long did you breastfeed altogether (including weaning period when transitioning baby to formula, pumped milk, and/or solid food?" and "How old was your child when he/she ended pacifier use?"

In conclusion, the hypothesis of this study was that pacifier use would have a negative relationship with both breastfeeding exclusivity and longevity. The correlations between the variables listed above support the hypotheses. In addition to the pertinent information found regarding the hypotheses' variables relationships, there were other interesting findings and noteworthy correlations from the study.

## Additional Correlations

### *Pacifier intensity and pacifier longevity*

There was a strong positive correlation between pacifier use intensity and pacifier use longevity ( $r_s=.767$ ,  $p<.001$ ,  $n=295$ ). This relationship was measured by the questions, “How old was your child when he/she ended pacifier use?” and “During any given day, how much did your baby suck on a pacifier?” Indicated is that when a child used a pacifier more times per day, the longer it took the child to discontinue pacifier use (measured in increments of months). Similarly, the fewer times a child used the pacifier during a 24-hour period (pacifier use intensity), the more quickly the child stopped pacifier use as measured in months (pacifier use longevity).

### *Breastfeeding exclusivity and breastfeeding longevity*

A weak negative correlation was found between the amount of bottle feeding and breastfeeding longevity ( $r_s=-.261$ ,  $p<.001$ ,  $n=301$ ). This means that with breastfeeding exclusivity came increased breastfeeding longevity. In other words, the more a bottle was used for supplemental feeding, the shorter the time frame was that the mother breastfed altogether. This relationship was measured by questions, “How long did you breastfeed altogether (including weaning period when transitioning baby to formula, pumped milk, and/or solid food?” and “Did your child have supplemental feedings with a bottle (breastmilk and/or formula)?”

### *Breastfeeding longevity and difficulties breastfeeding*

A weak negative correlation was found between breastfeeding longevity and experiencing difficulties breastfeeding ( $r_s=-.290$ ,  $p<.001$ ,  $n=301$ ). This was measured by

the questions, “How long did you breastfeed altogether (including weaning period when transitioning baby to formula, pumped milk, and/or solid food?” and “Did you experience difficulties breastfeeding?” The correlation between these two variables adds construct validity to the study because it is expected that difficulties breastfeeding would be related to a shortened amount of time breastfeeding.

#### *Breastfeeding longevity and age of child*

A confounding factor in this study is that the cut-off age for inclusion of the child’s case history was 6 months and above. This was an attempt to exclude newborns and young infants from the sample who continued to breastfeed and/or use a pacifier. An option to indicate that the child was still breastfeeding was not included in the survey, which complicates the results. It is impossible to know how many mother/child dyads of the sample population are still breastfeeding and/or using a pacifier. A weak to moderate, statistically significant, positive correlation between the child’s age and breastfeeding longevity is consistent with the notion that some mothers were still breastfeeding at the time of the survey ( $r_s=.345$ ,  $p<.001$ ,  $n=301$ ). This relationship was measured by the questions, “How long did you breastfeed altogether (including weaning period when transitioning baby to formula, pumped milk, and/or solid food)?” and the child’s age.

#### *Education level*

The final sample for this study was relatively highly educated in comparison to the state statistics for general population of males and females. This variable lends itself to a few interesting correlations among variables. For instance, a weak positive and

statistically significant correlation was found between higher education and increased breastmilk pumping ( $r_s=.190$ ,  $p<.001$ ,  $n=297$ ). This translates to the higher level of education the mother has obtained, the more she is likely to pump milk to feed by bottle. This relationship of variables may be reflective of the higher educated mother having a higher likelihood of working, therefore needing to pump breastmilk for when she is gone to work. Conversely, the lower the mother's education, the less she is likely to pump; and therefore, could be reflective of non-working mothers who need to pump less milk. This could also be stated in terms of exclusivity, such as the higher the mother's education the lower her breastfeeding exclusivity.

Another interesting characteristic of education is reflected in a weak positive, yet statistically significant correlation between higher education and breastfeeding as long as the mother planned to ( $r_s=.192$ ,  $p<.001$ ,  $n=296$ ). In essence, the higher the woman's education, the more she reported that she breastfed as long as she planned to. A confounding factor for these variables is that one person reported in the comments section that she breastfed longer than she planned to and there was not an option for that on the survey. This information would only minimally affect the results.

A weak positive, yet statistically significant correlation was detected between education and breastfeeding longevity ( $r_s=.121$ ,  $p=.038$ ,  $n=296$ ). These variables indicate that the higher the mother's education, the longer she breastfed. This relationship was measured by the questions, "How long did you breastfeed altogether (including weaning period when transitioning baby to formula, pumped milk, and/or solid food?" and "What is your highest education completed?"

*Breastfeeding exclusivity*

A weak to moderate positive and statistically significant correlation was found between breastfeeding exclusivity and breastfeeding as long as the mother planned to ( $r_s = -.271$ ,  $p = .000$ ,  $n = 301$ ). In other words, the more a baby had supplemental feedings by a bottle (with breastmilk and/or formula), the less mothers reported that they breastfed for as long as they planned to. Conversely, the more mothers breastfed exclusively, the more they met their longevity goal for breastfeeding.

*Breastfeeding longevity*

A weak to moderate positive statistically significant correlation was found between the mother's age and breastfeeding longevity ( $r_s = .269$ ,  $p = .000$ ,  $n = 293$ ). This relationship indicates that the older a mother's age, the longer she breastfed her child. Similarly, the younger a mother was, the shorter amount of time she breastfed her child. This was measured by the questions, "How long did you breastfeed altogether (including weaning period when transitioning baby to formula, pumped milk, and/or solid food?" and "Please enter your age in years."

## Chapter Four: Discussion

The purpose of this study was to assess the hypotheses that pacifier use will have a negative relationship with breastfeeding exclusivity and longevity for infants in Kootenai County, Idaho. For the purpose of more clearly understanding the relationships between pacifier use and breastfeeding variables, pacifier use was further delineated into specific variables: “pacifier intensity” and “pacifier longevity.” During participant sample qualification evaluation for inclusion in the study, pre-term infants born before 33 weeks gestational age were eliminated to prevent extraneous factors such as difficulties feeding secondary to disorders or prenatal/perinatal trauma. The wording of the hypotheses were changed to reflect “relationships” involved with correlation coefficients instead of “effects” of pacifiers on breastfeeding.

**H1:** Pacifier use intensity will have a negative relationship with breastfeeding exclusivity.

**H2:** Pacifier use intensity will have a negative relationship with breastfeeding longevity.

**H3:** Pacifier use longevity will have a negative relationship with breastfeeding exclusivity.

**H4:** Pacifier use longevity will have a negative relationship with breastfeeding longevity.

### Research Findings

All four hypotheses were confirmed by the data analysis conducted on the sample. Each relationship between pacifier use and breastfeeding was weak, yet statistically significant and negative.



**Hypothesis 1:** According to Spearman's Rank Correlation Coefficient, there was a weak, yet statistically significant negative correlation between intensity of pacifier use and breastfeeding exclusivity ( $r_s = -.123$ ,  $p = .034$ ,  $n = 298$ ). This correlation was made between the questions, "Did your child have supplemental feedings with a bottle?" and "During any given day, how much did your baby suck on a pacifier?" This relationship indicated that the more a child was bottle-fed, the more the child used a pacifier (pacifier intensity increased). Conversely, the more a mother breastfed her infant (breastfeeding exclusivity), the less the infant used a pacifier (pacifier intensity decreased).

**Hypothesis 2:** A weak negative, yet statistically significant correlation between breastfeeding longevity and pacifier intensity was found ( $r_s = -.148$ ,  $p = .010$ ,  $n = 297$ ). The relationship was measured between the questions, "During any given day, how much did your baby suck on a pacifier?" and "How long did you breastfeed altogether (including weaning period when transitioning baby to formula, pumped milk, and/or solid food?" The direction of the relationship indicated that the more times a child used the pacifier during any given day (pacifier intensity), the younger the child was when the mother and child ended breastfeeding.

**Hypothesis 3:** The relationship between pacifier use longevity and breastfeeding exclusivity had a weak, yet statistically significant negative correlation ( $r_s = -.151$ ,  $p = .009$ ,  $n = 295$ ). The correlation was made between the questions, "How old was your child when he/she ended pacifier use?" and "Did your child have supplemental feedings with a bottle (breastmilk and/or formula)?" This indicated that with more bottle feeding that

occurred, the longer the child sucked on a pacifier. Conversely, the more exclusive the breastfeeding was, the shorter the pacifier use duration.

**Hypothesis 4:** The last statistically significant correlation found regarding the hypotheses of the relationship between pacifier use and breastfeeding longevity and exclusivity was that of pacifier use longevity and breastfeeding longevity. A weak negative, yet statistically significant correlation was found between these two variables ( $r_s = -.220$ ,  $p < .001$ ,  $n = 294$ ). This relationship indicated that the more long-term a child used a pacifier, the younger the child was when he/she stopped breastfeeding. The two variables were measured in regards to the questions, “How long did you breastfeed altogether (including weaning period when transitioning baby to formula, pumped milk, and/or solid food?”

The findings of this study that intensity/longevity of pacifier use have negative relationships with breastfeeding exclusivity/longevity is consistent with findings in previous research that there is an epidemiological link between pacifier use and breastfeeding (Barros et al., 1995; Ford et al., 1994; Gale & Martyn, 1996; Victora et al., 1993). Increased breastfeeding longevity and exclusivity reduces the risk for respiratory tract infections, otitis media, gastrointestinal tract infections, necrotizing enterocolitis (NEC), sudden infant death syndrome (SIDS), infant mortality, allergic diseases, celiac disease, inflammatory bowel disease, obesity, and diabetes, according to the Policy Statement of American Academy of Pediatrics (AAP) (2012). Breastfeeding also promote overall health with species specific milk, host-resistance factors, immunologic

protection, mother-baby bonding, semi-upright positioning to help eliminate milk entering the middle ear, and decreased intake of air (Arvedson & Brodsky, 2002).

In addition to the benefits of breastfeeding listed above, pacifier use is a possible contributor to development of chronic otitis media in infants (Niemela et al., 2000; Rovers et al., 2008; Uhari et al., 1996), and may have an adverse affect on dentition (Natale & Sexton, 2009; Howard et al., 2003). Both otitis media and malocclusion have the potential to lead to speech and language delays and disorders. Acute otitis media is linked to hearing impairment and delayed speech development (Uhari et al., 1996). Dental malocclusions are closely related to abnormal bone growth and mandible development (American Academy of Pediatric Dentistry, 2013), which may also lead to open bite, tongue thrust, tongue thrust swallow, open mouth posture, and tongue forward posture. These oromyofunctional disorders cause speech and swallowing disorders that are regularly assessed and treated by SLPs. Consequently, research indicates that persistent and continuous pacifier use has potential to lead to hazardous behaviors related to swallow, speech and language development.

In the Howard et al. RCT (2003), 700 infants were studied for their breastfeeding and pacifier use habits. Those who took a pacifier in their first month of life were less likely to be breastfeeding exclusively. Early pacifier use was correlated with shortened breastfeeding time more than late pacifier exposure. In summary, the Howard et al. study (2003) found pacifier use in the neonatal period to be detrimental to both breastfeeding exclusively and overall breastfeeding. Due to conflicting studies of whether pacifiers interfere with breastfeeding attempts, the American Academy of

Pediatrics recommended pacifiers be offered at the age of 1 month, after breastfeeding has been established, and to wean usage in the 2nd half of the infant's 1st year (Natale & Sexton, 2009). Prolonged use, a time defined differently by different sources, may have adverse affects on the infant's breastfeeding, dentition, and risk of otitis media, according to Natale and Sexton's study. Therefore, the American Academy of Pediatrics recommended pacifier use at only nap and bedtime, to be offered at the age of 1 month, after breastfeeding has been established, and to wean usage in the 2<sup>nd</sup> half of the infant's 1<sup>st</sup> year (Natale & Sexton, 1990). As reported in this study, a weak negative relationship was found between intensity of pacifier use and longevity of pacifier use and breastfeeding exclusivity and longevity. According to Victora et al. (1997), the issue of pacifiers' effects on breastfeeding was not whether or not pacifiers contribute to the decline of breastfeeding, but if the mothers would have stopped or decreased breastfeeding regardless of pacifier use. Pacifiers were viewed as possible "markers" of breastfeeding difficulties or a mother's reduced desire to breastfeed (Kramer et al., 2001). Victora et al. suggested that there was a reverse causality in this relationship. In the Victora et al. discussion of their findings (1997), they referred to "nipple confusion" as a contributing factor to decreased instances at the breast among infants who used a pacifier. They cite the different sucking pattern among pacifier users as the culprit for not acquiring oral motor skills necessary for nutritive sucking. In addition, the duration of each breastfeeding time at the breast among pacifier users reportedly may be shorter in their study due to some mothers being less likely to let the infants decide when to stop feeding. This habit reduces the amount of hindmilk (which contains a higher fat

content) to be delivered to the baby, causing the baby to be more hungry and more likely to cry. According to Victora et al., the baby's crying may cause the mothers to introduce formula sooner.

Using correlation coefficients yielded more noteworthy information regarding relationships between several different variables outside of our hypotheses variables, as were reported in the Results section above. Such relationships include:

- A positive correlation between higher educated women with breastfeeding as long as they planned to, increased pumping of breastmilk, and breastfeeding longevity;
- A weak to moderate positive correlation between mother's age and breastfeeding longevity;
- A strong positive correlation between pacifier use intensity and pacifier use longevity;
- A weak negative correlation between bottle feeding and breastfeeding longevity;
- A weak positive correlation between bottle feeding and pacifier intensity of use;
- A weak positive correlation between bottle feeding and longevity of pacifier use;
- A weak to moderate negative correlation between breastfeeding exclusivity and breastfeeding as long as the mother planned to;
- A weak negative correlation between breastfeeding longevity and experiencing difficulties breastfeeding;

Mothers with higher educational degree levels had a positive relationship with breastfeeding as long as they planned to, increased pumping of breastmilk, and breastfeeding longevity. Victora et al. (1997) suggested that women who were educated regarding the benefits of breastfeeding and possible effects of pacifiers on

breastfeeding may be more likely to breastfeed longer and use pacifiers less. The positive correlation between educated mothers and pumping may be secondary to the woman returning to the workforce after having a baby. The sample for this study turned out to be relatively highly educated women who are predominantly in their 30s as compared to the general population of Idaho. It could be supposed that these women have a higher disposable income, as well, since they shop at a retail store that offers name brand merchandise at boutique shop prices. Included in the store merchandise are various pump options with accessories and even class instructions on how to pump effectively. The store offers a variety of classes supporting breastfeeding, including direct contact information and free consultation with certified lactation consultants. Mother's Haven visibly strives to be a support to breastfeeding women, encouraging successful breastfeeding through classes offered, networking with mothers who have breastfed, direct instructional opportunities with lactation consultants, and merchandise that troubleshoots any issues that may arise. It is possible that the typical clientele of the retail shop includes mothers who are more educated on breastfeeding best practices with more support to troubleshoot issues that arise than the typical state population.

The fact that the local hospital (located less than 1 mile from Mother's Haven) is part of the Baby Friendly Hospital Initiative adds to Kootenai County, Idaho mothers having a predisposition to being educated on the effects of pacifiers on successfulness of breastfeeding. Discouraging pacifiers was listed in the Ten Steps to Successful Breastfeeding and is used in the Baby Friendly Hospital Initiative – a worldwide program

to promote breastfeeding (World Health Organization; United Nations Children's Fund, 1990). According to the Ten Steps to Successful Breastfeeding (UNICEF, 2013), Baby Friendly Hospital staff are instructed to actively discourage pacifier use and to provide breastfeeding education through lactation consultation and support during the hospital stay. Other steps included in the Baby Friendly Hospital Initiative include rooming-in (baby and mother are allowed to stay in the same room together 24 hours per day), educating mothers on the benefits of breastfeeding, helping mothers to establish their first nursing encounter within 30 minutes post-delivery, providing instruction to mothers and helping them succeed with lactation despite any separation from baby, giving infants no alternative food/drink other than breastmilk unless medically necessary, encouraging feeding on demand, offering no artificial nipples (such as bottles or pacifiers) to breastfeeding infants, and fostering the development of breastfeeding support groups to refer women to upon discharge from the hospital. A hospital that is accredited as a Baby Friendly Hospital must have a breastfeeding policy in place that all staff are made aware of and trained on for effective implementation.

A strong positive correlation between pacifier use intensity and pacifier use longevity supports the notion that the more a pacifier is used throughout the day (versus just sleep times), the greater the likelihood that it will transition into an emotional attachment figure which may be more difficult for mothers to discontinue. Natale and Sexton (2009) cite benefits of pacifier use to include soothing effects, pain relief, shorter hospital stays of preterm infants, and a reduction of risk for SIDS. They also recommend weaning usage of pacifiers in the 2<sup>nd</sup> half of the infant's 1<sup>st</sup> year. Their

research states that pacifier use shouldn't be discouraged but the risks begin to outweigh benefits between 6 to 10 months of age, with a risk increase at 2 years of age. The more a pacifier is used during the day, the longer it is used over time (measured in months and years). Conversely, the less a pacifier is used during the day, the less amount of time it is used (in months and years).

Confounding factors to the above relationship are the correlations between bottle feeding, pacifier use, and breastfeeding longevity. The more that a baby received bottle feedings in this study, the higher intensity and longevity of pacifier use was reported. Consequently, the more a bottle was offered, the shorter breastfeeding longevity was reported. This intertwined relationship has clear implications. With increased bottle feeding and pacifier use comes shortened breastfeeding longevity. The authors of the Victora et al. randomized control trial (1997) found that pacifier users had less time and fewer instances at the breast, which may reduce the child's caloric and fat intake because he or she is missing the hindmilk. They also found that interruptions in breastfeeding, such as bottle feeding, may fuel the need for a more intense pacifier suck that meets the infant's oral stimulation and comfort needs. Information collected in their Brazilian study suggested that mothers who were knowledgeable of pacifiers' effect on breastfeeding were more likely to breastfeed longer and use pacifiers less frequently. They concluded that mothers who seem uncomfortable breastfeeding are susceptible to pacifiers, which contributes to early weaning, whereas mothers who are comfortable are not affected by the use of pacifiers. These findings provide support for the notion that mothers who are more



knowledgeable, educated on, and supported in successful breastfeeding as well as the effects of pacifiers on breastfeeding are more likely to breastfeed longer.

The last few noteworthy relationships reported on in this study were the negative correlation between breastfeeding exclusivity and breastfeeding as long as the mother planned to; and a negative correlation between breastfeeding longevity and experiencing difficulties breastfeeding. Mothers who used bottles more did not breastfeed as long as they planned to. The bottle feeding variable could have also contributed to increased pacifier use, which together resulted in not meeting their goal for breastfeeding longevity. Also, mothers who had difficulties breastfeeding had a shortened amount of breastfeeding time altogether. This relationship supports sound construct validity for the study in that we would expect this relationship between difficulty breastfeeding and reduced longevity of breastfeeding. Other factors that are possible at play here include increased supplemental bottle use and increased pacifier use while experiencing difficulties breastfeeding.

### **Summary and Conclusions**

The results of this study concluded that there are several weak, yet statistically significant correlations between intensity/longevity of pacifier use and breastfeeding exclusivity/longevity. Several other indicators have been identified in support of the direction of these relationships and in synchrony with other factors to reflect further negative relationships between pacifier use and breastfeeding. Pacifier use has been linked by several studies in the past to be associated with increased otitis media and

respiratory infections; dental malocclusions and oromyofunctional disorders; and tongue thrust and tongue thrust swallow (Howard et al., 2003; Natale & Sexton, 2009; Niemela et al., 2000; Rovers et al., 2008; Uhari et al., 1996). In contrast, increased breastfeeding exclusivity and longevity supports reduced risk for respiratory tract infections, otitis media, gastrointestinal tract infections, mother-baby bonding, semi-upright positioning to help eliminate milk entering the middle ear, decreased air intake, and normal swallow development (American Academy of Pediatrics, 2012; Arvedson & Brodsky, 2002; Flipsen et al., 2009).

Consequently, it is believed that increased education and support on successful breastfeeding habits helps mothers to increase breastfeeding exclusivity and longevity, thereby avoiding the heightened risks associated with speech, language, and swallow development. Increased education is needed to forewarn mothers of the negative relationships pacifier use has with breastfeeding. It would be beneficial for hospitals to increase education initiatives around recommended pacifier use. Appropriate pacifier education should follow the AAP guidelines of waiting until after the 1<sup>st</sup> month of life to introduce the pacifier, to only give the infant a pacifier at sleep times, and to wean pacifier use between 6 to 10 months to avoid evidenced risks associated with prolonged pacifier use and decreased breastfeeding exclusivity/longevity. Said risks include acute otitis media, dental malocclusions, oromyofunctional disorders, respiratory tract infections, gastrointestinal tract infections, NEC, SIDS, infant mortality, allergic diseases, celiac disease, inflammatory bowel disease, obesity, and diabetes. Recommendation to

not use pacifiers at all should be guarded with understanding that each mother and baby's experience is unique and should be evaluated on an individual basis.

Pre-term infants were not included in this study because they tend to have an additional set of developmental issues that exceeds the scope of examination for the purpose of this study. Pre-term cases should be treated with a different approach.

### **Limitations**

The sample base attained for this study differs from the general state population. There is a higher incidence of highly educated mothers in their 30s, with only one mother under the age of 20. Several factors may explain this skew in demographics, such as the maternity store's select merchandising, target demographic for sales, class offerings, and price point for merchandise. Subsequently, the sample attained for this sample is not a good representation of mothers state-wide or nationally. The mothers in Kootenai County have a higher chance of receiving high levels of breastfeeding education and support from professional services since the county hospital is a Baby Friendly Hospital and the retail store that distributed the survey for this study provides various avenues of support for mothers breastfeeding. Support options include personal recommendations in-store during visits from store staff, certified lactation consultant class offerings, breastfeeding support groups, breastfeeding basics classes, networking classes for breastfeeding mothers, support materials and merchandise for breastfeeding, and direct contact provided to professional breastfeeding support services.

## Future Research

This study was consistent with previous research that linked increased pacifier use to decreased breastfeeding. The Victora et al. (1997) study that was the original inspiration for this study was conducted in Brazil, where socioeconomic and cultural differences exist. It would be beneficial to compare the survey used in this study (Appendix A) with more populations both in the United States and worldwide to determine how different variables affect breastfeeding habits. This is a beneficial topic for speech language pathology studies in addition to other areas of interest to examine strategies to recommend as the best practices for optimal infant development. The areas of infant development to be examined include optimal practices to avoid chronic and acute otitis media which may lead to language and speech delays; dental malocclusions and abnormal facial growth related to oromyofunctional, articulation, and swallow disorders; and shortened breastfeeding exclusivity / longevity as it relates to healthy swallow function, mother-infant bonding, and prevention of otitis media. It is recommended that if the survey provided in this study is used again, a question should be added to determine if the mother is still breastfeeding. This information would be useful to further delineate relationships and to make clearer distinctions between groups analyzed.

A more specific population to analyze would be pre-term infants or those born before 33 weeks. This population has different needs associated with sucking, swallowing, overall health, and bonding. It is a difficult population to assess because there are so many confounding variables that are introduced secondary to infant

development, such as disorders, prenatal and perinatal trauma, syndromes, etc.

However, this population is of great interest to SLPs as the area of pediatric swallowing disorders is currently experiencing rapid growth and development in our field and scope of practice. Information derived from pre-term infant data would be valuable in assessing and treating infants seen in NICU and infant feeding therapy with specific developmental disorders.

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## Appendix A

1. Thank you for your willingness to participate in this study. The purpose of the study is to describe the effects of pacifier use on breastfeeding. Participation is completely voluntary and anonymous. Participants may choose to be entered to win a \$50 gift certificate to Mother's Haven by typing in your email address in the space provided. Please fill out the survey regarding your youngest child.

2. Please enter your email address if you would like to enter the drawing for a \$50 gift certificate to Mother's Haven in Coeur d'Alene, ID. After your email address is entered into the drawing, this information will be stripped from your data so your anonymity will be protected.

3. How old is the child you are answering this survey about, in years and months  
(Example: 2 years, 3 months; or 9 months)?

Years

Months

4. How many biological children do you have?

5. What birth order is the child for whom you are answering this survey?



First Born / Only Child



2nd Born



3rd Born



4th Born

☐ 5th Born

☐ More than 5th Born

6. Was your child born premature (before reaching 33 weeks gestation)?

☐ Yes

☐ No

7. Did your child have any complicating factors associated with feeding, such as syndromes, developmental disorder, abnormal delivery, cleft lip/palate, troubles swallowing and/or feeding, muscle weakness related to swallowing, congenital heart defects, etc.?

☐ Yes

☐ No

7b. Please list complicating factors associated with feeding, such as syndromes, developmental disorder, abnormal delivery, cleft lip/palate, troubles swallowing and/or feeding, muscle weakness related to swallowing, congenital heart defects, etc.

8. Did your child have alternative feedings that were not by mouth? Please check all that apply.

☐

My child only received food

☐

Tube from esophagus

- |                          |                             |                          |                                    |
|--------------------------|-----------------------------|--------------------------|------------------------------------|
|                          | by mouth                    |                          | to stomach                         |
| <input type="checkbox"/> | Tube from nose to stomach   | <input type="checkbox"/> | Tube directly into stomach         |
| <input type="checkbox"/> | Tube from throat to stomach | <input type="checkbox"/> | Tube directly into small intestine |

9. Did your child have supplemental feedings with a bottle (breastmilk and/or formula)?

- ☐ Never
- ☐ Rarely
- ☐ Sometimes
- ☐ Often
- ☐ All of the time

10. Did you pump breastmilk to feed with a bottle?

- ☐ Never
- ☐ Rarely
- ☐ Sometimes
- ☐ Often
- ☐ Always

11. Did you experience difficulties breastfeeding?

- ☐ None



- ☐ Little difficulty
- ☐ Moderate difficulty
- ☐ Frequent difficulty

12. Did you receive professional services by someone to help you with breastfeeding?

Check all that apply.

- ☐ Did not receive any consultation
- ☐ At hospital
- ☐ At my home
- ☐ At doctor's office
- ☐ Over the phone

13. How long did you breastfeed altogether (including weaning period when transitioning baby to formula, pumped milk, and/or solid food)? Please choose the answer closest to your actual length of breastfeeding.

14. Did you breastfeed as long as you planned to?

- ☐ Yes
- ☐ Almost as long as I planned to
- ☐ No

15. Was your child ever offered a pacifier?

- ☐ Yes

☐ No

16. When was the pacifier first offered?

17. During any given day, how much did your baby suck on a pacifier?

☐ Never accepted pacifier

☐ Rarely accepted pacifier

☐ Only during naps and night sleep

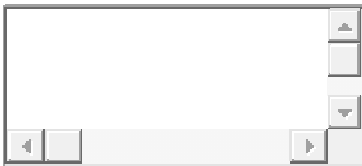
☐ Part-time during daytime only

☐ Part-time during day and night

☐ Almost all of the time.

18. How old was your child when he/she ended pacifier use?

19. Please enter any other information you would like to share about your experience with bottles, breastfeeding, or pacifier use in the box below.



20. Please enter your age in years (example: 18, 24, 33, 45)

22. What is your highest education completed?

## Appendix B



### Survey of Mothers Who Have Breastfed

Please click this survey link to participate in a local study if you are a mother who has breastfed your child. The study is being conducted by Lauren Tandy, Speech-Language Pathology graduate student at Idaho State University. The purpose of this study is to compare effects of pacifier use on breastfeeding.

Participation is completely voluntary and anonymous. No identifying information will be requested. You may choose to be entered to win a \$50 gift certificate to Mother's Haven by typing in your email address in the space provided in the survey. Email addresses will then be separated from survey responses to protect your anonymity. The survey will take less than 10 minutes to complete.

Thank you.

**Click Here to  
Take the Survey!**