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Colic in Infancy as an Indicator of Subsequent Sensory Processing Development

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COLIC IN INFANCY AS AN INDICATOR OF SUBSEQUENT SENSORY PROCESSING
DEVELOPMENT

COLIC IN INFANCY AS AN INDICATOR OF SUBSEQUENT SENSORY PROCESSING
DEVELOPMENT

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science in Human Environmental Sciences

By

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ABSTRACT

This paper attempted to find a link between infantile colic and subsequent sensory processing development. Literature research turned up very few studies linking colic with later development of sensory processing disorder. Ten hypotheses, based on literature research, linked colic in the first year with later indications of sensory processing disorder, whether formally diagnosed or anecdotally reported. None of the 10 hypotheses were proven.

This thesis is approved for recommendation
to the Graduate Council.

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DEDICATION

I dedicate this project to all of my parents for all of their love, support, and guidance and for believing I could finish this project.

I would like to dedicate this to my little sister who cried for the first 2 years of her life and inspired this project and my little brother for being the inspiration for me to change directions and follow a new path. If I could choose siblings I would pick you two!

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TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	LITERATURE REVIEW	2
	A. Colic	2
	B. Sensory Integration Disorder	6
	C. Correlation between Colic and Sensory Integration Disorder	9
	D. Theoretical Approach	11
III.	METHODS	13
	A. Participants	13
	B. Data Collection Procedure	14
	C. Hypotheses	15
IV.	RESULTS	17
	A. Statistical Analysis	17
	B. Hypotheses	17
V.	DISCUSSION	21
VI.	REFERENCES	22
VII.	APPENDIXES	24
	A. INFORMED CONSENT	24
	B. SURVEY INSTRUMENT	26
	C. DATA TABLES	40

I. INTRODUCTION

Statement of the problem

Researchers have tried for years to find the causes of colic in infancy (Groopman, 2007). Groopman stated that “as many as 20% of American and European infants are thought to suffer from” colic (para. 6). Groopman stated that “the sound of a crying baby ... is just about the most disturbing, demanding, shattering noise we can hear” (para 6). This problem can leave families feeling desperate for some relief (2007). Dealing with colic causes many emotions in parents such as guilt, depression, and severe stress and fatigue (Rautava, Lehtonen, Helniues, & Sillanpää, 1995).

As researchers have struggled to identify the cause of colic, another type of disorder, sensory processing disorder, has come to the forefront of our attention. These disorders run the gamut between mild sensory integration issues to severe disorders. Sensory processing disorder was initially written about by an occupational therapist, Dr. A. Jean Ayres in the 1950s. By the 1970s, this disorder was designated as a “unique clinical category” (Byrne, 2008, p. 315). This study attempted to find a link between colic in infancy and later diagnosis with sensory processing disorders. Evidence of such a link could be used to help parents cope with and prepare for both conditions.

II. Literature Review

Colic

A brief definition of colic is based on the “rule of three” (Roberts, Ostapchuk, & O’Brien, 2004). If an infant who is otherwise healthy, cries for at least three hours per day for more than three days per week and this behavior continues for more than three weeks, then the child may be diagnosed with colic. Other researchers (Barr, 1995; Miller-Lancar, Bigsby, High Wallach & Lester 2004; De Santis, Coster, Bigsby, & Lester, 2004) also included fussiness and irritability in their definition of colic. Miller-Lancar, et al. note that some pediatric textbooks once attributed excessive crying and feeding difficulties typically associated with colic to under-developed gastro-intestinal tracts (2004). This excessive crying usually started around the third week of the infant’s life and quite often disappeared by the third or fourth month (Barr, 1995). Barr noted that although there are many definitions of colic, if we focus on finding a common definition to adhere to, we may miss the “depth and breadth” of the problem (p. 220).

Infants with colic typically cry mostly in the late afternoon or early evening hours. One study found that the mean amount of crying per day was 285 minutes per day or 4.75 hours for infants with severe colic, and for moderate colic it was 206 minutes, about 3.5 hours (Räihä, Lehtonen, Huhtala, Saleva, & Korvenranta, 2002). The control group time crying time was only 49 minutes.

A red, flushed face, furled eyebrows, and clenched fists are commonly seen in colicky infants. Frequently, the infants pull their legs up to their abdomens (Roberts et al., 2004). When crying sounds “painful” and the infant is inconsolable, the situation becomes an ordeal for the entire family (Long & Johnson, 2000). It has been reported that 90% of shaken-baby syndrome incidents occur because the infant was crying (Groopman, 2007). The sounds of infants crying

have purportedly been used as an instrument of torture by the United States Military (Groopman, 2007).

A 1995 study by Riih , Lehtonen, and Korvenranta noted that there are typically three causes of colic: feeding difficulties, extrinsic psychosocial factors, or intrinsic infant behaviors. The extrinsic factors include maternal anxiety, inappropriate handling, and mother-child attachment difficulties. These researchers defined colic by the rule of threes; which is a means of determining if excessive crying can be categorized as colic. If parents report their infant cries for more than 3 hours per day, for more than 3 days per week, for more than 3 weeks, then a diagnosis of colic can be made. In this study they concluded that although food allergies were often cited as a cause of colic, the evidence of such a link was inconclusive. However, evidence does support the tie between colic and behavioral problems related to inadequate attachment (Riih  et al., 1995). Furthermore, “mother’s psychosomatic stress symptoms during pregnancy, parents’ dissatisfaction with their sexual relationship, and parents’ negative emotions during birth have been found to be related to the development of infantile colic in some studies” (Riih  et al., 1995, p. 208).

In another study (2002), Riih  and her colleagues looked at the relationships between mothers and infants, between fathers and infants, and between the mothers and fathers. Overall, this study found that parents of colicky infants had less than optimal interactions with their infants, particularly between the fathers and the infants. This may be due to the fact that the fathers lacked experience with a happy, content infant. Raiha et al. also found that the infants’ behavior during interactions with their fathers predicted the fathers’ behavior, and mothers of severe-colic infants had less meaningful communication and were less connected to their infants. Again a lack of positive feedback may contribute to the problem. In conclusion, they noted that

there were less than optimal interactions in families with excessively crying infants (Räihä et al., 2002).

A study done in the Netherlands (Zwart, Vellema-Goud, & Brand, 2007) with 104 colicky infants found that most children admitted to the hospital for excessive crying had normal crying behaviors while in the hospital. In fact, there were no medical causes of crying found in any of the study participants. The highest risk factor they found for excessive crying was a complicated pregnancy or birthing process. These researchers concluded that these parents may simply have a predisposition to be “hyper-responsive” to their “hyper-sensitive” infant’s crying (Zwart et al., 2007).

A relationship has been reported in the literature between colic and feeding disorders (Miller-Lancar et al. 2004) and colic and motor issues (Crepeau-Hobson 2009). In their 2004 study, Miller-Lancar et al., looked at the incidence of feeding difficulties in infants with colic compared to a control group of infants who were not diagnosed with colic. They found clear indication of four different types of feeding difficulties in colicky infants. They found that the infants in the colic group had problems with reflux, sucking, swallowing and breathing, as well as demonstrating less responsiveness to mothers during feeding and more parent-reported feeding discomfort (Miller-Lancar et al., 2004). They also noted, feeding difficulties can be related to overall motor skill deficiencies. The authors state this correlation “suggests the potential for ongoing regulatory problems” (p. 908) for colicky infants. Crepeau-Hobson (2009) noted that “feeding problems in infants are often related to sensory defensiveness” (p. 324).

A 2002 study (Neu & Keefe) looked at mothers’ views of the characteristics of school-aged children who had colic as infants as well as the characteristics of a control group of mothers whose children did not have colic. Within the study population, infants had been diagnosed with colic by

parents and medical professionals following the “rule of threes.” Mothers were interviewed by the researchers and asked to answer open ended questions about their children’s behavior and personality traits. Most children were described as being “independent/self-reliant... highly active...emotionally labile/intense” (Neu & Keefe, p. 28). However, researchers found differences within those categories between children who had colic and the control group children. Colicky children were found to be intense about their traits. For example, a child was described as independent by her parent, who emphasized, “She’s bound and determined she’s going to do it” (Neu & Keefe, p. 28). Children who were not colicky were independent but more able to compromise. Colicky children were described as “rough and vigorous” (Neu & Keefe, p.29) in their activities, as compared to siblings without colic. The children without colic were active but were also more likely to relax for a while after activities. Colicky children were considered “intense,” “explosive,” and more likely to have temper-tantrums (Neu & Keefe, p. 29).

Savino et al. conducted a 10 year prospective study of infants with severe colic which found that colic may be the “early expression of some of the most common disorders in childhood” (2005, p. 129) and suggested that colic may be the “synergistic interaction between biological and behavioral factors” (p. 129). This study followed up on 96 infants who had enrolled in the study from January 1991 through December 1993. Fifty two of the infants were found to be severely colicky and were hospitalized for what the authors described as “full force crying with no apparent reason several times a day” for more than 4 hours each day for more than 4 weeks with no response to consolation techniques (2005, p.130). These infants were compared to infants who were hospitalized for disorders unrelated to colic, although none of these children had chronic or severe illnesses (Savino et al., 2005). The authors studied the patients 10 years later, looking for various physical and psychological disorders. In terms of physical health issues, the study found

that many of the colicky patients later had recurrent abdominal pain and allergic rhinitis. They also found that 56% of the children with colic later had sleep disorders versus 12.5% of non-colicky children and that 41.67% of the colicky children were aggressive versus 6.20% of non-colicky children. These findings seemed to confirm the hypothesis that colic may be related to subsequently diagnosed childhood disorders (Savino et al., 2005).

Sensory Integration Disorder

The sensory integration process begins in utero with the development of various sensory systems. The vestibular system is controlled by the inner ear and its response to the body's movements and to gravity. The proprioceptive system gets input from muscles and joints. Sensory processing difficulties are reported to be easier to diagnose when children reach preschool age (DeSantis et al., 2004), largely because all children, whether they are developing typically or not, are challenged to order their sensory input as infants and toddlers.

Crepeau-Hobson (2009) noted that in defining sensory integration disorder or dysfunction, the term sensory integration refers to "the theory, the disorder, and an intervention" (p. 315). So, sensory processing disorder essentially is the result of sensory integration dysfunction (2009). He also noted that this disorder is often noticed in children who have various other developmental diagnoses, such as attention deficit disorder. This makes it difficult to determine if the deficits in sensory processing are really due to sensory integration disorder or just manifested because of the other disorder (Crepeau-Hobson, 2009).

In this study (Crepeau-Hobson, 2009) he was looking at the association between various perinatal risk factors and later sensory processing development/dysfunction. He defined the perinatal period as beginning at the 12th week of gestation and ending at the 28th day of post-birth life. This is the time frame for much brain and therefore sensory development. He explained that

the cerebral cortex, one part of the brain “mediates sensory arousal and motor functions” (Crepeau-Hobson, 2009, p. 316). He theorized that harm to the brain during this time frame would likely impact later ability to process sensory and other types of input.

The study (Crepeau-Hobson, 2009) found that specific types of sensory processing issues were related to specific types of risks. Specifically, “psycho-social events, maternal weight gain, teratogenic stress, fetal oxygenation, and intrauterine stress” (Crepeau-Hobson, p. 324) were found to relate to later difficulties in “movement, visual/auditory, tactile and taste sensitivity, low energy and under-responsiveness” (p. 324). In conclusion, he reported that when a child is proposed to have sensory processing difficulties, it is important to look at the perinatal period of development and assess for risk factors. This information could also aid in early intervention and perhaps prevention of certain types of processing difficulties (Crepeau-Hobson, 2009).

Children who are diagnosed with sensory integration disorder have problems sifting through all the impulses received by their nervous systems (Yisreal, 2004). They become “over-stimulated” and don’t interact effectively with the world around them (Yisreal, 2004). However, as Greenspan pointed out (2004), sensory deprived people may also be under-sensitive. Yisreal (2004) concurred that children could be over-stimulated for part of a day and under-stimulated for part of the day. Examples of under-sensitivity include not hearing voices or falling down and not feeling anything.

There are some primary symptoms of sensory processing disorder, but not everyone has the same symptoms. The following is a list of symptoms of sensory disordered children:

Avoiding touch, over-reacting to touch, inability to identify objects by touch, spinning, hand-flapping, head banging, biting, poor eye contact, short attention span, distractibility, hyperactivity, lack of physical coordination, clumsiness and lack of balance, fear of

movement, avoids motor play, dislikes change, outbursts, difficulty using both sides of the body, repetitive speech, slow speech, slow moving, difficulty with coping, emotionally immature, lacks coping skills, behavior problems, lacks body image and awareness, difficulty relating to peers, learning or academic problems, raised shoulders, poor fine motor control, poor gross motor skills, poor handwriting, fear and anxiety in new situations, objecting to change, ritualistic behavior (Yisreal, 2004, para. 5).

Yisreal also listed some signs of sensory over-stimulation to look for: “sweating, thirst, sleepiness, pale face, flushed face, rapid respiration and heart rate, slow respiration and heart rate, loss of bowel or bladder control, over activity, under activity” (2004, para. 9).

This disorder is reported to trigger an infant’s emotional distress which could be exhibited by crying and fussing. It’s possible this is caused by the infant’s nervous system’s inability to process internal and external sensations. Such a child can be easily overwhelmed (DeSantis, 2004).

There are many developmental areas that are affected by sensory integration: fine and gross motor skills, balance, emotional stability and attention span (Yisreal, 2004). As with many disorders, therapy may help children who have sensory integration disorder. In this case, therapy is usually performed by occupational therapists, who select activities to stimulate the over or under responsive areas. Care must be taken by both therapists and parents to avoid over-stimulating the senses. Within this study, some parents reported that therapy has made a big difference in their child (Yisreal, 2004).

In a 2004 neurologist’s newsletter report, Brock and Eide noted that 52% of their past 50 consecutive patients at their learning disorders clinic had severe enough difficulties processing sensory inputs that it interfered with their learning. They noted that in 30 children who were

younger than 10 years of age, 70% had sensory processing disorders versus only 20% of children over the age of 10 (Eide, 2004).

A 2007 study (Ben-Sasson, Cermack, & Orsmond) found many similarities between sensory processing disorder and anxiety in toddlers. This study found that psychologists were more likely to diagnose specific behaviors as anxiety related. In conclusion, they found that toddlers whose fears were nonphysical were more likely to be diagnosed with anxiety disorders (2007).

However, the authors acknowledged that sensory processing disorder and anxiety disorders can be difficult to diagnose in toddlers because toddlers lack the ability to describe their feelings, emotions, and sensations.

Correlation between Colic and Sensory Integration Disorder

Desantis et al., (2004) found a correlation between colicky/fussy infants and a later diagnosis of sensory processing disorder in their study of 28 infants. There were 28 families who participated in this study, most recruited from families who attended a colic clinic at Women and Children's Hospital between 1991 and 1997. Mothers completed questionnaires and were given a small incentive for doing so. Questionnaires including parental permission forms were also sent to the teachers of the participants when those children reached school-age. Researchers also looked at cry-diary information and medical history through hospital medical chart review (2004).

The DeSantis et al. study (2004) attempted to answer 3 questions: (1) Is there a relationship between excessive infant crying/fussing at 4-12 weeks and sensory-processing abilities, coping skills, and behavioral/attention regulation at 3 to 8 years of age? (2) Do children with early crying and fussing that persists past 22 weeks demonstrate decreased sensory processing abilities and more coping difficulties at 3 to 8 years of age in comparisons to crying/fussing that ended

prior to 22 weeks of age?, and (3) Are there differences between infants who had low versus high hours of early crying and fussing on measures of sensory processing, coping and behavior/attention regulation at 3 to 8 years of age? (p. 526-527).

The data (Desantis et al., 2004) showed that 75% of the sample “demonstrated atypical behavioral responses to sensory experiences” (p. 522). They operationalized the sensory disordered infant’s nervous system as “inefficient in coordinating internal and external sensations” (p. 524). In comparing the relationship between colicky/fussy infants and their subsequent sensory processing abilities between the ages of 3 and 8, Desantis et al. found that infants who had the most hours of fussing were less efficient at sensory processing later in life. In addition, babies who began fussing at the earliest ages were most likely to develop sensory processing difficulties, such as hyperactivity. The researchers theorized that early onset of colic might signal innate sensitivities in some infants. The infant’s inefficient, hyper-sensitive nervous system’s inability to process stimuli may lead to excessive crying. If an infant is not able to self-regulate and therefore cannot maintain homeostasis, then the infant would likely exhibit feeding and sleeping difficulties, two things commonly thought to connect to colic. If a parent of a colicky baby follows natural instincts and spends more time trying to calm or soothe a fussy baby who can’t regulate sensory input, the added stimuli from the parent may actually cause the baby more distress (2004).

In conclusion, this study (DeSantis et al., 2004) found that 75% of participants exhibited some “degree of atypical sensory processing” (p. 533). High hours of simply fussing were more related to deficient sensory processing skills than were high hours of crying (2004). The two highest correlations were found between “hours of fussing and Emotional Reactivity and Inattention/Distractibility on the Sensory Profile” (p. 533). The researchers concluded that

“emotional distress can be precipitated by overstimulation to sensory stimuli, an inability of the child to regulate behaviors when presented with external sensations and/or a caregiver who may unknowingly overwhelm rather than support the child” (p. 533). DeSantis et al. concluded by stating, “If sensory difficulties are identified early, parents can learn specifically tailored strategies to enhance infant sensory and regulatory capacities as they influence the dynamic parent-child relationship during the formative years” (p. 536).

Theoretical Approach

Vygotsky (Lamb, Bronstein, & Teti, 2002) is best known for his concepts of the zone of proximal development (ZPD) and the more knowledgeable other (MKO). Vygotsky believed that the internalization of these tools led to higher thinking skills. These theories state that learners do better when presented with tasks at the right time during their development. An infant could be presented a task and be partially successful on his own without guidance from a more knowledgeable other or could be guided by his parent. He also noted that more knowledgeable others could be peers. He concluded “the more advanced or expert partner (e.g., the mother) raises the level of performance of the less advanced or expert partner (the infant) through social interaction” (Lamb, Bronstein, et al. 2002, p. 243). A sensory overloaded infant could take longer to reach the zone of proximal development.

Vygotsky stated that there are 2 types of reactions to the world around us, inherited and acquired. These reactions are actually behaviors. He further breaks them down into 2 categories, reflexes and instincts (1997). Some can be changed at will and others cannot. Reflexes are innate, present from birth, involuntary and largely related to some biological need or stimulus. Reflexes such, as crying, breathing, coughing, do not change throughout a person’s life no matter the environmental influences. People later in life can control some reflexes. In the extreme there are people who can control their heart rate, perspiration, etc. The majority of people just have

minimal control over reflexes. Babies cry as a means to get biological needs met. It seems that colicky infants continue to cry after needs have been met.

Another example Vygotsky offered: people reflexively close their eyes to protect them. This may explain why bright lights affect some babies; some may have lower tolerance for brightness than others. In this way, a child could control his blinking later in life to decrease the amount of light let into the eye. Later in life, those children may have a bit more control over blinking.

Vygotsky also believed that social interactions (intra-personal) preceded inter-personal interactions. Even babies learn from those around them who are more knowledgeable than they. Vygotsky's believed that intra-personal actions preceded inter-personal. He taught interpersonal interactions are crucial for cognitive development; explaining that, initially tools like speech and writing are developed to aid social functioning.

III. METHODS

Participants

The participants in this study were the parents of children enrolled in a Northwest Arkansas child care center and parents of children enrolled in a Northwest Arkansas public school. IRB approved this research project and gave the approval number 10-04-598. After approval was obtained, parents were given a 50-question survey booklet, which included an informed consent form (see Appendix A). A small beta group consisting of various professionals and one set of parents were given the survey to review before it was passed out to the larger group of participants.

Participant rights and confidentiality were protected by coding the surveys, then separating the informed consent form from the survey. At the end of this study the completed survey booklets will be shredded.

Design of Research Instrument

The researcher designed the survey based upon a review of available literature. The literature review revealed numerous documents regarding both colic and sensory processing disorder. The questions related to each symptoms of each disorder were based on this research.

The survey was divided into sections. The first few questions were demographical. The next set of questions was designated to determine whether or not a child had colic. Parents were directed to certain questions based on whether or not colic was diagnosed by a physician or was just suspected by the parent.

If the participant did not have a child with colic, he or she was directed to the next series of questions. The first question in this section was designed to determine if the infant had difficulty with feeding. Research has shown that feeding difficulties may be present in children who later

develop sensory processing issues (Miller-Lancar et al 2004). Parents were then asked whether they bottle or breast fed and the length of time for each method of feeding. Although this data was not used in this study, later research could look for correlation between feeding difficulties and type of feeding.

The next series of questions dealt with specific symptoms frequently exhibited by children with sensory processing issues. Participants were asked the questions related to specific signs an infant might exhibit in relation to sensory inputs. These questions related to the hypotheses 2-6.

Some questions were asked which did not directly relate to this study, but this researcher thought the data gathered from those questions could help later researchers. For example, parents were asked if they felt they were to blame for a child's diagnosis. Also, parents were asked to which methods of soothing worked the best while the child had colic.

Those who reported a sensory processing disorder diagnosis and subsequent treatment were asked which type of professional provided the therapy. Finally, parents were asked whether or not they themselves had either colic or sensory processing disorder. Future studies could look for a genetic connection between adults and their children with either colic or sensory processing disorder.

Data Collection Procedure

Parents whose children attended two child care facilities were asked to complete the survey and return it with the signed consent form to the researcher directly. Parents whose children were enrolled in the schools were asked to place the consent forms and surveys in a sealed manila envelope to be picked up by the researcher at the end of the week. At one of the facilities there was a class of children who had been diagnosed with sensory processing disorder.

Confidentiality was maintained by keeping answered questionnaires in the sealed envelopes. This researcher coded each booklet and informed consent form using letters. The researchers then separated the consent form from the booklet before analyzing the data. Once the research was complete, the booklets were shredded.

Hypotheses

Many of the hypotheses were formed based on literature research and early childhood developmental theories. Hypotheses 2, 3, 4, 5, and 6 were based on hypothesis 1. If there is a positive correlation between colic and sensory processing disorder, then there is likely a connection between colic and the symptoms of sensory processing disorder that parents may have observed while their infants were colicky.

1. There is a positive correlation between presence of colic in infancy as reported by parents and later diagnosis with sensory processing disorder.
2. Children who had colic as an infant are in treatment more frequently for sensory processing disorder by age 6 than children who exhibited no colic.
3. According to parental report, children who were colicky are more likely to currently exhibit sensitivity to light stimuli than children who were not colicky.
4. According to parental report, children who were colicky are more likely to currently exhibit sensitivity to sound stimuli than children who were not colicky.
5. According to parental report, children who were colicky are more likely to currently exhibit sensitivity to tactile stimuli than children who were not colicky.
6. According to parental report, children who were colicky are more likely to have difficulty either falling asleep or staying asleep than children who were not colicky.

7. According to parental report children who had colic are more likely to be considered “clumsy” (as is common in children with sensory processing disorder).
8. If a child exhibits colic as an infant, his siblings are more likely to exhibit colic than other children.
9. Parents whose children are diagnosed with sensory processing disorder are more likely to report difficulty adjusting to bottle or breast feeding.
10. Parents report that their children who have outgrown colic seem more developmentally advanced than other toddlers.

IV. RESULTS

Statistical Analysis

Data were analyzed using a chi-squared goodness of fit non-parametric test and chi-squared crosstabs. The level of significance was .05. Data was analyzed using the SPSS version 15 software.

There were 33 surveys tabulated. Respondents were 82% female (see Table 1). Analysis showed that 41% of the families had 2 children, 28% of the families only had 1 child, 25% had 3 children, and the remainder of the families had 4 children (see Table 2). Of the respondents, 82% were married (see Table 3) and 36% were between the ages of 36 and 40; and the second largest group of respondents was between the ages of 31-35 (see Table 3). The majority of the respondents had either a college degree (36%) or a post-graduate degree (27%). Of the 33 respondents, 10 reported that their child/children had colic. Only 6 children were reported to be in treatment for sensory processing disorder (see Table 4). However, the low numbers made it difficult to prove any correlation between these 2 disorders. In addition, this was largely a convenience sample, which may also have affected the results.

Hypotheses

The data for hypothesis 1 was analyzed using Pearson 2-tailed correlation.

The data for the remaining hypotheses was analyzed using χ^2 non-parametric goodness of fit test.

Hypothesis 1

There is a positive correlation between presence of colic in infancy as reported by parents and later diagnosis with sensory processing disorder.

The data in this study did not reveal a positive correlation between colic in infancy and later diagnosis with sensory processing disorder (see Table 5). Hypothesis 1 is rejected.

Hypothesis 2

Children who had colic as an infant are in treatment more frequently for sensory processing disorder by age 6 than children who exhibited no colic.

Of the 6 children reported as being in treatment for sensory processing disorder, only 1 was reported to have had colic as an infant (see Table 6). Hypothesis 2 is rejected.

Hypothesis 3

According to parental report, children who were colicky are more likely to currently exhibit sensitivity to light stimuli than children who were not colicky.

Only 14 of the 33 answered Question 31 regarding infant sensitivity to light. Of those, only 2 parents responded and both reported that their colicky infant was being easily mesmerized by visual stimuli such as television. The remaining 12 respondents reported their non-colicky infants were mesmerized by visual stimuli and squinted frequently (see Table 7). Hypothesis 3 is rejected.

Hypothesis 4

According to parental report, children who were colicky are more likely to currently exhibit sensitivity to sound stimuli than children who were not colicky.

Only 12 of 33 answered Question 32 regarding infant sensitivity to sound. Of those, 5 had colic. The children with colic were reported to show sensitivity to sounds as follows: 1 reported crying upon hearing loud noises, 3 reported their babies startled easily, and 1 flinched at loud noises. Of the children who did not have colic, 4 reported crying upon hearing loud noises, 2 covered their ears, and 1 flinched at loud noises (see Table 8). Hypothesis 4 is rejected.

Hypothesis 5

According to parental report, children who were colicky are more likely to currently exhibit sensitivity to tactile stimuli than children who were not colicky.

Only 11 out of 33 answered Question 33, regarding infant sensitivity to tactile stimuli. Of the respondents, 4 had colic, 3 of those infants were reported to be easily bothered by clothing tags, and 1 was especially drawn to the tactile experience of certain blankets. Of the children who did not have colic, 2 were easily bothered by clothing tags, and 5 were especially drawn to the tactile experience of certain blankets (see Table 9). Hypothesis 5 is rejected.

Hypothesis 6

According to parental report, children who were colicky are more likely to have difficulty either falling asleep or staying asleep than children who were not colicky.

Eight of 33 respondents answered Question 34 regarding sleep difficulties. Of the respondents, 2 had colic, 1 was reported to sleep for short periods of time, and 1 was reported to have difficulty staying asleep. Two infants without colic were reported to have difficulty falling asleep, 1 was reported to sleep for short periods of time, and 3 had difficulty staying asleep (see Table 10). Hypothesis 6 is rejected.

Hypothesis 7

According to parental report, children who had colic are more likely to be considered “clumsy” (as is common in children with sensory processing disorder).

There were 8 who answered Question 25, of those only 2 felt their child who had outgrown colic was clumsier than peers (see Table 11). Hypothesis 7 is rejected.

Hypothesis 8

If a child exhibits colic as an infant, his siblings are more likely to exhibit colic than other children.

There were no families who had more than one child who had colic (see Table 12).

Hypothesis 8 is rejected.

Hypothesis 9

Parents whose children are diagnosed with sensory processing disorder are more likely to report difficulty adjusting to bottle or breast feeding.

There were 9 who responded to Question 28, 6 of whom were in treatment for sensory processing difficulties. Of those, only 1 had difficulty eating. The remaining 5 did not. The 3 respondents whose children were not in treatment for sensory processing disorder did not report any difficulty eating (see Table 13). Hypothesis 9 is rejected.

Hypothesis 10

Parents report that their children who have outgrown colic seem more developmentally advanced than other toddlers.

Eight parents responded to Question 26 regarding development in toddlerhood after having colic as an infant. Of those, 1 rated development in toddlerhood as slower than normal, 6 rated it normal, and 1 rated development in toddlerhood as advanced (see Table 14). Hypothesis 10 is rejected.

V. DISCUSSION

Vygotsky believed that interactions between others precede development within. It's possible that this theory could explain why some babies who have colic may not develop as others. If their early interactions with their parents were upsetting to their parents, the infants may be missing that piece of positive social interaction which would allow them to then move on to inter-personal development.

The purpose of this research was to look for a possible link between 2 early childhood disorders. This researcher's hypotheses were unfounded in the study population. No relationship between these 2 disorders was found. However, the small number of responses made proving any of the hypotheses highly unlikely. Many participants reported their child did not show symptoms of colic or sensory integration disorder.

Although none of the hypotheses were confirmed, there still may be some validity to the hypotheses. The sample used for this study was a convenience sample. An effort was made to find a directed, specific population, but this researcher was unable to find a suitable one. If the researcher used a directed sample the findings could be dramatically different. Additionally, many parents did not completely fill out the survey. This could have been because the instrument was too long and detailed. Some parents verbally reported to this researcher that they did not have time to complete the survey.

When deciding which variables to use to measure sensitivity to light, this researcher asked if infants were easily mesmerized by lights. Being mesmerized by and sensitive to light was most commonly reported by parents of non-colicky infants. This could mean that infants without colic could be mesmerized as their brains were in a calm state.

The instrument also asked many questions not directly related to this particular thesis, but may be beneficial to later researchers. However, the design of the instrument did not allow all participants to answer some of the questions. In particular the questions about feeding were largely unanswered by those whose children did not have colic.

This researcher also asked parents if they felt they were to blame for their child's disorder. No one reported that the professional made them feel they were to blame and only reported they blamed themselves. Future researchers could expand on this and look at the long term relationship between parents and their children who were either colicky or have sensory processing issues.

The only hypothesis that had the expected result was number 9. There were no families with multiple infants who were colicky. This area could be further explored as well.

Overall the greatest limitation to this project was the low number of respondents and the lack of a directed population.

Future Direction

In the future, this research could continue, using the current results and instrument as a pilot test. It would be beneficial to redesign the instrument based on feedback from participants. Then the survey should be given to a much larger, directional group and to a larger control group. The results may be dramatically different.

REFERENCES

- Barr, R. G. (1995). Infant crying and colic: it's a family affair: invited commentary. *Infant Mental Health Journal*, 16(3), 218-220.
- Ben-Sasson, A., Cermack, S.A., Orsmond, G.I., Carter, A., & Fogg, L. (2007). Can we differentiate sensory over-responsivity from anxiety symptoms in toddlers? Perspectives of occupational therapists and psychologists. *Infant Mental Health Journal* (28)5, 536-558.
- Byrne, M.W. (2009). Sensory processing disorder: any of a nurse practitioner's business? *Journal of the American Academy of Nurse Practitioners* 21 314-321.
- Crepeau-Hobson, M. F. (2009). The relationship between perinatal risk factors and sensory processing difficulties in preschool children. *J. Dev Phys Disability* (21)315-338. doi: 10.1007/s10882-009-9-9144-x.
- Desantis, A., Coster, W., Bigsby, R., & Lester, B. (2004). Colic and fussing in infancy and sensory processing at 3 to 8 years of age. *Infant Mental Health Journal*(25)6, 522-539. doi:10.1002/imhj.20025.
- Degangi, G.A., Porges, S.W., Sickel, R.Z., & Greenspan, S. I. (1993). Four year follow up of a sample of regulatory disordered infants. *Infant Mental Health Journal* (14)4, 330-343.
- Eide, B., & Eide, F. (2004). Sensory processing disorders in a learning disorders clinic. Retrieved from <http://neurollearning.com/sensorylearn.htm>.
- Greenspan, S. (2004). Working with the child who has sensory integration disorder. *Early Childhood Today*, 18(7), 20-21.
- Groopman, J. (2007). Crybabies. *New Yorker*, 83(27), 46-53.
- Lamb, M.E., Bornstein, M.H., Teti, D.M. (2002). Development in infancy: an introduction. Mahwah, New Jersey. Lawrence Erlbaum Associates.
- Miller-Lancar, C., Bigsby R., High, P., Wallach, & M. Lester, B. (2004). Infant colic and feeding difficulties. *Arch Dis Child* 89 980-913. doi:10.1136/adc/2003.033233.
- Neu, M., & Keefe, M.R. (2002). Characteristics of school-age children who had colic as infants: mothers' views. *JSPN*(7)1, 24-33.
- Räihä, H., Lehtonen, L., & Korvenrants, H. (1995). Family context of infantile colic. *Infant Mental Health Journal* (16)3, 206-217.
- Rautava, P., Lehtonen, L., Helenius, M. & Sillampää, M. (1995) Infantile colic and family three years later. *Pediatrics*(96)1, 43-47.

Roberts, D., Ostapchuck, M., & O'Brien, J. (1995). Infantile colic. *American Family Physician*(70)4, 735-740.

Savino, F., Costagno, E., Bretto, R., Brondello, C., Palumeri, E., & Oggero, R. (2005). A prospective 10 year study on children who had severe infantile colic. *Acta Pædiatrica* (94)449, 129-132. doi:10.1080/0835320510043691.

Social development theory (Vygotsky) (2008) at Learning-Theories.com. Retrieved November 30th, 2011 from <http://www.learning-theories.com/vygotskys-social-learning-theory.html>

Stifter, C.A., Bono, M., & Spinrad, T. (2003). Parent characteristics and conceptualizations associated with the emergence of infantile colic. *Journal of Reproductive and Infant Psychology* (21)5, 309-322. doi:10.1080/0264830310001622123.

Vygotsky, L.S. (1997). *Educational psychology* (Silverman, R. Trans.) Boca Raton, FL. St. Lucie Press

Yisreal, L. (2004). About sensory integration disorder and sensory integration therapy. Retrieved from <http://www.infantrefluxdisease.com/sensory-integration-disorder-sensory-integration-therapy>.

Zwart, P., Marije, G.A., Vellema-Goud, P.L., Brand, P (2007). Characteristics of infants admitted to hospital for persistent colic, and comparison with healthy infants. *Acta Pædiatrica*(96) 401-405.

Appendix A
Informed Consent

Title: Colic in Infancy as an Indicator of Subsequent Sensory Processing Development

Researcher(s):

Administrator(s):

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Mardel A. Crandall, M.S., Faculty Advisor
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(479)575-7484

Description: You are being given the opportunity to participate in a University of Arkansas research study. This research explores a possible link between colic in infancy and later development of sensory processing disorder. Colic can be simply defined as excessive crying. People with sensory integration disorder have a hard time processing various sensory inputs, such as sound and light. The survey you will complete consists of questions regarding your child's behaviors in infancy and early childhood.

Risks and Benefits: There are no apparent risks to participating in this study. The benefit is an increased understanding of colic and sensory processing disorder, which may help parents and professionals predict and cope with these issues.

Voluntary Participation: Your participation in this study is strictly voluntary. There are no monetary rewards for participation.

Confidentiality: Survey participants are not identified by name. Every reasonable effort to maintain confidentiality will be made.

Right to Withdraw: You are able to withdraw from and not participate in this study at any time with no penalty to you.

If you have questions or concerns about this study, you may contact Terri Pohlenz at (xxx)xxx-xxxx or Mardel Crandall at (479) 575-5224 or by e-mail at mcranda@uark.edu. For questions or concerns about your rights as a research participant, please contact Ro Windwalker, the University's Compliance Coordinator, at (479) 575-2208 or by e-mail at irb@uark.edu.

Informed Consent:

I, _____, have read the description

(please print name)

of this study and agree to participate in this study. I understand that I am able to withdraw at any time without penalty and I may refuse to participate in this research. I understand this will be completely confidential and that my participation in this research is completely voluntary. The researcher has explained everything I need to identify. I understand that my signature below indicates that I freely agree to participate in this experimental study.

Signature

Date

Appendix B

Survey Instrument

This research seeks to find a possible link between infant colic and certain traits. Some of these traits may be linked with sensory issues. Please complete the entire survey. Thank you for participating in this study.

Please check the box that best answers the question.

1. Your gender:

- female
 male

2. Your current marital status:

- single
 unmarried, but living with child's other parent
 married
 divorced
 widowed

3. Your primary child care arrangements and the age(s) of your child(ren) when it began:

- stayed at home with mother Began at age(s) _____
 stayed at home with father Began at age(s) _____
 stayed at home with other relative Began at age(s) _____
 stayed at home with nanny Began at age(s) _____
 attended child care center M-F. Began at age(s) _____
 attended child care center part-time Began at age(s) _____
 other _____

4. Your education:

- GED/high school
 some college or technical school
 college degree
 post-graduate
 other

5. Your age currently:

- Under 18 36-40
 19-24 41-45
 25-30 over 45
 31-35

6. Number of children:

- 1
 2
 3
 4

5 or more

7. Birth dates (month/year) of your children:

- 1st child's birth date _____ This child did did not have colic.
2nd child's birth date _____ This child did did not have colic.
3rd child's birth date _____ This child did did not have colic.
4th child's birth date _____ This child did did not have colic.
5th child's birth date _____ This child did did not have colic.

*Please use a separate questionnaire for each child. Ask your child's teacher or therapist for extra questionnaires.
If none of your children had colic, please go to question 28.*

8. Did your baby have colic, either diagnosed by a physician or suspected by you?

- Yes, colic was diagnosed by a physician. (Please go to number 9)
 Yes, colic suspected. (Please go to number 12)
 No colic. (Please go to number 28).
 I don't know

9. Please indicate the age of your infant when you first received the diagnosis of colic.

- 0-3 weeks 9 weeks & 1 day-12 weeks
 3 weeks & 1 day-6 weeks after 12 weeks
 6 weeks & 1 day-9 weeks

10. If your child was diagnosed with colic did the professionals who made the diagnosis ever make you believe that you were in any way to blame?

- yes
 no
 I don't know

11. If your child was diagnosed with colic, did you ever believe you were to blame even though the professional told you otherwise?

- yes
 no
 I don't know

12. If not diagnosed by a doctor, at what age did you suspect colic?

- 0-3 weeks 9 weeks & 1 day-12 weeks
 3 weeks & 1 day-6 weeks after 12 weeks
 6 weeks & 1 day-9 weeks

13. If your child was not diagnosed by a professional, did you ever believe you were to blame?

- yes
 no
 I don't know

14. Whether diagnosed or not, what symptoms of colic did you observe? Please check all that apply.

- crying in the early evenings trouble soothing
 trouble sleeping difficulty feeding
 crying throughout the day I don't recall

- crying in excess of 3 hours per instance
- other (briefly explain) _____

15. Different babies are soothed in different ways. How did you soothe your baby during the time he/she was colicky? Please check all that apply.

- vibration of washing machine/other appliance
- swinging feeding music
- driving carrying child in a sling bouncing
- rocking cradling
- background noise other than music
- my baby was inconsolable
- other, please explain _____

16. Was your baby breast fed for any length of time?

- yes If yes, go to number 17.
- no If no, go to number 18

17. How long did your baby breast feed?

- 3 weeks or less 12 weeks to 1 year
- 4 -6 weeks 1-2 years
- 6-8 weeks 2 years or more
- 8-12 weeks

18. Was your baby bottle fed?

- yes
- no
- Give beginning and ending ages (month/year): _____

19. During the time your baby was colicky, how long did breast and/or bottle feedings typically last?

- 0-30 minutes 60-90 minutes
- 30-60 minutes more than 90 minutes
- I don't remember

20. How long did feedings last once colic ended?

- 0-30 minutes 60-90 minutes
- 30-60 minutes more than 90 minutes
- I don't remember

21. Was your baby gassy compared to other children his/her age?

- yes If yes, go to number 22.
- no If no, go to number 23.
- I don't remember

22. Did you believe the gas was related to colic?

- yes
- no
- I don't remember

23. Was your baby diagnosed with reflux issues?
 yes
 no
 I don't remember
24. Did you use Mylicon or any other medication or over the counter remedies for these issues?
 yes
 no
 I don't remember
25. Did your child who was diagnosed with colic seem to be clumsier than other children his/her age?
 yes
 no
 I don't remember
26. If your child has outgrown colic how would you rate his/her development in toddlerhood?
 slower than normal
 normal
 advanced
 I don't remember
27. What age was he/she when the colic ended?
 Give age in months _____ or I don't remember
28. Some babies have difficulty eating, others do not. Did you believe your baby had difficulty feeding?
 yes If yes, go to number 29.
 no If no, or you don't remember go to number 30.
29. Rate how you felt about the difficulty of feeding:
 easier than I expected somewhat difficult
 extremely difficult it varied
- yes
 no
 I don't remember
31. Some babies show signs of being sensitive to light (such as squinting), others do not. Did your baby show any such signs? Check all that apply.
 squinting turning head away from light
 crying in bright lights other signs
 I don't remember
 easily mesmerized by visual stimuli such as television
32. Some babies show signs of being sensitive to sounds, others do not. Did your baby show any such signs? Check all that apply.
 crying upon hearing loud noises grimacing at loud noises
 startle easily flinching at loud noises
 covering ears other signs

I don't remember

33. Some babies are extremely sensitive to tactile experiences, others are not. Did your baby show any such signs? Check all that apply.

- easily bothered by clothing tags
- especially drawn or attached to the tactile experience of a certain blankets
- hyper sensitive to hot and cold
- other _____

34. Some babies have difficulty sleeping, others do not. Did your baby show any signs of sleeping difficulties? Check all that apply.

- difficulty falling asleep
- difficulty staying asleep
- sleeping for short periods of time
- other
- I don't remember

35. At what age did your baby start sleeping in stretches of more than six hours at night?

36. Have you been told by a professional that your child has difficulty processing sensory input?

- yes If yes, go to number 37.
- no If no, go to number 42.

37. How old was your child when he was diagnosed with sensory processing issues? Please give estimated age in months _____.

38. Is your child in treatment for sensory processing issues?

- yes If yes, go to number 39.
- no If no, go to number 42.

39. Did he/she begin treatment before age six? If so, give age in months _____.

40. How often does your child go for treatment?

- 1 time per week
- 2 times per week
- monthly
- other

41. What type of professional works with your child? Please check all that apply.

- social worker
- child development specialist
- psychologist
- psychiatrist
- occupational therapist
- physical therapist
- school-based therapist
- speech therapist
- other _____.

42. Do you believe that your child has sensory processing issues even though there has been no formal diagnosis?

- yes
- no
- I'm not sure what sensory processing issues are

43. If your child was diagnosed with both colic and sensory processing issues, do you believe the early colic experience helped prepare you to deal with sensory processing issues?

- yes
- no
- I don't remember

44. Do you believe you yourself have sensory processing issues?

- yes If yes, please continue to answer the following questions.
- no If no, thank you for your participation.
- I'm not sure what sensory processing issues are

45. Which of the following sensory processing difficulties do you have?

- sensitivity to light
- sensitivity to sounds
- sensitivity to food textures
- sleeping difficulties
- over-sensitivity to shirt labels or other skin irritants
- clumsiness
- hyper sensitive to hot and cold
- other _____

46. Were you yourself diagnosed with sensory processing issues at any point by a physician or other professional?

- yes
- no
- I don't remember/know

47. At what age were you yourself diagnosed?

- before age 12
- 12-19
- 20-25
- older than 25
- I don't remember

48. Did you yourself receive treatment for this?

- yes
- no
- I don't remember

49. If you yourself were not diagnosed, do you believe you have sensory processing issues?

- yes
- no
- I don't know

50. Did you have colic as a baby?

- yes
- no
- I don't know

Thank you for your help with this research!

Appendix C
Data Tables

Table 1

Respondent's Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	27	81.8	81.8	81.8
	Male	6	18.2	18.2	100.0
	Total	33	100.0	100.0	

Table 2

Number of Children

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	9	27.3	28.1	28.1
	2	13	39.4	40.6	68.8
	3	8	24.2	25.0	93.8
	4	2	6.1	6.3	100.0
	Total	32	97.0	100.0	
Missing	-9	1	3.0		
Total		33	100.0		

Table 3

Age of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	19-24	1	3.0	3.0	3.0
	25-30	4	12.1	12.1	15.2
	31-35	7	21.2	21.2	36.4
	36-40	12	36.4	36.4	72.7
	41-45	6	18.2	18.2	90.9
	Over 45	3	9.1	9.1	100.0
	Total	33	100.0	100.0	

Table 4a

Colic Frequency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Had colic	10	30.3	30.3	30.3
	Did not have colic	23	69.7	69.7	100.0
	Total	33	100.0	100.0	

Table 4b

Sensory Integration Disorder Frequency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	4	12.1	12.9	12.9
	No	27	81.8	87.1	100.0
	Total	31	93.9	100.0	
Missing	didn't answer	2	6.1		
Total		33	100.0		

Table 5

Hypothesis 1 Results

		Colic as Reported by Parents	Diagnosed with sensory processing difficulties
Colic as Reported by Parents	Pearson Correlation	1	-.227
	Sig. (2-tailed)		.219
	N	33	31
Diagnosed with sensory processing difficulties	Pearson Correlation	-.227	1
	Sig. (2-tailed)	.219	
	N	31	31

Table 6

Hypothesis 2 Results

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	4	12.1	12.9	12.9
	no	27	81.8	87.1	100.0
	Total	31	93.9	100.0	
Missing	didn't answer	2	6.1		
Total		33	100.0		

		In treatment for sensory processing difficulties		Total
		yes	no	yes
Colic as Reported by Parents	Had colic	1	2	3
	Did not have colic	5	1	6
Total		6	3	9

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Had colic	10	30.3	30.3	30.3
	Did not have colic	23	69.7	69.7	100.0
	Total	33	100.0	100.0	

Table 7a

Hypothesis 3 results

			Sensitive to light		Total
			Squinting	easily mesmerized by visual stimuli	Squinting
Colic as Reported by Parents	Had colic	Count	0	2	2
		% within Colic as Reported by Parents	.0%	100.0%	100.0%
		% within Sensitive to light	.0%	15.4%	14.3%
		% of Total	.0%	14.3%	14.3%
	Did not have colic	Count	1	11	12
		% within Colic as Reported by Parents	8.3%	91.7%	100.0%
		% within Sensitive to light	100.0%	84.6%	85.7%
		% of Total	7.1%	78.6%	85.7%
Total		Count	1	13	14
		% within Colic as Reported by Parents	7.1%	92.9%	100.0%
		% within Sensitive to light	100.0%	100.0%	100.0%
		% of Total	7.1%	92.9%	100.0%

Table 7b

Chi-Squared Tests

	Value	df	Asymp. Sig. (2- sided)	Exact Sig. (2- sided)	Exact Sig. (1- sided)
Pearson Chi-Square	.179(b)	1	.672		
Continuity Correction(a)	.000	1	1.000		
Likelihood Ratio	.321	1	.571		
Fisher's Exact Test				1.000	.857
Linear-by-Linear Association	.167	1	.683		
N of Valid Cases	14				

a Computed only for a 2x2 table

b 3 cells (75.0%) have expected count less than 5. The minimum expected count is .14.

Table 8a
Hypothesis 4 results

		Sensitive to sound				Total	
		crying upon hearing loud noises	startle easily	covering ears	flinching at loud noises	crying upon hearing loud noises	
Colic as Reported by Parents	Had colic	Count	1	3	0	1	5
		% within Colic as Reported by Parents	20.0%	60.0%	.0%	20.0%	100.0%
		% within Sensitive to sound	20.0%	100.0%	.0%	50.0%	41.7%
		% of Total	8.3%	25.0%	.0%	8.3%	41.7%
	Did not have colic	Count	4	0	2	1	7
		% within Colic as Reported by Parents	57.1%	.0%	28.6%	14.3%	100.0%
		% within Sensitive to sound	80.0%	.0%	100.0%	50.0%	58.3%
		% of Total	33.3%	.0%	16.7%	8.3%	58.3%
Total		Count	5	3	2	2	12
		% within Colic as Reported by Parents	41.7%	25.0%	16.7%	16.7%	100.0%
		% within Sensitive to	100.0%	100.0%	100.0%	100.0%	100.0%

	sound					
% of Total	41.7%	25.0%	16.7%	16.7%	100.0%	

(Table 8a continued)

Table 8b

Chi-Square Tests

	Value	df	Asymp. Sig. (2- sided)
Pearson Chi-Square	6.651(a)	3	.084
Likelihood Ratio	8.524	3	.036
Linear-by-Linear Association	.086	1	.770
N of Valid Cases	12		

a 8 cells (100.0%) have expected count less than 5. The minimum expected count is .83.

Table 9a
Hypothesis 5 results

			Sensitive to tactile		Total
			easily bothered by clothing tags	especially drawn or attached to the tactile experience of certain blankets	easily bothered by clothing tags
Colic as Reported by Parents	Had colic	Count	3	1	4
		% within Colic as Reported by Parents	75.0%	25.0%	100.0%
		% within Sensitive to tactile	60.0%	16.7%	36.4%
		% of Total	27.3%	9.1%	36.4%
	Did not have colic	Count	2	5	7
		% within Colic as Reported by Parents	28.6%	71.4%	100.0%
		% within Sensitive to tactile	40.0%	83.3%	63.6%
		% of Total	18.2%	45.5%	63.6%
	Total	Count	5	6	11
		% within Colic as Reported by Parents	45.5%	54.5%	100.0%
		% within Sensitive to tactile	100.0%	100.0%	100.0%
		% of Total	45.5%	54.5%	100.0%

Table 9b

	Value	df	Asymp. Sig. (2- sided)	Exact Sig. (2- sided)	Exact Sig. (1- sided)
Pearson Chi-Square	2.213(b)	1	.137		
Continuity Correction(a)	.737	1	.391		
Likelihood Ratio	2.284	1	.131		
Fisher's Exact Test				.242	.197
Linear-by-Linear Association	2.012	1	.156		
N of Valid Cases	11				

a Computed only for a 2x2 table

b 4 cells (100.0%) have expected count less than 5. The minimum expected count is 1.82.

Table 10a

Hypothesis 6 Results

			Difficulty sleeping			Total
			difficult y falling asleep	sleeping for short periods of time	difficulty staying asleep	
Colic as Reported by Parents	Had colic	Count	0	1	1	2
		% within Colic as Reported by Parents	.0%	50.0%	50.0%	100.0%
		% within Difficulty sleeping	.0%	50.0%	25.0%	25.0%
		% of Total	.0%	12.5%	12.5%	25.0%
	Did not have colic	Count	2	1	3	6
		% within Colic as Reported by Parents	33.3%	16.7%	50.0%	100.0%
		% within Difficulty sleeping	100.0%	50.0%	75.0%	75.0%
		% of Total	25.0%	12.5%	37.5%	75.0%
Total	Count	2	2	4	8	
	% within Colic as Reported by Parents	25.0%	25.0%	50.0%	100.0%	
	% within Difficulty sleeping	100.0%	100.0%	100.0%	100.0%	
	% of Total	25.0%	25.0%	50.0%	100.0%	

Table 10b

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.333 ^a	2	.513
Likelihood Ratio	1.726	2	.422
Linear-by-Linear Association	.212	1	.645
N of Valid Cases	8		

a. 6 cells (100.0%) have expected count less than 5. The minimum expected count is .50.

Table 11

Hypothesis 7 Results

		Colicky child clumsier than peers			
		Yes	No	Total	
Colic as	Had colic	Count	2	6	8
Reported by		% within Colic as	25.0%	75.0%	100.0%
Parents		Reported by Parents			
		% within Colicky child	100.0%	100.0%	100.0%
		clumsier than peers			
		% of Total	25.0%	75.0%	100.0%
Total		Count	2	6	8
		% within Colic as	25.0%	75.0%	100.0%
		Reported by Parents			
		% within Colicky child	100.0%	100.0%	100.0%
		clumsier than peers			
		% of Total	25.0%	75.0%	100.0%

Table 12

Hypothesis 8 Results

There were no families with more than one colicky child.

			Number of Children				Total
			1	2	3	4	
Colic as	Had colic	Count	3	4	2	1	10
Reported by		% within Colic as	30.0%	40.0%	20.0%	10.0%	100.0%
Parents		Reported by					
		Parents					
		% within Number	33.3%	30.8%	25.0%	50.0%	31.3%
		of Children					
		% of Total	9.4%	12.5%	6.3%	3.1%	31.3%
	Did not	Count	6	9	6	1	22
	have	% within Colic as	27.3%	40.9%	27.3%	4.5%	100.0%
	colic	Reported by					
		Parents					
		% within Number	66.7%	69.2%	75.0%	50.0%	68.8%
		of Children					
		% of Total	18.8%	28.1%	18.8%	3.1%	68.8%
Total		Count	9	13	8	2	32
		% within Colic as	28.1%	40.6%	25.0%	6.3%	100.0%
		Reported by					
		Parents					
		% within Number	100.0%	100.0%	100.0%	100.0%	100.0%
		of Children					
		% of Total	28.1%	40.6%	25.0%	6.3%	100.0%

Table 13a

Hypothesis 9 Results

		Difficulty eating		Total	
		Yes	No		
In treatment for sensory processing difficulties	yes	Count	1	5	6
		% within In treatment for sensory processing difficulties	16.7%	83.3%	100.0%
		% within Difficulty eating	100.0%	62.5%	66.7%
		% of Total	11.1%	55.6%	66.7%
	no	Count	0	3	3
		% within In treatment for sensory processing difficulties	.0%	100.0%	100.0%
		% within Difficulty eating	.0%	37.5%	33.3%
		% of Total	.0%	33.3%	33.3%
	Total	Count	1	8	9
		% within In treatment for sensory processing difficulties	11.1%	88.9%	100.0%
		% within Difficulty eating	100.0%	100.0%	100.0%
		% of Total	11.1%	88.9%	100.0%

Table 13b

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.492 ^a	3	.921
Likelihood Ratio	.474	3	.925
Linear-by-Linear Association	.001	1	.979
N of Valid Cases	32		

a. 5 cells (62.5%) have expected count less than 5. The minimum expected count is .63.

Table 14

Hypothesis 10 Results

		Development in toddlerhood after colic as an infant			Total	
		slower than normal	normal	advanced		
Colic as Reported by Parents	Had colic	Count	1	6	1	8
		% within Colic as Reported by Parents	12.5%	75.0%	12.5%	100.0%
		% within Development in toddlerhood after colic as an infant	50.0%	100.0%	100.0%	88.9%
		% of Total	11.1%	66.7%	11.1%	88.9%
	Did not have colic	Count	1	0	0	1
		% within Colic as Reported by Parents	100.0%	.0%	.0%	100.0%
Total		% within Development in toddlerhood after colic as an infant	50.0%	.0%	.0%	11.1%
		% of Total	11.1%	.0%	.0%	11.1%
		Count	2	6	1	9
		% within Colic as Reported by Parents	22.2%	66.7%	11.1%	100.0%
		% within Development in toddlerhood after colic as an infant	100.0%	100.0%	100.0%	100.0%
		% of Total	22.2%	66.7%	11.1%	100.0%

Table 14b

Chi Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.938 ^a	2	.140
Likelihood Ratio	3.506	2	.173
Linear-by-Linear Association	2.462	1	.117
N of Valid Cases	9		

a. 5 cells (83.3%) have expected count less than 5. The minimum expected count is .11.