

A Literature Review: The Effects of Maternal Stress in Pregnancy on Sensory Integration in Children

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Abstract: None available.

Full Text: Headnote ABSTRACT: This article reviews existing research on how a pregnant mother's mental health status, stress level, and temperament affect her unborn baby's sensory processing abilities. After a brief introduction to sensory integration and sensory processing, research on how scientists learn about the fetus' developing nervous system by observing his/her behavior is presented. Maternal temperament and increased stress during pregnancy often impact temperament and developmental delay. This appears to negatively impact the unborn baby's physical, cognitive, self-regulation, and sensory processing abilities. An unhealthy maternal mental state negatively affects the unborn child's development. This stress during pregnancy appears to negatively impact the baby's cognitive and physical development and self-regulation abilities. **KEY WORDS:** Maternal stress, prenatal, sensory integration, temperament. **INTRODUCTION** Health care providers working with children suffering from prenatal and perinatal trauma often encounter sensory processing disorders. "Up to ninety percent of the children seen by mental health professionals have under-lying processing difficulties, in addition to self-esteem and behavioral control issues," says Beverly Russ, MFT (2005). Although no specific research has yet been conducted, there is a preponderance of agreement among other mental health professionals on the impact of sensory integration on a child's sense of self and behavioral control. A majority of children referred for mental health concerns includes children with specific prenatal stress, birth trauma, or developmental injuries. However, many of these children have no known etiology to their developmental problems. Unfortunately, research literature is sparse to quantify how the prenatal and perinatal environment and maternal stress affect developing infants. "Sensory integration (SI) is the organization of sensory input which people use to appropriately respond to their environment" (Ayres, 1972, p. 1). SI is also the ability to take in and organize sensory information for use. It is the involuntary process of the brain to assemble a picture of our environment at each moment in time using information from all of our senses. Through sensory integration, the many parts of the nervous system work together so that a person can interact with their environment effectively and experience appropriate satisfaction with their daily activities. When something goes wrong with the way a person takes in, interprets and responds to sensory information, the person's resultant behavior can appear out of proportion or confusing to other people. (Ayres, p. 2). Occupational therapists that specialize in pediatrics have identified many risk factors for developing sensory processing difficulties. According to Kwar (2005), the sensory systems are "highly susceptible to ear infections, high fevers, recurrent soft tissue swelling, cranial misalignment-trauma, allergies, stress during pregnancy, and genetics." However, there have been no definitive etiological studies performed to identify true cause and effect. The purpose of this literature review is to identify what is known about how an unborn child interacts with his/her environment, how doctors can determine the neurological status, the impact of maternal stress, and how other environmental factors impact the developing fetus' potential for later life difficulties. **LITERATURE REVIEW** Organization for this review involved comprehensive literature searches and discussions with professional research experts. Initially, the author examined studies linking the mother's emotional state during pregnancy to her unborn baby. Next, occupational therapy literature studying sensory integration [and sensory processing disorder] was reviewed for specific incidences of difficulties in early development. Finally, the two fields of research were merged to examine areas for further study. According to Chamberlain (1998), "The emotional life of baby will be tuned in with the mother. The child must be prepared to live in the world of the mother." The neonate inherits both the genetic make up and the predisposition to the mother's emotional state. This makes sense as the unborn child

is completely reliant on the mother until birth for food, shelter, self-regulation and everything else. The baby experiences all the hormonal activity, movement, and emotions of his/ her mother. One research study investigated what a mother gives to her fetus during the prenatal and perinatal period. Ronca and Alberts (1992) used rat testing to provide details of the rat pup's behavior during different stages of pregnancy. These authors describe how the fetus receives transmissions of the mother's vocalizations through the uterine cavity. Additional fetal sensory input from the mother includes vascular activity, breathing, eating, drinking, swallowing, and audible by-products of digestion. The mother's physical activity created pressure and vibrated the fetus. They concluded the behavior and experiences of the unborn baby are impacted by the mother's behavior. Therefore they advise expectant mothers to keep happy, listen to good music, eat healthy, and remember that anything they experience, their child also experiences. Modern technology allows investigators to get a better look at the world of the unborn baby. Hepper (1992) looked at prenatal behavior and its impact on later functioning. He examined how a fetus' tendency to suck its thumb related to later development of handedness. Thumb sucking is apparently present from as early as 15 weeks gestational age. While the fetus' preference for one or the other thumb remained constant throughout pregnancy, the baby's choice to suck his/her thumb in-utero correlated highly with head turning response after birth. During the perinatal period, the newborn usually turned its head to the thumb sucking side. In actuality, this is also a neurological reflex (the asymmetrical tonic neck reflex [ANTR]) that appears shortly after birth. Later in life, when the infant was 15-18 month old, grasping patterns were also symmetrical with the thumb-sucking side. These toddlers would grasp a ball suspended in front of them while sitting up with the same hand they used to suck. Hepper (1992) concluded that observation of the fetus' behavior gives investigators information regarding the developmental status of the nervous system. Those babies who did not exhibit a use of the same hand to which they turned their heads, could possibly be identified for possible difficulties and potentially receive early intervention. Looking at the fetus' behavior from a motor skills and sensory integration perspective may help indicate difficulty with later development. The babies did not develop symmetrical motor patterns. Children who do not exhibit neurological reflexes (such as the ATNR) may later have difficulty coordinating both sides of their bodies. For example, neurological reflexes should integrate around the sixth month of life. Children should be able to jump with one foot forward and one foot backward in a cross-country skiing manner, with their arms swinging alternate to their feet between ages four to five years old. Another indicator of motoric disorganization is the inability to cross midline. Infants should be able to visually track across their midline as they gain solid neck strength, which typically occurs around three months old. Such a child might also develop an inability to organize him/herself, track visually across midline, or reach towards his right side with his left hand. Misri, Oberlander, and Fairbrother (2004) examined the relationship of pregnant women in psychiatric treatment and their neonatal health outcomes after birth. In general, researchers found that pregnant women who were depressed and anxious were more likely to have newborn babies at a higher risk for developmental difficulties. These factors included earlier gestational age at birth, lower APGAR scores, increased jitteriness, respiratory difficulty, hypoglycemia, and weak or absent crying. This research, even though their sample size was relatively small (46 participants), provided a scientific estimate of how maternal mood affects the newborn's initial developmental status. Children with the above mentioned symptoms are also more likely to develop sensory processing difficulties. Since an unhealthy maternal mental state impacts unborn babies negatively, it is possible that increasing maternal stimulation would improve developmental status. The project by Carlsen and Lickliter (1999) addresses the question of "How does increased stimulation of tactile and vestibular input impact the prenatal period?" The authors mimicked how a Bobwhite Quail mother hen would treat her eggs. They placed the eggs on a sliding metal grid and turning them for 30 seconds every ten minutes, four hours every day. This lasted for seven days. Results were compared to a control group that did not get turned. After birth, the chicks went through an obstacle course requiring them to locate their mother by sound and sight. The chicks who received tactile and vestibular movement were able to respond better to maternal calls than the control group. However, they were less able to

respond to visual cues of the mother than the control group. The authors concluded that some prenatal stimulation was beneficial but that it may be detrimental to species-specific perceptual development. Buitelaar, Huizink, Mulder, Robles de Medina, and Visser (2003) examined how maternal stress during pregnancy influences motor and cognitive development of newborns. Test subjects included only pregnant mothers who were generally healthy, in their first trimester, and had no major pregnancy complications. Maternal stress was measured through self-report on the Pregnancy-Related Anxiety Questionnaire (Huizink, 2000). In addition, cortisol levels were analyzed from the mother's saliva to identify stress on the endocrine system. Babies were tested at three and eight months old using the Bayley Scale of Infant Development (BSID-II) and Behavior Rating Scale (BRS). Babies whose mothers perceived increased stress during pregnancy had difficult temperaments and delayed motor and cognitive skills. These babies at eight months scored eight testing points lower than the control group. Mothers who were afraid of giving birth during mid-pregnancy also had babies with lower cognitive and physical developmental scores and decreased attention regulation at the eighth month testing period. The impact of stress was easier to ascertain when the infant was eight months rather than at three months old, due to a greater range of measurable developmental milestones. However, since older infants may exhibit stranger anxiety, age of the infant also became an intervening variable. The BSID-II and BRS are common assessment tools used by pediatric occupational therapists to assess an infant's cognitive and physical development. The BRS gives additional information on the infant's sleep/wake cycles, attention/arousal, orientation, engagement, emotional regulation, and motor quality. These factors are important in determining how a child is processing sensory information, learning to self-calm, and regulate their sleep-wake cycles. The sensory processing perspective recognizes that stress during pregnancy puts the baby at an increased risk for difficulties with self-regulation, sleep-wake cycles, self-calming abilities, and later developmental milestone delays. Kawar (2005) described the risk factors associated with the development of sensory processing difficulties to include difficulty with self-calming and poor sleep-wake regulation. Typically, the medical community diagnoses these difficulties "colic." Although colic is sometimes treated effectively with medical interventions, the child's neurological system issues are not addressed by medications or surgery, and thus do not develop much needed foundational skills. Miller (2004) conducted a prevalence study in Colorado by administering a Short Sensory Profile to 703 children entering kindergarten. The prevalence of Sensory Processing Difficulties (SPD) was determined to be approximately five percent. This is an interesting figure, since children who receive special education services make up about ten percent of the population. However, children with SPD do not usually have intellectual deficits, and therefore do not typically qualify for intervention. One additional factor regarding the genetic tendency for developmental disabilities is provided by the U.S. Government (1999). According to the Surgeon General, the inheritance of attention deficit hyperactivity disorder (ADHD) is an important consideration with 10 to 35 percent of children with ADHD having a first-degree relative with this diagnosis. Approximately one-half of parents who had ADHD have a child with the disorder. However, according to research completed by Miller (2004), there is a 60% over-lap in symptoms when diagnosing SPD vs. ADHD. In other words, there may be up to a 60% diagnosis error, wherein more children labeled ADHD when they are actually SPD. It is possible that these mis-diagnosed children with SPD inherited their symptoms from their families. Further research is required to validate this conclusion. CONCLUSION Although there is sparse literature on how a mother's temperament directly impacts her infant's sensory processing ability, several research projects provide insight into how a mother's temperament affects her unborn child. Scientists have learned about the developmental status of the nervous system by observing the fetus' behavior. For example, thumb-sucking behavior in utero may help identify hand dominance and central nervous system organization. Those babies who do not exhibit a symmetrical hand preference to head turning response later on could be watched for potential developmental difficulties. An unhealthy maternal mental state negatively affects the unborn child's development. According to the research, increased maternal stress during pregnancy is a determinant of temperament and developmental delay. This stress during pregnancy appears to negatively

impact the baby's cognitive, physical development and self-regulation abilities. In addition, increasing sensory stimulation during the prenatal period appears to be healthy, but parents are cautioned that too much stimulation may cause the neonate to miss other specific developmental tasks. If maternal temperament during pregnancy negatively impacts the unborn child's physical, cognitive development, and self-regulation, it is possible that sensory processing abilities will not develop effectively. Continued exploration of how prenatal and perinatal health-care and mental health professionals, occupational therapists, birth educators, and obstetricians can improve maternal mental health is vital. Further research is also needed to determine how support and intervention during pregnancy could improve the child's functional outcome. References

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