

A LUCKY LINK: PRENATAL STRESS AND CHILDHOOD DISORDERS

Susan Andrews, Ph.D.
Clinical Neuropsychologist

Many discoveries are *serendipitous*, that is, a lucky finding while searching for something else. The Tomatis Method to help children was one such serendipity. While Dr. Tomatis was trying to help singers recover their voices, the singers would sometimes bring their children. Dr. Tomatis would put headphones on the children to keep them occupied. The children benefitted so much that Dr. Tomatis developed a program that has helped thousands of children who have been diagnosed with autism, learning problems, attention problems, childhood anxiety, and a host of other disorders.

The same lucky discovery is true about Dr. Tomatis' finding that women benefit from listening while pregnant. When mothers brought their children for their program, Dr. Tomatis' policy was that the mothers were to listen while they waited. When the mother was pregnant with her next child when she listened, there was a noticeable difference in her pregnancy, delivery and the disposition of the child. This led Dr. Tomatis to develop the pregnant mother's listening program.

For my part, I became interested in Dr. Tomatis' program for pregnant mothers when I first heard of the results from the Klopfenstein study. Dr. Klopfenstein found that the listening program was beneficial to the mothers' delivery and the children's disposition and wellbeing. It was 1992 and I was training with Dr. Tomatis. While he had his theories, Dr. Tomatis did not actually know *why* the babies born to mothers who had attended his clinic while pregnant were so different. At that time (the late 80s), the terms prenatal stress or antenatal anxiety were relatively unknown.

My personal investigation to discover why the listening program had such a profound benefit for the pregnant mother uncovered a serendipitous relationship between prenatal stress and later childhood problems. I discovered a substantial body of research that has led me to understand that the key to the success of the listening program for the pregnant mother is that it reduces her prenatal stress and anxiety. The more I read, the more I knew this information needed to become better understood by the general public.

My book, *Stress Solutions for Pregnant Mothers* (available in February 2012), explains how prenatal stress strongly impacts the developing baby if the pregnant woman experiences too much of certain kinds of stress and anxiety. Part 1 of the book describes the research that has led to prenatal stress becoming recognized as a danger and provides details of the research now linking many childhood disorders to prenatal stress. An brief overview of the research in the book is provided in the following pages.

Part 2 of *Stress Solutions for Pregnant Mothers* presents a new and easy to use method, similar to the point system of well-known diet systems, for women to manage and keep track of their stress levels. Part 3 is the Resource Guide for reducing stress. It is in Part 3 that the value of music and listening therapy are described and included among other recommended stress reduction methods.

The rest of this article summarizes the research connecting prenatal stress and childhood disorders. As you will see, encouraging pregnant mothers to do a listening program can help

boost their baby's potential by helping to break the link between prenatal stress and childhood disorders. I hope it will prove helpful for encouraging pregnant mothers to spend 20 to 30 hours listening during their 3rd trimester.

Attention Deficit Hyperactivity Disorder (ADD/ADHD)

The Children of the 90s study or, more properly, the Avon Longitudinal Study of Parents and Children (ALSPAC) is the longest-running and largest medical study in the world. It includes approximately 14,000 children born in the Avon area of England (around Bristol and Bath) between April 1, 1991 and December 31, 1992. This study is presented in detail in *Stress Solutions for Pregnant Mothers* and the findings are summarized here as they pertain to prenatal anxiety and stress.

In 2002, an important paper on prenatal stress was published from the data collected on Avon mothers and children.¹ The study included approximately 7,500 mothers and babies from Avon.² This paper compared the mothers' reported prenatal anxiety levels to the problems they later reported about their 4-year-old children.

Avon mothers completed prenatal questionnaires at 18 weeks and 32 weeks gestation including their prenatal ratings of stress and anxiety. The forms also collected on their health, smoking and drinking history, and statistics about their pregnancy and delivery. Additional postnatal questionnaires about the mother's levels of anxiety, stress and depression were gathered when the child was 8 weeks, 8 months, 21 months, and 33 months old. The children went through a thorough hands-on evaluation when they reached the age of 4. For the purposes of the study, the mothers were considered *anxious* if their anxiety ratings ranked in the top 15 percent.

Dr. O'Connor and his Avon prenatal stress research team³ compared the mother's level of anxiety during her pregnancy to how she rated her child's conduct problems, emotional adjustment issues, and problems with attention at age 4.⁴ They found that mothers who scored in the top 15 percent of anxiety at 18 weeks or 32 weeks gestational age were 2 to 3 times more likely to have a child with significant emotional problems or conduct difficulties at age 4. Mothers who reported high prenatal anxiety at 32 weeks gestation were likely to have children with attention problems. The authors reported this as a "strong and likely causal relationship between high levels of prenatal anxiety and the child's conduct problems, emotional adjustment, and attention difficulties at age 4."

¹ O'Connor et al. (2002). *British J of Psychiatry*. Dr. Thomas O'Connor was the first author on this and several of the articles. Drs. Jonathon Heron, Jean Golding, Michael Beveridge, and Vivette Glover are the other important members of the ALSPAC prenatal stress research team.

² The entire sample from the Avon study is approximately 14,000 mother-child pairs. The 2002 journal article reported on a smaller sample of 7,448 for several reasons. The data were collected over several assessment times. To be in this particular data analysis, all questionnaires from all time points needed to have been collected within a specified time frame. This caused the drop in the total number of mother-child pairs.

³ Many different research topics and teams exist.

⁴ Elander, J. and Rutter, M. (1996). *Child Psychology and Psychiatry Review*. Reference for the scales used to rate children's behavior, emotional adjustment and attention.

By age 10, the children's problems had not gone away.⁵ Another study found that the mother's high stress levels during pregnancy predicted the child's high cortisol levels at age 10. The higher the mother's prenatal cortisol levels were, the higher the child's cortisol levels were later. Data is still being gathered on the Avon children.

The results from Avon, England are compelling in and of themselves; however, studies are now being published all over the world with the same or similar findings. It turns out that the more the mothers report anxiety during their pregnancy, the more likely it is that, even 8 and 9 years later, their children will be diagnosed as overly active, hard to manage, overreacting to stress, and as being anxious.⁶ The authors of this study took a number of other possible explanations into consideration by looking at factors like smoking during pregnancy, the child's birth weight, the mother's educational level, and whether or not the mother was anxious after the birth. None of those factors explained the data. It turns out that the more the mothers were reporting anxiety during the early part of their pregnancy, the more likely it was that 8 and 9 years later, their children would be seen as overly active, hard to manage, overreacting to stress, and as being anxious.

Childhood Anxiety and Depression

In addition to the increased probability of Attention Deficit Disorder, increased childhood anxiety and dysfunctional stress reactions (excessive fear, irritability, difficulty calming once upset, hiding, freezing when in danger, etc.) are strongly associated with prenatal stress. The link between prenatal anxiety and the later development of anxiety in child is strong and there are many studies that report and support this phenomenon.⁷ If the mother reported a lot of anxiety during her pregnancy, she would have likely had high levels of blood cortisol, which would have circulated in the developing brain of the fetus. The developing brain of the child adjusts to the higher levels of cortisol and begins to consider that level as "normal." Thus, the fetal brain reduces the number of cells in the part of the brain that will later help the child deal with stress, making it more likely that the child will show early anxiety and possibly depression (H-P-A dysregulation). There are other studies looking at increased problems in the newborn, such as irritability and increased difficulty calming the child down once upset.⁸

Autism and Spectrum Disorders

Several converging lines of evidence suggest that prenatal exposure to the mother's stress may increase the child's risk for Autistic Disorder. The increased risk of autism is also associated with a significantly increased risk of depression and schizophrenia. Some of the studies indicate that the exposure to prenatal stress produces behaviors that "resemble" or look like the symptoms of autism. In other words, while there are many variables or factors that potentially increase the risk of autism, one strong factor that is related and may be imminently preventable is the exposure to prenatal stress. An excellent review article by Kinney et al was published as recently as 2008, which discusses stressful life events (like losing your job or your husband's source of income, financial stress in the household, or the death of a loved one) and environmental hardships that can distress an expectant mother. The authors also acknowledge that prenatal

⁵ O'Connor, et al. (2005). *Biological Psychiatry*.

⁶ Van den Bergh, Bea R. H. and Marcoen. (2004). *Child Development*.

⁷ O'Connor, Heron, Golding et al. (2002). *British J. of Psychology*.

⁸ Van der Wal, M. F., van Eijsden, M., & Bonsel, G. J. (2007). *J of Dev and Beh Pediatrics*.

stress has received little attention. But, the review article definitely links prenatal stress to an increased risk of autism.⁹ This paper is a tremendous resource for people who want to read further as the authors reviewed well over 40 recent articles, many of them published since 2000.

Lower IQ Scores

Surely you have seen books that have “raising your IQ or your child’s IQ” in the title. Our society has prized intelligence as the key to success in school and in business. It turns out that Emotional Intelligence is more highly related to success in business and in life. But, still, moms want their kids to be smart enough to do well and to be successful in school and to have meaningful work and partnerships. As it becomes better known that prenatal exposure to stress is now considered to cause delays in development, and, in particular, motor and intellectual development, I think people will try even harder to find ways to reduce the impact of prenatal stress on our children.

In the last 5 or 6 years, several studies have been published suggesting that prenatal stress, particularly during the early and middle trimesters, can drop your child’s IQ by an average of 8 points.¹⁰ An 8-point drop can actually be a very significant loss and could result in a child dropping from an average level of intellectual functioning to a below average level of intelligence. For example, an IQ of 100 is at the 50th percentile, meaning that if there were 100 children randomly selected, a score of 100 would be in the middle of the group. If you lost 8 points, that brings your score to 92, which is only at the 30th percentile. In other words, instead of standing at position 50 in the middle of the group, you would be standing at position 30 and some twenty more people would be ahead of you, competing for that job or grade.

In the study mentioned above, Dr. Huizink and her team collected self-report questionnaire data at 3 time points on a group of 170 pregnant mothers in the study. Mothers completed questionnaires at three times during pregnancy, and then again at three times after giving birth, answering questions about the frequency of their daily hassles, anxiety about being pregnant, and perceived level of stress. Exposure to environmental stress in the first and second trimesters is associated with an average decrease of eight points on the Mental Development Index (MDI) of the Bayley Scales at age 8 months. It was also found that high levels of prenatal stress in the third trimester, measured with salivary cortisol, predicted lower IQ or mental development as well as a poor level of social adaptability in their children.

Another study of 832 children found that the mother’s cortisol levels in the 3rd trimester were negatively related to the child’s full scale WISC IQ when the children were 7 years old.¹¹ The Verbal IQ scores of the children, whose mothers were in the highest 1/5th of the cortisol levels, was 3.83 points lower than the Verbal IQs of the children in the lowest 1/5th of cortisol.

Childhood Asthma

At this point, several human studies are linking prenatal stress to the higher risk of the baby developing asthma, allergies, and reduced immune function. The stress of poverty has been identified as a risk factor in a study done at Brigham and Women’s Hospital and just published in 2010.¹² This study was led by Dr. Rosalind Wright, at Brigham and Women’s Hospital in

⁹ Kinney, Munir, Crowley, and Miller (2008) *Neuroscience & Biobehavioral Reviews*.

¹⁰ Huizink, Anja C. et al. (2003). *J of Child Psychiatry and Psychology*.

¹¹ Gutteling, B. M. et al, (2006). *Journal of Abnormal Child Psychology*.

¹² Wright, Rosalind J. et al. (2010). *Am J of Respiratory and Critical Care Medicine*.

Boston and an assistant professor of medicine at Harvard Medical School in Boston. This survey included 557 families from Boston, Baltimore, New York and St. Louis, mostly ethnic minorities and mostly living in poverty. A questionnaire asked questions about stresses such as domestic violence and money worries. A sample of cord blood was tested for reactions to various allergens. Children born to more stressed moms had different immune cell responses than children of less stressed mothers.

Reduced Birth Weight, Preterm Birth, and Infant Illness

The list of problems associated with excessive prenatal stress includes a number of problems that can negatively affect the child's health, including reduced birth weight and preterm birth to name just two of the biggest ones. Reduced birth weight is, of course, related to preterm birth. Preterm babies have a higher risk of pulmonary disease, developmental delays, learning disorders, and even infant mortality. Preterm birth is of major concern today and many OB/GYNs are trying to find solutions. Dr. Calvin Hobel, for example, is a perinatologist, a professor of obstetrics/gynecology and pediatrics at University of California, Los Angeles, and the director of Maternal-Fetal Medicine at well-known Cedars-Sinai Medical Center in Los Angeles. Dr. Hobel has served on many national committees, particularly in the areas of his primary research interests, Preterm Birth Prevention and Maternal Stress, including the Surgeon General's Committee on Preterm Birth Prevention. Dr. Hobel has spent a lot of his career documenting the effects of stress on pregnancy and developing ways to help the pregnant woman to relax.

Dr. Hobel and the other physicians involved in research to reduce the number of women affected by preterm delivery have discovered that anxiety and excess stress in the first trimester may be setting the clock for early labor. The reason for this is that when a pregnant woman gets anxious, her nervous system releases epinephrine and norepinephrine, which constrict blood vessels and reduce oxygen to the uterus. Another major factor in the dynamic of prenatal stress and preterm delivery is the placenta's overproduction of corticotropin releasing hormone (CRH) in the first trimester when the pregnant woman is under stress. CRH levels rise throughout the second and the early part of the third trimester and then dramatically increase in the last 6 weeks. CRH regulates the duration of the pregnancy and fetal maturation. The amount of CRH in the woman's blood early in her pregnancy predicts the onset of labor months later.¹³

Prenatal Stress Does *Not* Have to Result in Problems

Despite the strong evidence of a connection between higher levels of prenatal stress and later childhood problems, I want to stress that we are only talking about an *increased risk* of problems. But, we are well beyond just "smoke"; now the "fire" is obvious. Research is ongoing and we will continue to learn more in the coming years. The point to take home is enough evidence now exists to take precautions where it is possible to do so. The necessary steps to reduce these risks are relatively easy to do.

Do any of us really know what a "normal" amount of stress is? And how do we know when the stress we are under is too much stress? The truth is we all handle our tensions in different ways and we all experience different types of life problems. Many variables are involved in *how much is too much* for us and when that extra load on our nervous system will impact our child in the womb and beyond.

¹³ Hobel, C. J., et al. (1999). *Am J Obstet Gynecol*.

Events and situations that could cause distress are around all of us. We cannot avoid stress no matter what we try to do. In fact many young women and their babies do *not* seem to be as affected by daily, even chronic pressures as others do. This tells us something very important: *It is not the external events in and of themselves that are the problem.* If that's true, then identifying the baby's risk by whether a pregnant woman is undergoing "normal" or "abnormal" stress may not be the best way to go about diagnosing the problem. Instead, my best scientific and clinical intuition tells me that the most significant factors are:

- How does your body respond to stressors?
- What is your baseline level of stress at the time you get pregnant?
- And how quickly can you reduce the negative effects on your body?

In other words, *I believe that the pregnant mother's ability to recover from variations in stress is what will determine the impact her strained nervous system has on her baby.* That's why I also believe that we need to and we *can* focus on prevention—how to help expecting women measure their stress levels and then regularly lower the tensions and reduce the possibility of later problems for their babies. And, for the above reasons, I am writing to listening therapy consultants and practitioners that work with pregnant women. You are in a unique position to help reduce prenatal stress using music and listening therapy in combination with the new Formula for Stress Reduction from *Stress Solutions for Pregnant Mothers*.

REFERENCES

- Elander, J. & Rutter, M. (1996). An update on the status of the Rutter parents' and teachers' scales. *Child Psychology and Psychiatry Review*, 1, 31-35.
- Gutteling, B., Weerth, C., Zandbelt, N., Mulder, E. J. H., Visser, G. H. A., and Buitelaar, J. K. (2006). Does Maternal Prenatal Stress Adversely Affect the Child's Learning and Memory at Age Six? *Journal of Abnormal Child Psychology*, 34, 6, 787.
- Hobel, C. J., Dunkel-Schetter, C., Roesch, S. C, Castro, L.C., and Arora, C. P. (1999). Maternal plasma corticotropin-releasing hormone associated with stress at 20 weeks' gestation in pregnancies ending in preterm delivery. *Am. J. Obstet. Gynecol.*, 180 (1 Pt 3): S257-63.
- Huizink, A. C., Mulder, E.J., and Jan, K. (2003). Stress during pregnancy is associated with developmental outcome in infancy. *J Child Psychol Psychiatry*. 44: 810–818.
- Kinney, Dennis K., Munir, Kerim M., Crowley, David J. and Miller, Andrea M. (2008). Prenatal stress and risk for autism. *Neuroscience & Biobehavioral Reviews*, 32: 1519-1532.
- O'Connor, T. G., Ben-Shlomo, Y., Heron, J, Golding, J., Adams, D., and Glover, V. (2005). Prenatal Anxiety Predicts Individual Differences in Cortisol in Pre-Adolescent Children. *Biological Psychiatry*, 58, 211-217.
- O'Connor, T. G., Heron, J, Glover, V, & ALSPAC Study Team. (2002). Antenatal anxiety predicts child behavioral/emotional problems independently of postnatal depression. *Journal of the American Academy of Child and Adolescent Psychiatry*, 41, 1470-1477.
- O'Connor, T.G., Heron, J., Golding, J., Beveridge, M. & Glover, V. (2002). Maternal antenatal anxiety and children's behavioural/emotional problems at 4 years. Report from the Avon Longitudinal Study of Parents and Children. *British Journal of Psychiatry*, 180, 502-508.
- Van den Bergh, Bea R. H. and Marcoen, A. (2004). A. High antenatal maternal anxiety is related to ADHD symptoms, externalizing problems, and anxiety in 8- and 9-year-olds. *Child Development*; 75: 1085-1097.
- Wright, Rosalind J., Visness, C., Calatroni, A. et al (2010). Prenatal Maternal Stress and Cord Blood Innate and Adaptive Cytokine Responses in an Inner-City Cohort. *American Journal of Respiratory and Critical Care Medicine*, 182: 25-33.