Freeway Pollution Linked with Autism?

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In recent years, the topic of external factors triggering the onset of autism has been a subject of controversy as groups try to pinpoint controllable variables that could help prevent or offset the developmental disorder. Autism, characterized by delayed social development and impaired communication and interaction skills, manifests itself within the first few years of a child's life and has been largely considered out of the control of both parents and their children. However, as more is discovered about autism and the number of affected children increases steadily every year, it seems as though there may be other causes contributing to the developmental disorder. While it is uncertain whether children with autism are directly born with the disease or if their environment triggers the onset of the disorder, it is undoubtedly clear that there is much to be uncovered about this topic.

Dr. Heather E. Volk, an assistant professor at the Department of Preventative Medicine at the Keck School of Medicine, is one of the latest to explore the possible impact environmental factors specifically have on developmental disorders such as autism. In a study published by a team headed by Dr. Volk, the correlation between children with autism and the proximity of their mothers' residences to freeways during and shortly after their pregnancy was examined to determine the effect of vehicular pollutants on a child's development.

This study is a culmination of Dr. Volk's long-time interest in the impact of environmental factors upon human development as well as a mere starting point for her future work. Dr. Volk said her focus on developmental disorders during her post-graduate studies fueled her interest in further exploring the relationship between genetics and the physical manifestation of such disorders over time.

"As I was doing my PhD coursework, I studied neurodevelopmental disorders, things like ADHD and autism," Dr. Volk said. "I came here to USC to come do a post-doctoral fellowship in genetics, looking at genes and their interactions."

During her research at the university, Volk also began to wonder about the role of the environment in genetic expression and whether or not it can be noted as a considerable factor in the development of health-related issues.

"While I was doing my post-doctorate [studies], I got really interested in the environment and disease, how that works with genetics to cause neurodevelopmental disorders," Dr. Volk said. "That training really got me interested in looking for environmental risk factors for autism."

With the infinite number of directions to approach the study in, Dr. Volk said she found a starting point to her research after noting that several of the physical indicators of autistic children have been determined to be influenced by environmental factors by previous studies.

"I realized a lot of the same pathways that are induced by air pollution in regard to asthma, things like inflammation and oxidative stress are increasingly being indicated as present in children with autism," Dr. Volk said. "So I thought there might be some common factor underlying these diseases."

After compiling data and performing several tests that examined this possible relationship further, Dr. Volk and her team published their findings, "Residential Proximity to Freeways and Autism in the CHARGE Study," in the December 2010 edition of *Environmental Health Persepctives*. They found that children living within a relatively close proximity to a freeway at or around the time of birth face an increased risk of autism, suggesting that environmental factors may impact a fetus in harmful ways and ultimately have a control over its physical and genetic developments.

Using data from the Childhood Autism Risks for Genetics and the Environment (CHARGE) study, a case-control study of pre-school children from around California based at the University of California, Davis, the research team compared 304 cases of autism and 259 generally normal control cases by calculating each subject's distance from both freeways and major roads during vitally important developmental phases, including both gestation and early infancy. The proximity of mothers' residencies during the first, second and third trimesters of their pregnancy to the nearest interstate and state highways or major road, was calculated using ArcGis software and information from prenatal records. This data was then used to estimate the exposure to residential traffic pollutants and determine the relationship between the distances from freeways and autism.

Approximately ten percent of the children involved in the study were found to have lived within 309 meters, or 1000 feet, of a freeway at or around the time of birth. Increased risks of autism were observed among this group, with the subjects believed to be twice as likely as others to eventually develop the disorder. Such a correlation points to a possible direct relationship between high toxin or pollutant levels and abnormal cognitive development, which could in turn lead to the onset of autism and other neurological deficits.

On the other hand, the same pattern was not evident in children living next to major roadways at or around the time of birth. No substantial relationship was determined between children with autism and their proximity to such roadways, which then places a special importance on the results obtained from the tests comparing the prevalence of autism among children who live near or close to freeways.

Freeways, subject to more vehicular contact due to the vast number of cars and trucks that can speedily pass through an area, cause much greater concentrations of pollutants in the areas surrounding them as compared to the relatively low volume traffic encountered on even major roadways. Previous studies show that the pollutant particles are at greater concentration close to freeways and begin to become more negligible at distances approximately 300 meters or more away from the freeway. Such results correlate directly with the relationship established by Dr. Volk and her team between the close living proximity of many children with autism to freeways.

The toxic chemicals released by vehicles on freeways are thought to have especially detrimental effects on development if exposure occurs during critical maturation periods of gestation or infancy as fetuses and young children will be more sensitive to the introduction of toxins into their system. For example, the presence of toxins may have altered standard growth among the children of the study found to be living within close proximity of a freeway and caused abnormal brain development and cognitive function.

High levels of pollutants could also deleteriously impact a child's genetic makeup and trigger normally functioning genes to instead produce harmful effects on the child's overall development. Such disruptions in development could possibly account for the large number of cases of autism that continue to arise among children living at or near such areas and explain why more and more children are developing the disorder every year.

"Everyone has a little bit of a baseline inherent risk due to your genetic makeup and you can come to encounter with different things in the environment over time and that can alter your risk," Dr. Volk stated in an interview with KTTV Fox 11 News.

Further reinforcing the dangerousness of vehicular pollutants on children's neurodevelopment, when the subjects' demographic characteristics were accounted for in the study, the backgrounds of each of the subjects proved to be an insignificant factor in the overall results Dr. Volk and her team obtained.

"I think we were surprised at how the results didn't change when we tried to account for things like socio-economic status and demographic characteristics," Volk said. "There's some literature indicating that people of lower SES (social economic status) live closer to freeways, so they might be more likely to be exposed. In our data, these results are pretty robust; we didn't find any sort of affect that might come into play."

This was one of the most interesting conclusions of the research to Dr. Volk since such negligibility places additional emphasis on the pervasive power of such toxins, which were concluded to act impartially towards those of various social and economic backgrounds. It also supports the perspective that in terms of environmental factors, specific types and concentrations of vehicular pollutants may have the largest impact on the physical expression of genes in neurodevelopmental disorders such as autism.

Though the results of this study are certainly a cause to study the subject further and develop a more comprehensive understanding of the relationship between environmental pollutants and neurodevelopmental disorders, Dr. Volk wants to assure easily concerned parents to not be alarmed by the findings, but to rather be just aware of the increasingly noticeable trends between environmental toxins and several health-related disorders.

"This is the first time we are examining this interaction so we really don't quite understand the whole relationship between air pollution and autism quite yet," Volk said. "We need to do additional research to follow it up and understand the importance of the timing of the exposure as well as if there is a particular pollutant that might be involved."

Yet while no conclusive points were reached about which specific toxins and pollutants potentially cause the malicious developmental defects leading to autism, the study further supported the view that general environmental factors as well as gene-pollutant interaction could have a larger impact on people's lives than is currently known. Now that such a sensitive relationship between humans and the environment has been established, further studies and research will be needed to identify exactly what should be done to prevent such negative effects from altering normal growth and development. Dr. Volk has already begun another project that would allow her and her team to expand upon and develop the basic relationships determined in this study.

"We are already working on a follow up trying to look at the amount of air pollution individuals might be exposed to in this study," Dr. Volk said. "We are also going to look at some genetics to look at individuals who are particularly susceptible based on their genetic makeup to be at a further risk for autism."

Results from such studies may further clarify the biological mechanisms underlying the interactions between the body and pollutants, the specifics of which have been quite ambiguous despite past studies and research. Determining the actual concentration of environmental toxins the body can tolerate before reacting negatively or establishing healthy daily exposure limits would be the first step to changing general societal actions and attitudes concerning environmental, especially vehicular, pollution. While it has been a growing issue in the political, economical and technological arenas, pollution has been fairly unchecked at this point, furthering the notion of large urban cities' low standards for air quality and environmental surroundings. Citizens have thus grown seemingly accepting of the amount of toxins being released into the environment on a daily basis as they know of no other alternative. However, general apathy and passiveness to the clearly growing number of health-related problems, including, but not limited to, autism, caused by pollutants will only harm society as a whole.

If further work building off Dr. Volk and her team's initial findings is able to create a substantial case of just how dangerous toxins really are to the health of the general public and prove how basic living conditions are putting people's physical health at risk, effective and permanent improvements would have to be made in order to control such hazards. Legislative regulations coupled with technological improvements could be the basis for lasting changes that lead to noticeable improvements in public health and even help to limit the risks for those with high genetic susceptibility to neurodevelopmental disorders.

The seemingly direct relationship between environmental toxins and autism established in Dr. Volk's research has several similarities to the results of previous studies that focused on the impact toxins have on several other major health-related issues. If the factor of environmental toxin exposure can be controlled and even offset, many people may reap the benefits of prevention and avoid the life-changing affects brought about by serious diseases and disorders.

"There's actually quite a bit of literature looking at exposure to air pollutants based on living near freeways and major roadways. My colleagues here at Environmental Health have done a lot of research looking at exposure to pollutants from traffic and their effects on asthma and lung function. There's other research going on looking at heart disease and at cancer and at early onset dementia. So there's quite a bit of data saying that exposure to pollution coming from traffic isn't very good for your health. In this case, it is in regard to autism and I think that's especially interesting due to the rising autism rates and the fact that it is a pre-natal exposure, hopefully something that we can look at and intervene on."

Dr. Volk and her team's findings are especially applicable to the citizens of the ever-smog-ridden city of Los Angeles and its surrounding communities, which have been long known for their large stretches of freeways winding in and around populous residential areas. Dr. Volk hopes future endeavors exploring this gene-environment interaction further will allow her to specifically focus on areas around Los Angeles in order to determine the potential risks the surrounding environment may have on the public's health.

"The kids in the CHARGE study come from across California, most centered around San Francisco, Sacramento and Los Angeles," Dr. Volk said. "But I think it would be really

interesting to do this study in other parts of the country, or specifically down here in L.A., where we have a mix of pollutants that's pretty unique and we are all highly exposed, making it relevant to know what the health effects of those pollutants might be."

Media clip: Dr. Volk's interview with Fox 11 News in January
http://www.myfoxla.com/dpp/health/living-near-freeways-linked-autism-risk-20101216