# Brain Tumors and Traffic-Related Air Pollution, $PM_{2.5}$ and $NO_2$

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Children may be especially susceptible to the impact of air pollution on the central nervous system (CNS) due to the immaturity and active growth of their brain, lungs, and immune system. Air pollution has been associated with increased risk of several central nervous system disorders in children, including Autism, cognitive dysfunction, and potentially brain tumors. [1-5] Particulate air pollution from vehicle traffic is a common environmental exposure that is recognized as a source of chronic neuroinflammation. [6] Experimental evidence suggests that when inhaled, ultrafine (UFP; <0.1 μm in diameter) and fine particles ($PM_{2.5}$; <2.5 μm in diameter) can reach the brain and cause lesions and inflammatory responses in animals. [7-13] Direct exposure of the brain to particulate matter may occur by movement of particles along the olfactory nerves to the brain, or by their passage through the alveolar wall of the lungs into the systemic circulation and eventually across the blood brain barrier.[8, 11, 13, 14] Other mechanisms by which pollutants may impact the brain include inflammation and/or oxidative stress.[6, 8, 11-13] While it is not known whether air pollution is a risk factor for brain tumors in children, exposures resulting in direct DNA damage or chronic inflammation are both associated with elevated risk of cancer.

To further investigate the potential role of air pollution on brain tumor risk in children, we assessed the association between traffic related air pollutants and childhood brain tumor (CBT) risk, with exposure estimates for fine-particulate air pollutants ($PM_{2.5}$) and nitrogen dioxide ($NO_2$) using data from a population-based case control study of brain tumors in Southern California, USA. An exposure assessment for $PM_{2.5}$ and $NO_2$ was completed based on residential address of a child from the mother's pregnancy with the child to diagnosis using air pollution monitoring records and land use regression models. The study included children diagnosed in Los Angeles County from 1984-1991 who were 0-19 years of age at diagnosis and population-based controls. We found a significant increase in risk of brain tumors in children with increasing levels of exposure to $PM_{2.5}$; specifically we found a 22% increase in risk of CBT per 3 ug/$m^3$ exposure to fine particulates when considering residential history from birth until diagnosis. Risk due to exposure to $NO_2$ was not elevated after adjustment for $PM_{2.5}$. Our findings suggest that cumulative exposure to traffic related air pollutants is associated with an increased risk of childhood brain tumors. The exact component of air pollution that may explain this association requires further investigation.

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