Secondhand Smoke Exposure and Low Blood Lead Levels in Association with Attention-Deficit Hyperactivity Disorder and its Symptom Domain in Children: A Community-based Case-Control Study


Nicotine Tob Res (2016)
doi: 10.1093/ntr/ntw152
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Aim.
Second-hand smoke (SHS) is a major indoor pollutant. We examined the possible association between exposure to both SHS and low levels of lead and attention deficit–hyperactivity disorder (ADHD) and its symptom domain in children.

Methods.
This case–control study was based on the results of a community survey using the ADHD rating scale conducted in 49 elementary schools. Both cases and control subjects were confirmed by a child psychiatrist. Each case was matched with one control subject according to gender, school, and grade in school. Using a multivariate conditional logistic regression model, we analyzed 214 case–control pairs of children who ranged in age from 6 to 10 years. Urine and blood levels of cotinine and of lead were determined, and information pertaining to SHS exposure was obtained by means of a questionnaire.

Results.
Exposure to low levels of lead (geometric mean=1.65 μg/dL) was related to ADHD, particularly inattention (Odds ratio (OR)=1.67, 95% Confidence Interval (CI)=1.07-2.59), whereas SHS exposure was associated mainly with hyperactivity/impulsivity (OR=3.85, 95% CI=1.55-9.56). In the pathway from blood lead to hyperactivity/impulsivity, children’s SHS exposure mediated and indirectly accounted for about 73% of this relationship. The combined exposure to lead and SHS synergistically increased the risk of ADHD, evident as both inattention and hyperactivity/impulsivity.

Conclusion.
SHS, which is associated with hyperactivity/impulsivity in particular, combined with exposure to low blood levels of lead synergistically increased the risk of ADHD. Therefore, the exposure of children to both SHS and lead needs to be reduced.

Implications.
Although exposure to low levels of lead has been shown to be associated with ADHD, there is little evidence of symptom domain specificity. In our study, low blood lead levels were related to inattention. In addition, prenatal or postnatal exposure to SHS increased the risk of ADHD, particularly hyperactivity/impulsivity. Combined exposure to lead and SHS synergistically increased the risk for both these ADHD symptom domains. To protect children from environmental risk factors related to ADHD, it is necessary to further reduce children’s exposure to SHS and lead, even in those with low blood lead levels.