Editorial

Does traffic proximity at home and school influence asthma exacerbations?

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The adverse health effects of air pollution are an important issue for policy makers and continue to be of high public health interest. Many studies published during the last decades provide sufficient evidence that increased (short-term) exposure to ambient air pollutants is associated with increasing severity and exacerbations of pre-existing asthma, which increase the number of emergency hospital visits[1] and associated economic burden.[2] However, the potential role of air pollution on the development of childhood asthma remains controversial but is particularly relevant given that asthma is a highly prevalent pediatric condition, and health effect assessment strategies suggest that air pollution might contribute to a significant burden of childhood asthma cases.[3] Although some large cohort and cross-sectional studies have suggested a likely role of air pollution on asthma development (as reviewed by Khreis et al[4]), a recent systematic review of birth cohort studies (supplemented with previous systematic reviews and recent high-quality original publications) did not report strong evidence for adverse associations between air pollution exposure and development of any allergic outcome.[5]

A common criticism of studies focused on asthma development, which might explain some of the inconsistencies in the literature, is that air pollution exposures are nearly universally assessed at the home address only under the assumption that air pollution levels around the home are a good approximation of a subject's total daily air pollution exposure. There is some evidence to support this assumption. For example, a Swedish[6] and French[7] study showed that traffic exposures and characteristics assessed at the home address are good approximations of those at schools, possibly because schools tend to be located in the close vicinity of homes in these study areas. However, a study conducted in 2497 children participating in the Southern California Children's Health Study found that associations of asthma with traffic-related air pollution from nearby sources at schools were independent of, and of similar size as, the effects of air pollution levels estimated to the home addresses.[8] In general, uncertainty remains as to the amount of misclassification that can be introduced by modeling air pollution concentrations to the home address only and how this might affect estimated associations with allergic disease development.

The study by Hauptman et al[9] aimed to fill this knowledge gap by analyzing home and school proximity to major roadways (assessed individually and using a time-weighted composite measure that includes both home and school exposures) with pediatric asthma exacerbations (measured using several outcomes, including maximum number of asthma symptom days over a 2-week period; Fig 1). The analyses included data from a small sample of 350 school-aged children with asthma participating in the 5-year prospective School Inner-City Asthma Study conducted in the northeastern United States. The authors concluded that air pollution exposure at home and potentially also at school might be associated with asthma exacerbations in inner-city schoolchildren. Although of some interest, 3 issues should not be overlooked when interpreting this study's contribution to the field.

First, the analysis was conducted exclusively in children with pre-existing asthma, and thus the role of ambient air pollution exposure on the development of asthma cannot be assessed, which is the major remaining uncertainty. As mentioned, there is already rather strong and consistent evidence based on numerous large studies that supports an adverse role of short-term increases in ambient air pollution concentrations on asthma exacerbations. The study by Hauptman et al[9] evaluated whether differences in long-term air pollution concentrations (captured by comparing spatial proximity to major roadways) are associated with increased asthma exacerbations, which is conceptually more difficult to understand.

Second, one of the study's findings is that the maximum number of asthma symptom days reported over a 2-week period increased (nonsignificantly) with greater distance to major roadways up to a threshold at 100 m by using the home/school composite measure (which is contrary to what might be expected). Only after this 100-m threshold were (significant) associations observed between fewer asthma symptom days and greater distance from a major roadway (which is in line with expectations; see Fig 1 in Hauptman et al[9]). Because of this apparent nonlinear relationship, all associations with health outcomes are estimated and reported as effects of a 100-m change in distance to major roadways of greater than this 100-m threshold, although 62% and 40% of participants attended schools and lived within 100 m of a major roadway, respectively. The rationale for this approach, both biologically and statistically, is difficult to comprehend and thus so are the resulting effect estimates.

Third, associations estimated separately for distance to major roadways from the home (see Table E2 in Hauptman et al[9]) and

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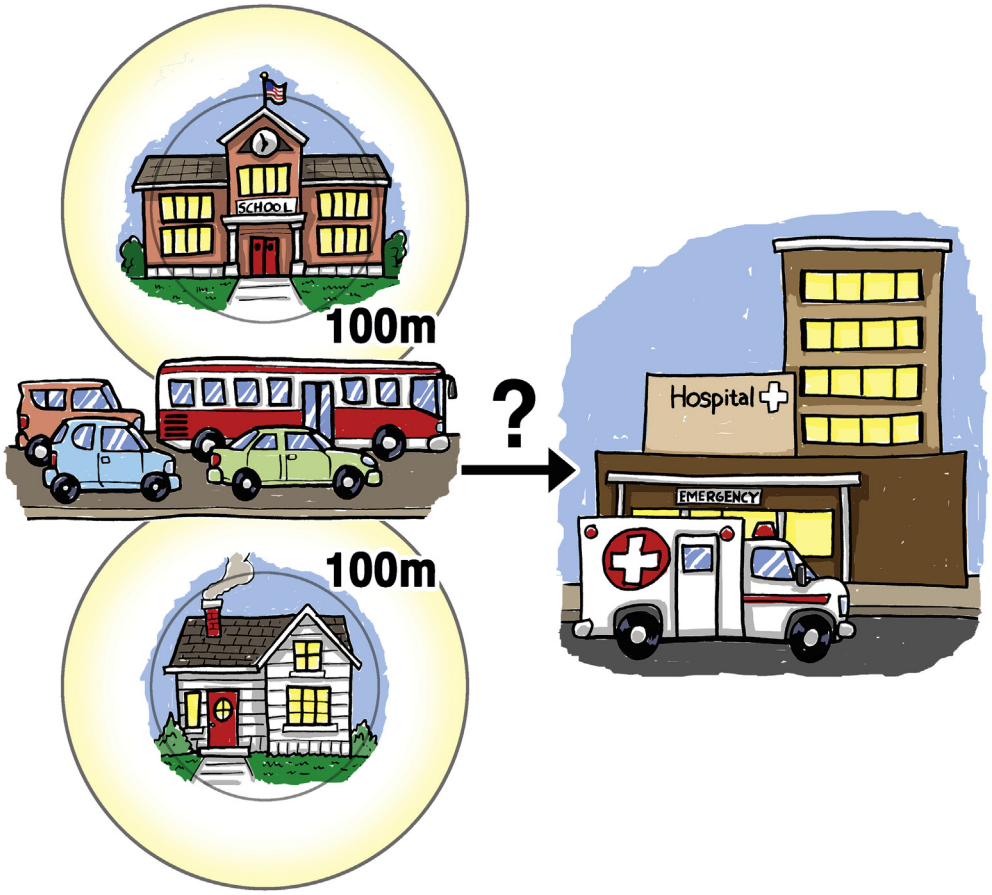

FIG 1. Does traffic proximity at home and school influence asthma exacerbations?

school (see Table E3 in Hauptman et al[9]) convincingly show the importance of the home environment but do not provide support for a role of the school environment. In fact, increasing distance from a major roadway appeared to be negatively associated with small decreases in both percent predicted FEV_1 and forced vital capacity when considering only the effect of major roadways around schools (see Table E3 in Hauptman et al[9]). Only when school-based distances from major roadways were dichotomized (greater than vs less than 100 m) were associations observed in the expected direction for most of the primary and secondary asthma morbidity–related outcomes considered (see Table E4 in Hauptman et al[9]).

The authors should nonetheless be commended on their work, which is largely based on "hard-to-reach" vulnerable populations that are frequently exposed to high levels of air pollution yet underrepresented in epidemiologic studies. For example, the study population was ethnically diverse (35% black/African American, 37% Hispanic/Latino, and 23% mixed/other, with only 5% identifying as white), and 41% reported annual household incomes of less than USD $25,000, the latter of which indicates that a large percentage of lower-income families were included. Finally, it is noteworthy that the distances to major roadways from the home and school addresses were not correlated for the 350 children participating in this study in the northeastern United States (Pearson correlation, 0.08). In contrast, very high correlations were reported in a Swedish study including more than 2500 children living in Stockholm (time-weighted average lifetime air pollution exposures at home addresses were highly correlated with total exposure estimates also including daycare and school addresses ($r = 0.98$).[6] This result highlights the likely important differences between studies conducted in Europe and North America and raises the question of whether results generated in one geographic area can be generalized to another.

In conclusion, we highly appreciate the effort put forth by Hauptman et al[9] to try and reduce air pollution exposure misclassification by considering the school environment. However, in our opinion the results generated do not provide compelling evidence to suggest that the distance of a school from a major roadway has a meaningful effect over and above air pollution levels at the home. Nonetheless, we strongly believe that higher noise levels, greater potential for traffic accidents, and lower walkability of schools close to busy roadways are sufficiently strong arguments to support policies that prohibit schools to be built near major roadways.

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