



## Reply

## Reply to comment on “Resuspension of urban soils as a persistent source of lead poisoning in children: A review and new directions” by John D. Bogden and Francis W. Kemp

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The authors welcome the opportunity to clarify some of the most important points in their recent review paper. The comment by Bogden and Kemp supports the concept that Pb resuspension in urban areas is an important public health burden to young children, the main conclusion. They feel, however, that the role of vitamin D in affecting at least part of the seasonality signal observed in children's blood Pb values has been dismissed too quickly. In particular, the 4–8 year old cohort (Kemp et al., 2007) shows some statistically significant correlations between vitamin D and blood Pb levels. The authors agree that they should have noted this relationship in the older cohort, but this omission reflects the different implicit focus of the review – namely the 0–5 year old cohort, which is the age range for which Pb poisoning has the greatest neurological impact (e.g., Jusko et al., 2007).

This comment brings up an important issue related to the uptake and absorption mechanisms for Pb. There are three reasons to argue that soil Pb resuspension is a dominant vector for Pb exposure to young children: (1) the authors' analysis of seasonality patterns in large populations of children in several cities revealing that climatic factors alone can predict blood Pb levels (Laidlaw et al., 2005), (2) the robustness of this prediction for children from cities with very different climatologic regimes, ranging from mid-continent to coastal monsoon (Laidlaw et al., 2005; Laidlaw and Filippelli, 2008), including cases where seasonal fluctuations in blood Pb levels predicted by soil resuspension models do not coincide with sunlight exposure seasons, and (3) the lack of correlation between vitamin D, a sunlight exposure/bone remineralization indicator, and blood Pb levels for young children (0–4 years of age; Kemp et al., 2007). It is concluded from this that the soil resuspension model must be dominant for very young children, but that the vitamin D model may in fact become an additional factor once children reach the 4–8 year range.

So, what factor(s) causes this age difference in Pb risks? Bogden and Kemp note in their comment that physiological differences are important. The present authors would argue that both physiology AND behavior drive the age differences that are seen. Young children, with hand-to-mouth exploration behavior, crawl-

ing locomotion, and indiscriminant intestinal systems, ingest and absorb dust-borne Pb to a much greater extent than do children of 5 years and older. Although the sunlight exposure mechanism may be active for even these young children, the dust resuspension overwhelms this mechanism as a human health menace. As the behavior and physiology of children change, not only do mean blood Pb levels decrease, but also some indication of the sunlight/vitamin D mechanism noted by Kemp et al. (2007) begins to appear in seasonal variations in blood Pb. Of course, that relationship might not be causal, but causality can't be discounted either. So while the general statement in the Comment by Bogden and Kemp that both mechanisms may operate is perhaps correct, the key is that for the 0–5 year old population at greatest risk for permanent neurologic damage from Pb, the soil resuspension pathway is dominant.

The authors thank Bogden and Kemp for expanding on the abridged summary of their work that appeared in the review, and applaud their efforts to understand physiological controls on childhood Pb poisoning. Childhood Pb poisoning is not a thing of the past, especially for the urban poor, and it is important to analyze the multiple factors involved to fashion effective ways to combat this public health menace.

### References

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