

## Hypertension and Low-Level Lead Exposure: A Scientific Issue or a Matter of Faith?

To the Editor:

Vupputuri et al<sup>1</sup> analyzed the NHANES III data. They reported that among blacks, a 3.3  $\mu\text{g}/\text{dL}$  increment in the blood lead concentration was associated with an increase in systolic pressure averaging 0.82 mm Hg in men and 1.55 mm Hg in women. In contrast, blood pressure was not associated with the blood lead level among white men and women.

We analyzed the same NHANES III database.<sup>2</sup> In line with Vupputuri's article, we also found a significant and positive relationship between systolic blood pressure and the blood lead concentration in blacks. On the other hand, our analyses revealed significant and negative associations between diastolic pressure and blood lead in whites. We concluded that, across the NHANES III race and sex strata, the relationship between blood pressure and lead exposure was not consistent and should probably be attributed to residual confounding rather than to causation. Vupputuri et al emphasized the positive results and disregarded alternative interpretation of their findings.

A recent meta-analysis of 31 studies revealed only a weak association between blood pressure and blood lead, which is probably not causal in nature.<sup>3</sup> Overall, a twofold increase in the blood lead concentration was associated with a 1.0 mm Hg rise in systolic pressure (95% CI: +0.5 to +1.4;  $P < 0.001$ ) and with a 0.6 mm Hg increase in diastolic pressure (95% CI: +0.4 to +0.8;  $P < 0.001$ ).

Although Vupputuri's findings were confined to blacks, the authors speculated that reducing the environmental exposure to lead might lead to a population-wide decrease in diastolic pressure of 2 mm Hg, which would result in a 17% reduction in the prevalence of hypertension and a 15% decrease in the risk of stroke. Our meta-analysis suggests that, if the relationship between blood pressure and low-level lead exposure would be causal and reversible, for which there is no evidence, the estimates of benefit in Vupputuri's extrapolations are highly speculative.

The possible role of low-level environmental exposure to lead in the pathogenesis of hypertension is a fascinating hypothesis with many uncertainties. The matter is not served by selective presentation or interpretation of data.

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1. Vupputuri S, He J, Muntner P, Bazzano L, Whelton PK, Batuman V. Blood lead level is associated with elevated blood pressure in blacks. *Hypertension*. 2003;41:463–468.
2. Den Hond E, Nawrot T, Staessen JA. The relationship between blood pressure and blood lead in NHANES III. *J Hum Hypertens*. 2002;16:563–568.
3. Nawrot TS, Thijs L, Den Hond EM, Roels HA, Staessen JA. An epidemiological re-appraisal of the association between blood pressure and blood lead: a meta-analysis. *J Hum Hypertens*. 2002;16:123–131.

### Response: Hypertension and Low-Level Lead Exposure in African Americans: A Public Health Reality

The effect of low-level environmental exposure to lead on blood pressure is not only a "fascinating hypothesis" but also a public health reality, especially for those at a socioeconomic disadvantage. Our analysis showed a positive and significant association between

blood lead levels and blood pressure in a large representative national sample of African Americans. This association was consistent for systolic and diastolic blood pressure and for African American men and women and in agreement with many previously published reports cited in our manuscript.<sup>1</sup> Furthermore, we found that a one-standard-deviation higher level of blood lead was associated with an 8% and 39% higher prevalence of hypertension in African American men and women. We did not find significant inverse associations between blood lead levels and blood pressure as Den Hond et al claimed. Our findings have important public health implications because our study also indicated that African Americans had significantly higher levels of blood lead. Reduced environmental exposure to lead in African Americans might be an important component of the comprehensive strategy to prevent the disproportional burden of hypertension in African Americans.

Nash and colleagues<sup>2</sup> also analyzed data from NHANES III and reported that, at levels well below the current US occupational exposure limit guidelines (40  $\mu\text{g}/\text{dL}$ ), blood lead level is positively associated with both systolic and diastolic blood pressure and risk of hypertension among women aged 40 to 59 years. They concluded that their results provide support for continued efforts to reduce lead levels in the general population, especially women.

We are puzzled that Den Hond et al decided to overlook these associations, holding it as "a matter of faith" that the small effects could not be important even though they were statistically significant and consistent. Interestingly, they chose to disregard significant differences in race-stratified models, attributing these differences to unmeasured factors, rather than accept the potential implications of known racial differences in level of exposure to environmental lead in the United States and possible racial susceptibility differences to the effects of lead. In their meta-analysis, the correspondents admitted to observing racial differences in blood pressure due to blood lead level; however, no data or further elaboration on this subgroup analysis was mentioned, and further, the correspondents did not report, in either of their analyses, the effect of blood lead on hypertension.

We submit that an objective presentation of observed associations contributes to scientific discourse, while selective suppression of such associations, in the belief that they are not biologically significant, does not.

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2. Nash D, Magder L, Lustberg M, Sherwin RW, Rubin RJ, Kaufmann RB, Silbergeld EK. Blood lead, blood pressure, and hypertension in perimenopausal and postmenopausal women. *JAMA*. 2003;289:1523–1532.