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Factors associated with elevated blood lead levels in first grade school children in Cape Town, South Africa

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ABSTRACT

Introduction: Lead metal toxicity in children is a major public concern internationally. In South Africa, January 2006 was the date set for the complete phase-out of leaded petrol, a well known major source of environmental lead contamination. Analysis was conducted to describe the distribution of blood in children, to establish proportions of children with elevated blood lead levels (unacceptable blood lead levels of ≥ 10 μg/dl) and to establish factors associated with elevated blood lead levels using data collected in 2007, one year after the phase-out of leaded petrol.

Methods and Materials: An analytical cross-sectional secondary data analysis was conducted on a survey dataset from the Environment and Health Research Unit of the Medical Research Council, South Africa. The primary sampling unit (cluster) was defined as primary schools. Data on first grade children from 13 schools from three suburbs of Cape Town – Woodstock (eight schools), Hout Bay (three schools) and Mitchell's Plain (two schools) – were analyzed using a survey method, calculating design-based robust standard errors. Different weights were applied to schools in the suburbs which formed the stratification variable. The outcome variable was defined as blood lead levels < 10 μg/dl or ≥ 10 μg/dl. A number of background characteristics – health and diet, housing and social aspects – were investigated; odds ratio measurement was calculated and reported.

Results: A total of 532 children were included in the analysis, representing a weighted total of 1 744 children. The children's weighted mean age was 7.40 years (95% CI 7.39 to 7.41). The geometric weighted mean blood lead level was 5.27 μg/dl (95% CI 5.08 to 5.46). The weighted proportion of children with BLLs ≥ 10 μg/dl was 11.81% (95% CI

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8.78 to 15.72); in Woodstock it was (21.0%). In the multivariable logistic regression, several factors were independently associated with higher odds of having BLLs ≥ 10 µg/dl, including use of gas for cooking OR 3.24 (95% CI 2.34 to 4.48) p <0.0001; houses in need of major repairs OR 7.81 (95% CI 1.59 to 38.33) p = 0.017; attending a crèche/preschool OR 15.23 95% CI (3.40 to 68.29) p = 0.003; Others included use of buses or taxis, which increased the odds of a child having a BLLs ≥ 10 µg/dl compared to walking to school by 5.20 times (95% CI 3.00 to 8.99) p < 0.0001 and children who were living in flats (OR 5.55, 95% CI 3.76 to 8.18, p < 0.0001) or in informal/shack dwellings (OR 2.09, 95% CI 1.06 to 4.12, p = 0.037) were at greater odds of having a blood lead ≥ 10 µg/dl than if they lived in free-standing houses. The following factors offered protection against elevated BLLs: Using private cars to transport children to school offered 0.83 lower odds of a child having elevated lead levels (OR 0.17, 95% CI 0.09 to 0.31, p < 0.0001) compared to walking to school, use of plastic water pipes OR 0.60 (95% CI 0.44 to 0.82) p = 0.005 and, domestic cleaning practices, such as cleaning floors with a wet mop (rather than a dry broom) reduced the odds of having blood lead levels ≥ 10 µg/dl by 0.88 (OR 0.12, 95% CI 0.10 to 0.15, p < 0.0001).

Conclusion and Discussion: This analysis indicated that the distribution of blood lead appears similar that determined in the leaded petrol era. The proportion of children with elevated blood lead levels in a Cape Town study was still high. Multiple factors were associated with BLLs ≥ 10 µg/dl. Some factors were protective. The implementation of the phasing out of the leaded petrol should be critically monitored to determine the time period before observing a reductive effect. Preventive measures targeting removal of non

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petrol sources of lead from the school and home environments should be considered as important.

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