Short reports

Decline of maternal blood lead concentrations in Glasgow

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Seventeen years ago we reported¹ the public health success of reduced lead exposure of mothers in Glasgow, achieved between 1977 and 1980 by increasing the pH of the water supply from 6.3 to 9.0 with lime to reduce plumbosolvency. A further reduction in plumbosolvency has now been made by addition of orthophosphate to the water supply. We report here on striking changes in maternal blood lead concentrations observed after this second measure to reduce lead exposure from drinking water and a decade of general lead abatement in our society.

Methods

Blood lead concentrations were observed in a population of mothers living in the same catchment area of Stobhill General Hospital in the north of the city as we reported on previously.¹ A 50% random sample of 214 mothers was selected from the 428 who gave birth in Stobhill between October and December 1991. Home visits were made between October 1992 and March 1993 to 76 mothers randomly selected from the 138 responders when samples of maternal blood, daytime tap water, and kettle water were obtained. Sampling procedures and determination of blood lead and water lead concentrations were by methods previously described.² The study was approved by the community and primary care research ethics committee of the Greater Glasgow Health Board.

Results

The geometric mean blood lead concentration was 3.5 µg/dl (0.17 µmol/l). In 4% (3 of 76) of cases (95%CI 1%, 11%) maternal blood lead exceeded 10 µg/dl (0.48 µmol/l) and no mother had a blood lead above 25 µg/dl (1.21 µmol/l). Daytime water lead results ranged from <2 to 16 µg/l (<10–77 nmol/l) with 22% (17 of 76) above 2 µg/l. Kettle water lead results ranged from <2 to 25 µg/l (<10–121 nmol/l) with 27% (20 of 74) above 2 µg/l.

The median age of mothers was 32, ranging from 21 to 44. All mothers lived in households supplied with low alkalinity water derived from either Loch Katrine (64%) or Loch Lomond (36%) to which orthophosphate addition was introduced in 1989 and 1991 respectively.

Figure 1 Prevalence of raised blood lead in mothers giving birth at Stobhill Hospital, Glasgow. Studies in 1977, 1980, and 1993. * The threshold for 1977 and 1980 is 14.5 µg/dl (0.70 µmol/l) rather than 15 µg/dl (0.72 µmol/l).

Discussion

In comparable populations^{1 3 4} of mothers, the geometric mean blood lead concentration was 14.6 µg/dl (0.70 µmol/l) in 1977 (236 cases) and 8.1 µg/dl (0.39 µmol/l) in 1980 (475 cases). The prevalence of maternal blood lead above 10 µg/dl (0.48 µmol/l) (fig 1) was 65% in 1977 (95%CI 59%, 71%) and 34% in 1980 (95%CI 30%, 38%).

The low drinking water lead concentrations observed in the homes of Stobhill mothers in 1993 reflect the trend in the city as a whole where the estimated² prevalence of lead in daytime samples above the present 50 µg/l (242 nmol/l) European Commission standard was 83% in 1977, 13% in 1980, and 2% in 1993.

The substantial decline in blood lead concentrations in this susceptible section of the population is encouraging. Reduction in blood lead between 1977 and 1980 was ascribed³ to treatment of the water supply alone, as little had been done in that period to abate lead from other sources. Since 1980 there have been diverse moves to reduce environmental lead exposure, including changes in food canning

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technology and introduction of lead free petrol; the much lower blood lead concentrations reported² for given tap water lead exposures in 1993 compared with a decade earlier are consistent with reduced lead exposure from non-water sources. Reduction in blood lead between 1980 and 1993 therefore parallels reduced exposure from both water and non-water sources of lead.

Although orthophosphate addition to the water supply has further reduced plumbosolvency, and may have reduced the bioavailability⁵ of lead from this source, drinking water remains the main correlate of raised maternal blood lead in Glasgow² where an estimated 50% of the 290 000 households still have some lead pipework between the water main and the kitchen tap. Currently there are no other established water treatment technologies to further reduce water lead concentrations; removal of lead pipework from the homes of pregnant women and their children would therefore need to be encouraged to sustain further reduction in the tap water contribution to maternal blood lead.

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Conflicts of interest: SJR and AB are employed by West of Scotland Water Authority.

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