the hypothesis that variations in income contribute an additional effect on mortality over the effect of deprivation alone.

This analysis cannot show which wards in an area of greater inequality suffer higher mortality: all might, or only the most deprived. Alternatively, increased mortality for poor wards might not be balanced by decreased mortality for rich wards in the same area—that is, the relation may not be linear, but analyses on transformed data did not alter the effect of variation on mortality.

The association between variation and mortality appears to be least in the most affluent and most deprived areas, although the result of a heterogeneity test was not significant. These findings deserve further investigation as some evidence exists that community solidarity may have a beneficial effect on all residents.³

Studies have produced contradictory results on

whether area characteristics have a truly independent effect on mortality.^{4,5} Although our analysis is based on areas, not individuals, it suggests that the characteristics of individuals are insufficient to account fully for differences between areas, as individuals in more variable areas appear to have worse mortality than their counterparts in more homogeneous areas.

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Effect of inadvertent intradermal administration of high dose percutaneous BCG vaccine

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In the United Kingdom it is recommended that all children receive BCG vaccination to prevent development of tuberculosis.^{1,2} The standard route of administration is intradermal. In neonates a 10 times more potent percutaneous preparation is used, a small volume being injected to a depth of 2 mm with a modified Heaf gun. The two preparations have similar packaging and labelling and so may easily be confused.³ We report the outcome of inadvertent intradermal administration of the stronger percutaneous product and we describe the relation between the development of skin lesions and the dose of vaccine.

Subjects, methods, and results

Thirty two school children aged 11-14 received 0.1 ml of BCG vaccine intradermally at a routine school immunisation session. Nineteen received the preparation for percutaneous administration, which contains 50-250 million colony forming units per ml. Thirteen received the correct preparation, which contains 8-26 million colony forming units per ml (Evans Medical, Leatherhead, England). The error occurred because of the similar packaging and labelling of the two products. All parents and children were informed of the error and all agreed to a period of close

observation. All observations were performed by the same observer (MMM). The study was not blind since a component of the consultation was to discuss any concerns with children and parents.

The area of induration increased progressively and was significantly greater in the group who had received the percutaneous vaccine intradermally (fig 1). Mean diameters were 0.96 cm (range 0.8-1.3, $P < 0.02$ by Student's *t* test) at two weeks, 1.15 cm (0.9-1.5, $P < 0.01$) at three weeks, and 1.23 cm (1.0-1.6, $P < 0.01$) at six weeks; the mean diameter had decreased to 0.91 (0.6-2.2) cm by 15 weeks. By contrast, the mean diameter of the induration in those receiving the correct intradermal vaccine was 0.83 cm (0.7-0.9) at two weeks, 0.83 cm (0.6-1.1) at three weeks, and 0.77 cm (0.5-1.1) at six weeks.

The sequence of symptoms was itchiness, soreness, and discharge. These were similar in both groups, although discharge was more common at six weeks in the group inadvertently given the percutaneous vaccine (nine out of 15 children *v* one out of 10 children). Ten of the 15 children given the percutaneous vaccine were examined at 28 weeks. They complained of no symptoms, and mature scars had formed (mean diameter 1.2 cm (range 0.8-2.0)).

Comment

This study emphasises the requirement for clear packaging and labelling of drugs. If subjects inadvertently receive the percutaneous BCG vaccine intradermally they may, however, be reassured that the lesion will resolve over a few months without treatment. Although the lesions were sometimes painful, the induration was larger and discharge more common after six weeks when the high dose preparation was given intradermally. The lesions had started to resolve at 15 weeks.

The results also suggest a clear dose-response relation in vivo between the size of the inflammatory response and the dose of vaccine. We do not know whether there is a relation between the size of the inflammatory response and the protective effect of BCG or the size of the scar.

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Conflict of interest: None.

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Fig 1—Mean (SE) diameters of skin lesions after intradermal BCG vaccine and percutaneous vaccine given intradermally