EDITORIAL: MEASURING IMMUNISATION COVERAGE

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Measurement of immunisation status is not as straightforward as it might seem. A child may have received several vaccines but despite this he or she may *not* be adequately protected against disease. Protection depends on the nature of the vaccines, the ages at which doses were given, the intervals between doses, the age at which courses were started, and the size and sometimes site of the doses. Surveys of immunisation coverage need to consider at least some of these issues.

Depending on the focus of interest, there are several possible definitions of immunisation status. The following is one scheme:

- *immunised up to date*. This means that a child has received an immunising course of a vaccine (and therefore should be protected against disease);
- *fully immunised*. This means that a child is immunised up-to-date for all recommended vaccines for which the child is eligible;
- *age-appropriately immunised*. This means that a child has received a full course of a vaccine at the recommended ages. An age-appropriately immunised child would also, by definition, be immunised up to date.

The primary objective of an immunisation program is to prevent disease, therefore our principal measurement of coverage should indicate our success or otherwise in reaching this goal. In my view, the best summary of immunisation coverage *in a single figure* is the proportion of children fully immunised at the second birthday. At the age of two years all children should have completed the major part of the primary schedule and will have had six months to receive their fourth doses of Hib (*Haemophilus influenzae* type b) and DTP (diphtheria-tetanus-pertussis) vaccines.

There are further complications. Should there be a minimum starting age to count an immunisation series as valid? Should there be a minimum interval between doses? Courses started too young, or doses given too close together, may be ineffective. Although a child may be up to date (and therefore protected), not all doses may have been received at the appropriate ages. Children usually do not receive their immunisations on the exact day they become due.

A reasonable, although demanding, method of assessing up to date immunisation status would be to count as *invalid*

- doses of Hib, DTP and OPV (oral polio vaccine) given at ages younger than six weeks;
- doses of these vaccines given less than six weeks after prior doses; and
- doses of MMR (measles-mumps-rubella) vaccine given at ages younger than 9 months.

In the measurement of age-appropriate immunisation status, count as *on time* doses given within one month of the recommended age, provided prior doses have also been given on time.

Perhaps more important than absolute epidemiological validity is uniformity. Depending on the methods adopted, it is possible to derive very different coverage levels for the same population. It is also evident that we need several indices of immunisation coverage to serve different purposes. In my view, the most important is the age-specific proportion of fully immunised children, as this determines how well vaccine-preventable diseases will be controlled. In order to evaluate the effectiveness and acceptability of the immunisation service, we also need to know the age- and antigen-specific proportions of children immunised up to date and age-appropriately immunised. In an attempt to clarify some of these issues, Heath, Bin Jalaludin and colleagues at the Western Sector Public Health Unit in Sydney are conducting a survey of immunisation experts.

Lloyd's study (in this issue of *CDI* page 217) shows that the Australian immunisation program serves children well until they reach the age of 18 months, when there is a large decline in the percentage of children receiving their Hib and DTP booster doses. As a result there is a fall in the proportion of children immunised up to date. This has become a serious problem in several countries. Britain (from 1993) and New Zealand (from February 1996) have implemented accelerated immunisation schedules to increase coverage.

The rationale underlying these changes is that more children complete the schedule when vaccines are given at younger ages. In both Britain and New Zealand the recommended immunisation schedules have been redesigned to reduce the number of immunisation visits, particularly in the second year of life. In Britain the accelerated schedules for Hib and DTP vaccines have been subjected to clinical trial, and immunisation authorities in both countries consider higher levels of coverage protect children far more than extra doses of vaccine. Increasing immunisation uptake and declining disease incidence figures in Britain would indicate that they are right. Perhaps Australia should also consider an accelerated schedule.