Assessing the impact of the expanded programme on immunization: the example of Indonesia

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The early impact of the expanded programme on immunization (EPI) in reducing morbidity from diphtheria was evaluated in the province of Yogyakarta, Java, Indonesia. Since 1980, coverage of two doses of diphtheria–tetanus–pertussis (DTP) immunization has been greater than 60% in Yogyakarta. The morbidity rate for diphtheria for children aged 0–4 years decreased from 4.3 per 100,000 population in 1978–79 to 1.7 per 100,000 in 1981–82, a reduction of 60%. In contrast, the morbidity rate for children aged 5–9 years remained relatively constant over the 5-year period. The EPI programme has therefore had a demonstrable effect on 0–4-year-olds in Yogyakarta.

To justify continued support, managers of immunization programmes must document the impact of immunization on reducing target diseases. During the initial phases of such programmes, surveillance of target diseases may be incomplete, thus making it difficult to assess programme impact. Methods other than simple analysis of overall disease morbidity rates may be needed to gauge the impact of immunization. We therefore investigated the impact of diphtheria–tetanus–pertussis (DTP) immunization on morbidity from diphtheria in Yogyakarta, Indonesia, and report our results here.

The expanded programme on immunization (EPI) began its operations in Indonesia in 1977. A combination of diphtheria–tetanus toxoid and pertussis vaccine (DTP) was used to immunize children aged 3–14 months. Administration of two doses of DTP was recommended in all areas where EPI was involved, and three doses were advised if polio vaccination was a part of the programme. Overall coverage levels for two doses of DTP in the target population in Indonesia steadily climbed from negligible levels in 1977 to 29% in 1982 (Fig. 1).

Age-specific morbidity rates from diphtheria for 1971–82 for the whole of Indonesia are shown in Fig. 2. Children aged 0–4 years consistently exhibited higher rates than those aged 5–9 years, which is the usual pattern in populations with no or low coverage of diphtheria toxoid. Serological and Schick test surveys for children aged 5–9 years are higher than those for children aged 0–4 years. The majority of persons over 4 years of age are immune, presumably because of cutaneous diphtheria or asymptomatic infection. It is difficult to demonstrate nationally the impact of the EPI programme in reducing overall morbidity rates for diphtheria in Indonesia because of variable degrees of completeness in surveillance reporting and different coverage levels for two doses of DTP—half of the provinces had under 50% coverage in 1982. In 1981–82, the proportion of children immunized, i.e., the coverage level, in various provinces ranged from 7.1% to 75.7%, as indicated by household surveys. In certain provinces, however, coverage reached levels that would be expected to cause an impact on disease incidence. As part of a continuing programme of evaluation, we therefore assessed the degree of impact of EPI in a high-coverage area.

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Fig. 1. Immunization coverage with diphtheria–tetanus–pertussis vaccine (DTP) of children aged 3–14 months from 1977 to 1982 in Indonesia.
Fig. 2. Age-specific morbidity rates for diphtheria among children aged 0–4 years and 5–9 years from 1971–82 for the whole of Indonesia.

MATERIALS AND METHODS

The province of Yogyakarta in Java was selected for the study because its coverage rates for two doses of DTP were the highest in Indonesia and the morbidity reporting system was relatively stable.

Immunization coverage for two doses of DTP was estimated by two methods: from data for children aged 3–14 months obtained from the reported number of second doses of DTP administered to the target population for the fiscal years 1978–83 (April to March); and from immunization data for children aged 15–20 months obtained from household surveys conducted between 1977 and 1982.

Morbidity data for diphtheria were obtained from summaries of monthly hospital surveillance reports. These data were available for the age groups 0–4 years, 5–9 years, 10–14 years, and those aged 15 years or more. Completeness of surveillance reporting was expressed as the percentage of months annually that a report was received from each hospital. Data for 1978–82 were available.

Population statistics were based on the 1980 census data. A 2.3% annual growth rate and the 1980 age structure for Indonesia were used to construct population denominators for determining annual rates for each age group.

RESULTS

For children aged 3–14 months, the coverage rates estimated from reported doses administered for the fiscal years 1977/78 to 1982/83 are shown in Fig. 3. The corresponding rates determined in the household survey for children aged 15–20 months are shown in Fig. 4. The data suggest that the coverage rate for two doses of DTP was less than 60% for 1978–79 but more than 60% for 1981–82.

On average, the completeness of monthly hospital surveillance reporting was above 85% for 1978–82, except for 1979 (61%). For RS Sarjito Hospital, the major referral hospital in Yogyakarta, which
accounts for 57% of all reported cases of diphtheria, the completeness of reporting never fell below 91% during this period.

The age-specific morbidity data for 1978–82 are shown in Fig. 5. The morbidity rate decreased by 60% for children aged 0–4 years, from 4.3 per 100,000 population in 1978–79 to 1.7 per 100,000 in 1981–82. The rate for all age groups during these same periods decreased by 21% from 1.1 per 100,000 to 0.9 per 100,000 population, respectively. In contrast, the morbidity rate for children aged 5–9 years remained relatively constant during this 5-year interval.

**DISCUSSION**

After 1980, the decrease in the annual morbidity rates from diphtheria for children aged 0–4 years compared to those aged 5–9 years in Yogyakarta is markedly different from the pattern of age-specific rates for Indonesia as a whole. This is consistent with a greater immunity level due to diphtheria toxoid in younger than in older children. The latter would not have been in the major target population for DTP vaccine, because either they were too old at the start of the programme or coverage was low when some of them were in the appropriate age group.

At present, some caution is needed in interpreting these data in terms of absolute reduction in diphtheria morbidity rates, since variation in overall disease rates may depend not only on immunity levels but also, *inter alia*, on factors such as increased circulation of toxigenic strains of *Corynebacterium diphtheriae* and increased utilization of hospitals by sick children. Data up to May 1983 suggest that overall morbidity rates may be higher for this year than in 1982. Nevertheless, analysis of the age-specific morbidity data for the first 5 months of 1983 shows that the morbidity rate for the 0–4-year age group (2.1 per 100,000 population) is lower than that of the 5–9-year age group (3.8 per 100,000 population). This corroborates the findings for 1981–82.
and strengthens the conclusions about the impact of the EPI programme on reducing morbidity from diptheria.

DTP immunization has therefore had a demonstrable impact on morbidity from diptheria among children aged less than 5 years in Yogyakarta. From 1980 to May 1983 there was a consistent reduction in annual morbidity rates for this age group compared to those for children aged 5–9 years. Changing trends in the morbidity rates of diptheria among children aged 0–4 years and those aged 5–9 years may be useful in evaluating the impact of the EPI during the early years of the programme in Indonesia.

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RÉSUMÉ

PROGRAMME ÉLARGI DE VACCINATION: L’EXEMPLE DE L’INDONÉSIE

Il importe de recueillir des informations sur les premiers résultats du Programme élargi de Vaccination (PEV). Toutefois, il peut s’avérer difficile d’évaluer dans quelle mesure le Programme permet de réduire les taux globaux de morbidité au niveau national en raison d’un certain nombre de facteurs, notamment parce que la notification des opérations de surveillance est plus ou moins complète et que la couverture vaccinale est variable. La province de Jogyakarta a été choisie dans le cadre d’un programme permanent visant à évaluer l’effet du PEV en Indonésie. Elle est caractérisée par une couverture vaccinale élevée et un système de surveillance relativement stable. D’après la notification du nombre de doses administrées à la population cible et les résultats d’enquêtes annuelles, la couverture pour deux doses de vaccin antidiphtérique-anti-tétanique-anticoquelucheux (DTC) était supérieure à 60% après 1980. De plus, le taux de morbidité due à la diphtérie avait diminué de 60% pour les enfants âgés de 0 à 4 ans, tombant de 4,3 pour 100 000 en 1978–1979 à 1,7 pour 100 000 en 1981–1982. Le taux de morbidité chez les enfants âgés de 5 à 9 ans est demeuré relativement constant pendant la période 1978–1982 et l’on peut conclure que le PEV a eu un effet certain sur le groupe d’âge de 0–4 ans dans la province de Jogyakarta.