The use of evaluation to improve the Expanded Programme on Immunization in Mozambique

F. Cutts,[1] A. Soares,[2] A.V. Jecque,[3] J. Cliff,[4] S. Kortbeek,[5] & S. Colombo[6]

Reported are the results of an evaluation of process indicators and outputs for the Expanded Programme on Immunization (EPI) in Mozambique which were used to modify immunization strategies from 1985 to 1987. In 1986 according to cluster sample surveys, 84% of children in Maputo, the capital, were fully vaccinated. In other cities in the country, vaccination coverage increased from an average of 36% in 1985 to 55% in 1987. The major determinants of low vaccination coverage were provision of vaccination services at health centres on less than 3 days per week; missed opportunities; and vaccinating too early or with too short an interval between doses.

The results of sentinel site surveillance in Maputo indicated that EPI had a marked impact on neonatal tetanus and to a lesser extent on poliomyelitis and measles.

Evaluation led to changes in EPI policy in Mozambique (e.g., adoption of a uniform national vaccination schedule and discontinuation of the use of expired vaccine) and strategies (elaboration of different strategies for urban areas, rural areas, and displaced people). Also, performance was improved by involving programme managers and implementors in evaluation, and by providing timely and widespread feedback of results to policy-makers, peripheral health workers, and the community.

Introduction

In developing countries immunization programmes prevent about 1 million deaths a year from measles, neonatal tetanus, and whooping cough (*1*). Significant contributions to the success of the WHO smallpox eradication programme were made by having measurable goals and performance standards, and by monitoring disease incidence, and carrying out problem-oriented research (*2*). For the Expanded Programme on Immunization, WHO recommends increased emphasis on evaluation (*3,4*).

---

[1] Epidemiologist, Ministry of Health, Mozambique, and Save the Children Research Fellow, Department of Tropical Hygiene, London School of Hygiene and Tropical Medicine, London, England. Requests for reprints should be sent to Dr Cutts at: Immunization Division, Centers for Disease Control (E05), 1600 Clifton Road, Atlanta, GA 30333, USA.

[2] Epidemiology Assistant, Expanded Programme on Immunization, Ministry of Health, Mozambique.

[3] Manager, Expanded Programme on Immunization, Ministry of Health, Mozambique.

[4] Epidemiologist, Ministry of Health, Mozambique.

[5] Health Education Advisor, Ministry of Health, Mozambique.

[6] Expert, Health Sector for Cooperation, Italian Ministry of Foreign Affairs, Mozambique.

Mozambique conducted a mass immunization campaign against smallpox, measles, and tuberculosis over the period 1976–79. Women of childbearing age also received one dose of tetanus toxoid. In 1980, immunization became part of the routine child health services. Different immunization schedules were followed in urban and rural areas; in the former a 2-month interval and in the latter a 3-month interval was recommended between doses of diphtheria-pertussis–tetanus (DPT) vaccine and poliovaccine. In 1985, a "pulse immunization" outreach project was developed in Inhambane Province (*5*), and immunization in rural areas was conducted during monthly visits by teams from the district centre, over three consecutive months. In 1986, programme "acceleration" began in the major cities.

We evaluated the following aspects of EPI in Mozambique: immunization coverage and how to increase it; vaccine efficacy; and the impact of the programme on the target diseases. Here, we describe the evaluation methods used and discuss how the results helped to improved the programme's performance.

Methods

Immunization coverage

The annual immunization coverage was estimated from routine data on the number of vaccinations performed on children aged 0–11 months and from

the estimated target population in this age group. The results were validated by carrying out regular surveys using the EPI cluster sample method (6).

In the analysis of coverage surveys the following criteria for effective vaccination were used: documented vaccination according to information on the child's "road to health" (RTH) card, which was kept at home; administration of the first dose of DPT-poliovaccine to children aged at least 6 weeks, with an interval of at least 4 weeks between subsequent doses; administration of measles vaccine to children after they had reached 8.5 months of age; and the presence of a BCG scar. Vaccinations that did not conform with these criteria were discounted.

Determinants of vaccination

"Knowledge, attitudes and practice" (KAP) surveys were conducted in urban and rural areas of Inhambane Province in 1987 to investigate the determinants of vaccination (7). In other cities in the country, we used modified coverage surveys to assess community knowledge and attitudes towards vaccination and selected maternal and child health (MCH) indicators. Since the RTH card in Mozambique serves both as a child immunization record and a growth monitoring chart, we also assessed missed immunization opportunities at preventive health services, by comparing the vaccines received with the number of times there was a record of a child having been weighed. These surveys were conducted in the course of an international programme review in 1987 in three of the major cities in Mozambique and have since been continued by activities at the national level.

Vaccine efficacy in cities

The methods used to estimate measles vaccine efficacy (VE) were first field tested in selected cities. The "screening method" was used to estimate the VE in cities from the proportion of notified measles cases among children who had previously been vaccinated, while the vaccine coverage was estimated from the results of surveys (8). In the cities of Beira and Nampula the VE was determined using the "coverage survey in endemic areas" method (9). Mothers were interviewed to ascertain their child's history of measles, while the vaccination status was determined from the RTH card. The VE study was repeated in Nampula together with serological investigations to estimate the sensitivity and specificity of maternal reporting of measles and to validate the survey method.

Morbidity and mortality

In Maputo, the capital, cases of measles, poliomyelitis, or neonatal tetanus are notified on detailed individual reports. All health centres notify measles and pertussis, while the physiotherapy department of the Maputo Central Hospital is a sentinel site for poliomyelitis; and this hospital and the three other maternity clinics in the capital notify cases of neonatal tetanus. Preventive medicine staff from each health centre meet weekly to discuss trends in disease incidence. Elsewhere in Mozambique disease notification is very unsatisfactory; for example, in 1983–84 the completeness of measles reporting in two provinces was estimated to be only 2–3% (10). We therefore employed other methods to evaluate the impact of immunization in provincial capitals, and in 1986 in Quelimane city used the EPI cluster survey method for this purpose (11). The history of measles, pertussis, tetanus, or of death from any cause in the year prior to the survey was elicited for children aged 0–4 years (12). Finally, sentinel sites were established for measles and neonatal tetanus and retrospective reviews of hospital registers were inaugurated that led to a prospective collection of data from hospitals and city health centres.

Improvement of EPI performance

To ensure that the results of evaluation were used to improve EPI performance, we involved programme implementors in the assessment process, provided timely feedback to a wide audience, and adapted health worker training and supervision according to the findings. Informal observations made during community surveys provided clues about how best to work with community leaders and fostered links between health workers and the community.

The results from the first year of the project in Inhambane were used to outline strategies for "accelerated" programmes in urban areas. For this purpose, a national EPI seminar was organized in 1986, where participants from each city formulated their plans of action, and practice sessions were organized to demonstrate the mobilization process developed in Inhambane Province.

Health workers, and medical and paramedical students participated in the surveys, in the analysis of the data, and in writing and presenting the results. The findings were incorporated into training manuals and used in seminars on EPI evaluation and on epidemiology. The evaluation process helped identify priority topics for refresher training and for supervision.

The results of the surveys were discussed with local health staff upon completion, and evaluators helped to draft plans to implement the recommendations and supervised their introduction by health centres. Summaries of the results were circulated to community representatives, together with informa-

tion about the vaccination schedule. The results were also presented at meetings with city or provincial executive councils, which included representatives of grassroots organizations. In this way, evaluation was followed immediately by discussions of how to solve the problems identified.

Results

Vaccination coverage

Table 1 shows the vaccination coverage determined from the surveys conducted in Maputo and in four other cities in Mozambique, before and after introduction of the accelerated immunization programme. Coverage for measles vaccine reached 86% in Maputo in 1986 and in the other cities increased from an average of 54% in 1985 to 71% in 1987.

Table 2 compares the coverages for 12–23-month-olds determined from surveys in Maputo (1986), Beira (1985), and Quelimane (1985) with estimates obtained from routine data for 0–11-month-olds in the year prior to the survey.

Determinants of vaccination

Table 3 summarizes the main reasons for incomplete vaccination in Mozambique. The most important factors were as follows: the availability of vaccination services at health centres less than 3 days per week; ineffective vaccination; and missed immunization opportunities.

In the KAP survey in Inhambane city, children whose nearest health centre provided vaccination services only once per week had a relative risk of 8.5 of incomplete vaccination compared with those whose nearest health centre vaccinated ≥3 days per week, after controlling for other factors.

Of the children surveyed who had received all the vaccines according to the information on their RTH cards, 10% had their vaccinations discounted because they were considered to be ineffective—most commonly because measles vaccine had been administered before they were 8.5 months of age.

Missed immunization opportunities occurred both at preventive and curative health services. In the

Table 1: Effective vaccination coverage determined from surveys of children aged 12–23 months and their mothers in Mozambique[a]

	Maputo city			Four other cities[b]	
	1982	1983	1986	pre-A (1985)[c]	post-A (1987)[c]
Children					
BCG (scar)	72	83	85	77	87
DPT/OPV1	74	84	96	79	86
DPT/OPV3	56	76	93	56	71
Measles	42	70	86	54	71
Fully vaccinated	38	68	84	36	55
Mothers[e]					
TT1	64	94	91	78	78
TT2	42	91	87	70	67

[a] Each survey covered 210 children.
[b] Unweighted averages for Beira, Inhambane, Quelimane, and Tete.
[c] pre-A = pre-accelerated programme; post-A = post-accelerated programme.
[d] Information from road to health cards. DPT = diphtheria–pertussis–tetanus: OPV = oral poliovaccine.
[e] As reported by the mothers. TT = tetanus toxoid.

Table 2: Vaccination coverage for infants estimated from surveys (S) and routine data (R) in Maputo, Beira, and Quelimane cities, 1985–86

	Maputo		Beira		Quelimane	
	S[a]	R[b]	S[a]	R[b]	S[a]	R[b]
BCG	85	99	81	107	90	191
DPT3[c]	93	80	71	63	73	125
Measles	86	78	69	58	75	110

[a] Effective coverage for 12–23-month-old infants.
[b] Coverage for 0–11-month-old infants.
[c] DPT = diphtheria–pertussis–tetanus.

Table 3: Reasons for incomplete vaccination in Mozambique

Reason	Identified through:[a]
Health services	
Missed opportunities	Coverage surveys; supervision; and KAP survey in Inhambane
Vaccines available <3 days per week in urban health centres	KAP survey in Inhambane
"Ineffective" vaccination	Coverage surveys
Inappropriate outreach services	Coverage surveys in cities; and group discussions in communities
Long waiting times	Supervision
Socioeconomic factors	
Resident less than 1 year in area	KAP survey in Inhambane and group discussions
Non-Portuguese-speaking mothers	KAP survey in Inhambane
More than five children in the family	KAP survey in Inhambane
Child born at home	KAP survey in Inhambane
Community knowledge–attitudes	
Mother knew child with post-vaccine abscess	KAP survey in Inhambane and group discussions

[a] KAP = knowledge–attitude–practice.

coverage surveys it was determined that an average of 8% of children who were not fully immunized had nevertheless had their growth recorded on their RTH cards at a health facility at least four times (excluding at birth), and were aged at least 9 months when they had last been weighed. In urban areas, 13% of mothers stated that they had been turned away at least once from an immunization session. The following reasons for missed opportunities were identified by supervisors: vaccination sessions not available every day at health centres; cold chain failures; poor stock control; absence of staff from health centres because they were sick or were conducting outreach visits; failure to open a vial of vaccine for only one or two children; failure to vaccinate sick children; and confusion about vaccination schedules.

While opportunities were missed at fixed facilities, outreach visits were unproductive in urban areas. From 33% to 67% of families in urban surveys reported that outreach teams had arrived in their neighbourhood; however, only 2–10% of children had been vaccinated by them. In group discussions, mothers from urban areas stated that they preferred to attend health centres (where curative services were available) than outreach sessions (where only vaccination was offered). By contrast, in rural areas 38% of children were vaccinated by outreach teams.

Other determinants of incomplete vaccination that were identified in the KAP surveys were socio-economic factors (mother's low educational level, residence for < 1 year in the area, and large family size); the child was born at home; and a mother who knew children with postvaccination abscesses.

Vaccine efficacy

In 1985 in Nampula and Beira cities the VE for measles vaccine was estimated by the screening method to be 54% and 82%, respectively. From cluster surveys, the estimated efficacy for measles vaccine in Nampula was 40% (95% confidence interval (CI), 28–56%) in 1985 and 37% (CI, 0–69%) in 1986; and 59% in Beira in 1986 (CI, 37–72%). However, in the seroprevalence study in Nampula, the specificity and sensitivity of a mother's account of a history of measles in her child was estimated to be only 83% and 56%, respectively. These results gave an adjusted estimate for the VE of measles vaccine of 66% (*13*).

Disease morbidity and mortality

Measles. Notifications of cases of measles in Maputo show that there was a major epidemic of the disease in 1980, the year after the mass vaccination campaign, but before high vaccine coverage was achieved through routine health services. Smaller outbreaks occurred in 1985–86 and 1987 (Fig. 1). As vaccination coverage has increased, the age distribution of reported cases has shifted towards older children (Table 4).

Measles epidemics have continued to occur at yearly intervals in cities such as Nampula, where according to surveys the vaccination coverage was 55–70% (Fig. 2).

According to the results of the survey in Quelimane, measles vaccine coverage was 56% for documented vaccinations and 77% if mothers' reports of their children having been vaccinated were

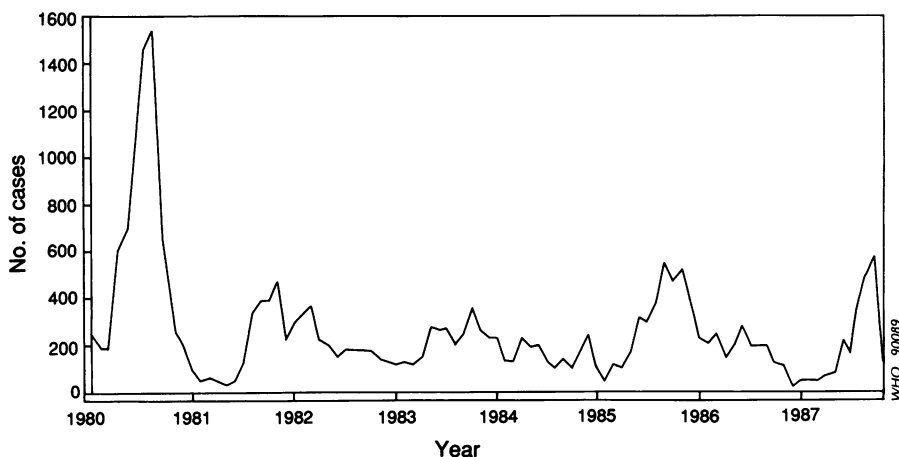Fig. 1. **Measles notifications, Maputo city, 1980–87.**

Table 4: **Age distribution of reported cases of measles, Maputo city, 1982–87**

Year	% of cases among children aged:				No. of cases
	0–8 months	9–23 months	24–59 months	≥60 months	
1982	19	43	29	9	2658
1983	19	41	28	12	2616
1984	20	35	30	15	2014
1985	22	28	27	23	3355
1986	21	33	18	28	2551
1987	15	24	20	40	2655

accepted for those without a vaccination card. The estimated incidence of and mortality rate for measles in 1985, the year prior to the survey, was 129 per 1000 and 11 per 1000, respectively, for children under 5 years of age. Comparison of the survey data with weekly measles notifications and with the findings of a review of the register of the paediatric ward of the provincial hospital in Quelimane indicated that all three sources showed similar trends (Fig. 3).

Poliomyelitis. Fig. 4 shows that the number of new cases of poliomyelitis with onset in Maputo city that

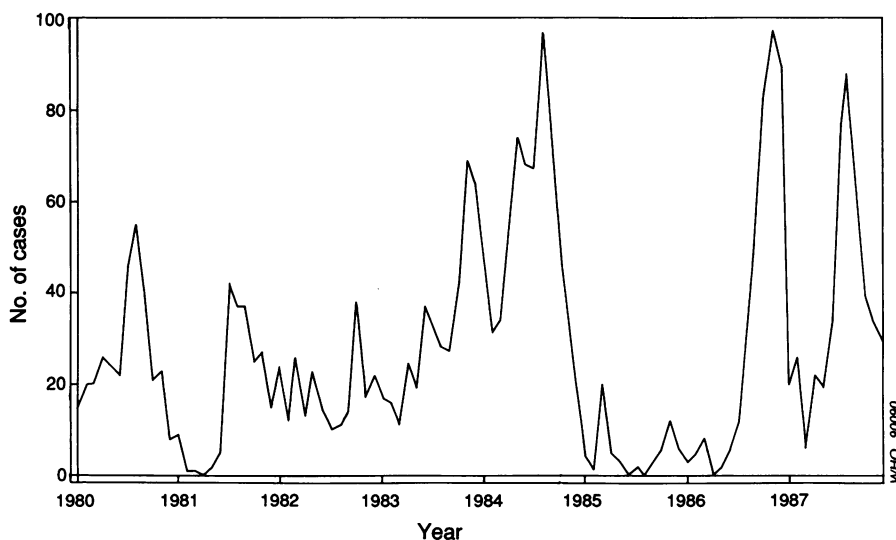Fig. 2. **Measles admissions to the paediatric ward of Nampula Hospital, 1980–87.**

Fig. 3. **Distribution by month or 4-week period of measles cases, Quelimane city 1985.**
Reproduced with permission from the *Journal of tropical medicine and hygiene*, **91**: 231–239 (1988).
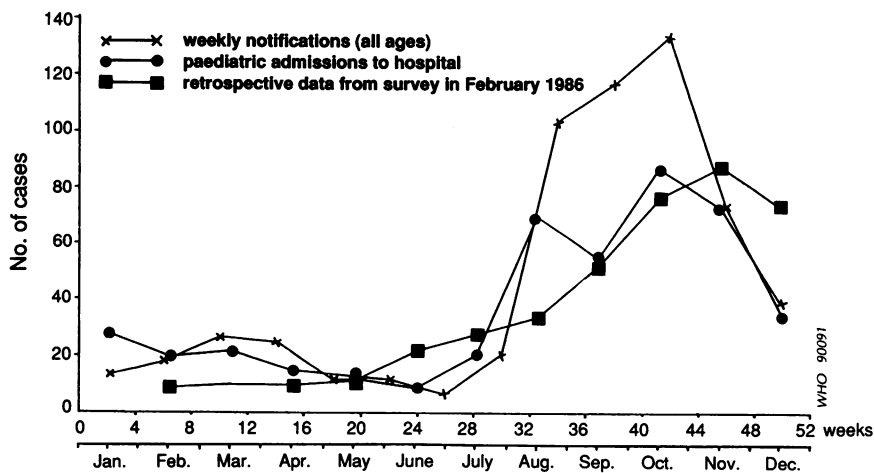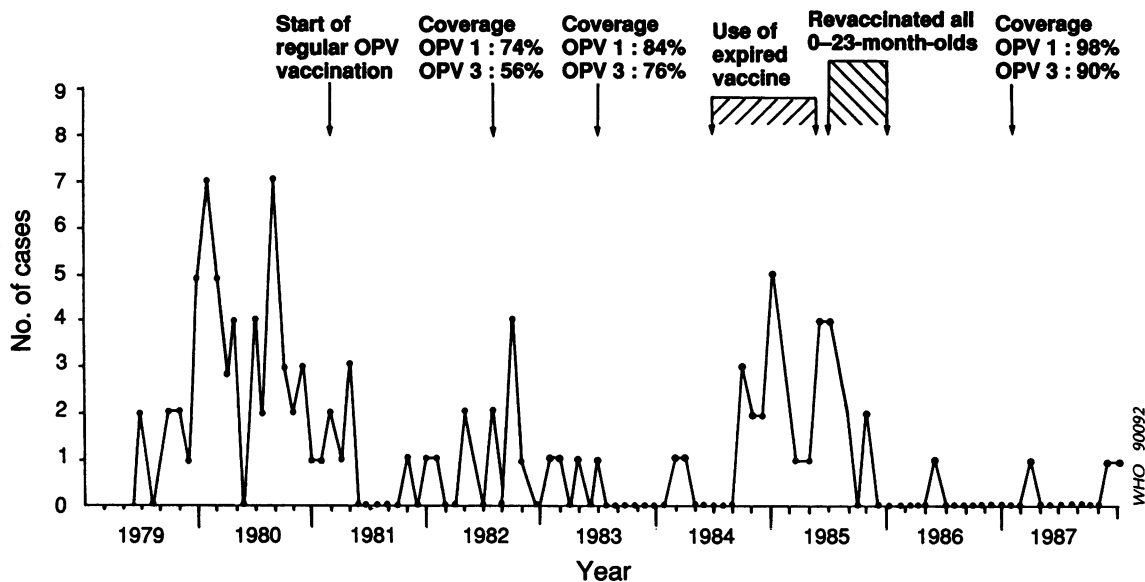
Fig. 4. **Cases of poliomyelitis in Maputo city that were registered in the physiotherapy department of Maputo Central Hospital, by month of onset of illness, 1979–87. The coverage in 1982 was estimated by cluster sample surveys, while that in 1987 was estimated from routine data. OPV = oral poliovaccine.**

were seen at the physiotherapy department of Maputo Central Hospital decreased from 1980 to 1984, but that there was a sudden increase in late 1984. Presumably this increase arose because the lots of poliovaccine in use at that time had expired in June or November 1984—new vaccine was not received until July 1985. Since most cases involved under-2-year-olds, children in this age group were revaccinated. Coverage with three repeat doses of the new vaccine was 51% in November 1985, and since then only sporadic cases have occurred.

Neonatal tetanus. The reported incidence of neonatal tetanus in Maputo city is shown in Fig. 5. From 1976 to 1978, before immunization was carried out, between 173 and 254 cases were reported annually (*14*). This fell rapidly after the vaccination campaign in 1979 and the introduction of regular immunization of pregnant women, and since 1982 only 3–13 cases have been reported per year.

Use of evaluation findings

Table 5 summarizes changes that have been made to the EPI in Mozambique, based on the results of evaluation.

The process of conducting the surveys had a stimulating effect on health services, since health workers were shown the need to work with the

community. For example, health workers previously had believed that the low attendance at outreach visits in Inhambane Province in 1985 indicated that the children had already been vaccinated. However, when the workers conducted household interviews they realized that this was not the case and that mothers had not received information about the outreach visits. In coverage surveys, incompletely vaccinated children were given referral slips to attend health centres. After one such survey, 60% of women brought their children for vaccination over the following 3 days. This, together with suggestions made by community leaders in Inhambane, led to the development of regular home visits and "door-to-door canvassing" to identify defaulters.

The results of evaluation helped peripheral health staff to understand the rationale behind many Ministry of Health policies, and showed what further specific actions were needed to increase vaccination coverage. The importance of using all contacts at health centres as vaccination chances was highlighted in the Inhambane survey by the reduction in potential coverage caused by missed opportunities, the frequent reports by mothers of their children having been refused vaccination, and the association of low vaccine coverage with the shortage of vaccination services at the nearest health centre. The importance of meeting performance standards was emphasized

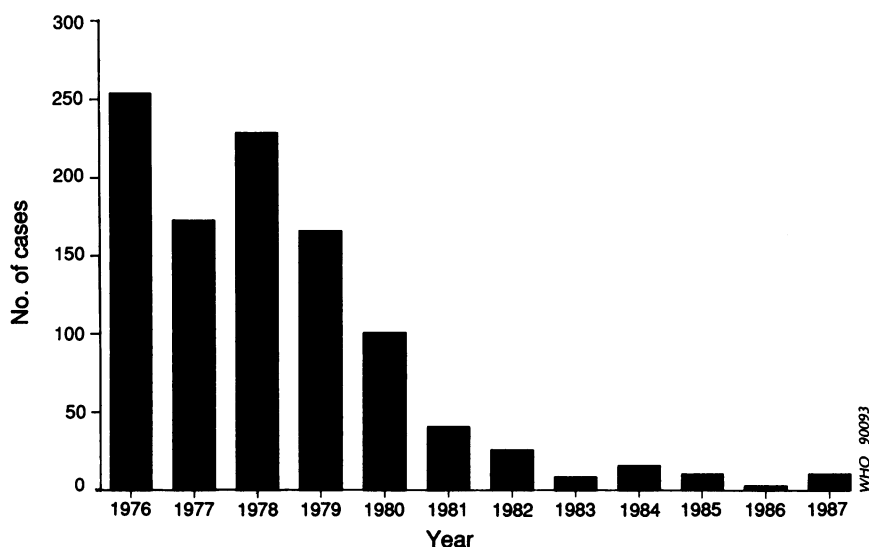Fig. 5. **Incidence of neonatal tetanus in Maputo city, 1976–87.**

Table 5: **Use made of evaluation findings in the Expanded Programme on Immunization (EPI) in Mozambique**

Programme area	Methods	Major findings	Programme changes
Strategy	Coverage surveys Group discussions Supervision Programme review	*Rural setting* Ineffective information about outreach services in Inhambane Demand for inclusion of MCH in outreach services Displaced people used services less	Detailed mobilization process designed MCH[a] integrated further with EPI Identification and referral system for newcomers designed
		Urban setting Inappropriate use of outreach services Missed immunization opportunities at fixed facilities	Reduced outreach services Increased supervision at all health centre contacts Uniform schedule adopted nationally
Activity	Supervision Programme review KAP[b] survey VE[c] screening from routine data and efficacy studies	Occurrence of post-vaccination abscesses Identified high-risk groups Apparently low vaccine efficacy	Improved sterilization techniques Activities targeted to high risk groups Increased monitoring of cold chain
Output	Routine data Coverage surveys including MCH indicators	Routine data inaccurate in many cities Coverage increasing Drop-out rate decreasing Women go to health centres after home visits	Improved registration of vaccinations Higher targets set for cities Door-to-door mobilization developed
Impact	Routine data Sentinel sites Cluster sample survey	Neonatal tetanus controlled in Maputo Poliomyelitis controlled in Maputo, except when expired vaccine used Sample survey of limited use for monitoring impact	Increased motivation of health workers Stopped use of expired vaccine Increased use of sentinel sites

[a] MCH = maternal and child health.
[b] KAP = "knowledge, attitudes, and practice".
[c] VE = Vaccine efficiency.

by discounting in the survey analysis ineffective vaccinations, by the association of postvaccination abscesses with incomplete vaccination of children, and by the low estimates of measles vaccine efficacy. These results convinced senior personnel in the health centres of the importance of proper supervision of staff.

In Inhambane, the survey results indicated the need to target mobilization activities to high-risk groups such as recent migrants, mothers who deliver at home, non-Portuguese speakers, and those with large families.

The evaluation findings also focused attention on disease control. The recrudescence of poliomyelitis in Maputo following the use of expired vaccine made clear to staff that the objective of EPI is to control disease and not only to achieve high vaccination coverage. This episode led to a change in Ministry of Health policy: prior to 1985 this had been to continue using vaccine up to 3 months past the expiry date; subsequently, this practice was stopped and efforts were made to improve stock control.

The international programme review provided a forum which permitted results from different studies in Mozambique to be collated and policy decisions inferred. The progress made by the accelerated immunization projects led to a national change in strategies and schedules; the schedule recommended by WHO was adopted for all areas of the country (3). The pulse immunization strategy was adopted for "safe" rural areas (those unaffected by war) and for displaced persons, while a strategy based on fixed facilities, with immunization at every contact and door-to-door canvassing to identify defaulters, was adopted for urban areas. Other existing policies were reinforced, for example, the integration of EPI with MCH.

Discussion

Evaluation methods

Evaluation involves both quantitative measurements of achievements and qualitative assessment of programme implementation. Progress can be measured through information gained from routine data or surveys. In Mozambique, the vaccination coverage obtained from analysis of routine data differed from that obtained in the surveys. For BCG vaccination, the routine data consistently indicated that coverage was higher than that obtained from surveys, probably because revaccinated children without scars were included. In Maputo and Beira, use of the routine data slightly underestimated the coverage with other vaccines, while in Quelimane it led to greatly overestimated coverage levels. Errors occur in the estimates made with the routine data because of inaccurate

population data, inclusion of vaccination of temporary migrants, and inaccurate registration of vaccinations. Coverage surveys should be conducted regularly in each province or city and comparisons with routine data continued, until the latter are more accurate.

Owing to the relative simplicity of the EPI cluster survey method, we attempted to adapt it to measure vaccine efficacy and programme impact; however, the method was not suitable. The low specificity of the disease diagnosis criteria introduced a large negative bias into the vaccine efficacy estimate. The accuracy of the classification of disease status might be improved by studying a narrow age range of children who are still within the high-risk period for measles and by using short recall periods. However, even when the specificity of diagnosis exceeds 90%, vaccine efficacy is greatly underestimated, especially if measles attack rates are low (13).

The survey on the incidence and mortality of the EPI target diseases followed a year in which an epidemic of measles occurred in Quelimane; the incidences obtained from 1-year's retrospective data, therefore, do not reflect the impact of EPI in Mozambique. Since the incidence of measles in the country varies markedly from year to year and from city to city, it is difficult to know when follow-up surveys should be carried out. Also, the survey was expensive, and the data obtained were no more suitable for guiding programme activities than those available from notifications of disease or from the registers of provincial hospitals. In Mozambique efforts have therefore been directed at improving the collection of data at sentinel sites to monitor trends in the morbidity and mortality from EPI target diseases.

Quantitative and qualitative methods proved to be complementary in investigations into the reasons for the low vaccination coverage in Mozambique. For example, the measurement of missed immunization opportunities at preventive health services in the course of coverage surveys provided useful information. Informal discussions with and supervision of staff in health centres clarified the chain of events that led to missed opportunities and suggested how such events could be avoided.

Use of evaluation findings

Evaluation findings prompted many changes in the immunization programme in Mozambique. The survey in Inhambane allowed an in-depth analysis of obstacles to the implementation of EPI plans (5). The design of urban accelerated immunization programmes was based on the experience gained in Inhambane, but further evaluation was needed to assess the suitability of pulse immunization for urban areas.

This showed that too many resources had been devoted to outreach visits and mobilization and too few to ensuring the correct use of existing facilities.

Some of the programme changes could have been brought about by the introduction of proper supervision in health centres instead of carrying out the reported surveys. However, evaluation generated more enthusiasm among staff, because it involved their participation, promoted links with the community, and gave quantitative results. Also it provided a stimulus to improve the standards of supervision in the health centres.

Evaluation was part of a continuous cycle of planning, implementation, and control in Mozambique. For example, the results led to the development of door-to-door canvassing, which evolved into an evaluation mechanism. Community representatives informed health workers of the number of target children and pregnant women in their area, and this was compared with attendance at outreach sessions. Such feedback improves performance (15).

WHOs five-point plan of action for immunizing all the world's children by 1990 recommends the promotion of EPI within the context of primary health care, the investment of adequate human and financial resources in EPI, the continuous evaluation and adaptation of EPI efforts, and the pursuit of research as part of programme operations (3). Evaluation can lead to the achievement of all of these points, by promoting community participation, providing data to convince decision-makers to invest adequate resources, showing the path forward, and by stimulating individuals to follow it.

Résumé

Recours à l'évaluation pour améliorer le Programme élargi de vaccination au Mozambique

Dans le présent article on a procédé à l'évaluation des stratégies de vaccination, de l'efficacité du vaccin antirougeoleux et de l'impact du Programme élargi de Vaccination au Mozambique.

C'est en 1985 qu'un projet pilote a été mis en place au Mozambique, dans lequel des services périphériques ont été "détachés" dans les régions rurales trois mois par an. En 1987, une enquête sur les "connaissances, attitudes et pratiques" a été menée afin d'évaluer le projet. Les principaux éléments qui ont fait que la vaccination était incomplète étaient les suivants: vaccination inefficace en raison de la non-observance du calendrier; occasions manquées de vaccination; peu de jours d'ouverture des services de vaccination du centre de santé le plus proche dans la semaine; connaissance par la mère d'un cas d'enfant ayant présenté un abcès postvaccinal; naissance d'un enfant à la maison; présence d'au moins cinq enfants dans la famille; mère n'étant pas de langue portugaise; mère incapable de citer au moins deux des maladies visées par le PEV.

Les études d'efficacité du vaccin ont été menées par sondage par grappes dans les régions d'endémie de la rougeole, notamment dans les villes de Nampula et de Beira. L'efficacité du vaccin a été estimée à 40% à Nampula (intervalle de confiance à 95%, 28–56%) et à 59% à Beira (intervalle de confiance à 95%, 37–72%). Toutefois, une étude séro-épidémiologique ultérieure a montré que la spécificité et la sensibilité des antécédents de rougeole rapportés par les mères à propos de leurs enfants étaient respectivement de 83% et 56%. Le sondage par grappes va donc devoir être amélioré avant de pouvoir être utilisé couramment pour surveiller l'efficacité du vaccin antirougeoleux.

La couverture par ce vaccin était en 1986 de 86% à Maputo, la capitale, et, dans les autres villes sur lesquelles l'enquête a porté, elle est passée d'une moyenne de 54% en 1985 à 71% en 1987. Une étude pilote a été effectuée en 1986 avec le sondage par grappes du PEV afin d'évaluer l'impact de ce programme dans la ville de Quelimane. L'incidence et le taux de mortalité estimés de la rougeole chez les moins de 5 ans ont été respectivement de 129 pour 1000 et de 11 pour 1000. Cette méthode ne convient pas à la surveillance de l'impact du Programme et il a donc fallu établir des endroits sentinelles pour la surveillance de la rougeole, du tétanos néonatal et de la poliomyélite. A Maputo, les résultats ont montré: une baisse de l'incidence du tétanos néonatal qui est passée de 173–250 cas par an avant vaccination, à 3–13 cas par an après vaccination; une baisse de l'incidence de la poliomyélite et un déplacement de la répartition par âge des cas de rougeole vers des enfants plus âgés.

Les résultats de cette évaluation ont conduit à modifier les politiques de vaccination (adoption d'un calendrier national de vaccination et arrêt de l'utilisation de vaccins dont la date limite d'utilisation est dépassée), et les stratégies employées (élaboration de stratégies différentes pour les zones urbaines et rurales, ainsi que pour les personnes déplacées). Les résultats des centres de santé ont été améliorés en faisant participer les administrateurs et les responsables du programme au processus d'évaluation, et en informant correctement et en temps utile les décideurs,

les agents de santé périphériques et la communauté dans son ensemble, des résultats de cette évaluation.

Acknowledgements

References

1. **Henderson, R.H. et al.** Immunizing the children of the world: progress and prospects. *Bulletin of the World Health Organization*, **66**: 535–543 (1988).
2. **Henderson, D.A.** Principles and lessons from the smallpox eradication programme. *Bulletin of the World Health Organization*, **65**: 535–546 (1987).
3. The World Health Organization's Expanded Programme on Immunization: a global overview. *World health statistics quarterly*, **38**: 232–252 (1985).
4. **World Health Organization.** Global eradication of poliomyelitis by the year 2000. *Weekly epidemiological record*, **63**(22): 161–168 (1988).
5. **Cutts, F.T. et al.** The development of appropriate strategies for EPI: a case study from Mozambique. *Journal of health policy and planning*, **3**: 291–301 (1988).
6. **Henderson, R.H. & Sundaresan, T.** Cluster sampling to assess immunization coverage: a review of experience with a simplified sampling method. *Bulletin of the World Health Organization*, **60**: 253–260 (1982).
7. **Cutts, F.T. et al.** Evaluation of factors influencing vaccine uptake in Mozambique. *International journal of epidemiology*, **18**: 427–433 (1989).
8. Field evaluation of vaccine efficacy. *Weekly epidemiological record*, **60**(18): 133–136 (1985).
9. **Orenstein, W.A. et al.** Field evaluation of vaccine efficacy. *Bulletin of the World Health Organization*, **63**: 1055–1068 (1985).
10. **Ministry of Health Mozambique.** [Appraisal of notification of various communicable diseases in 1984]. *Noticiario epidemiologico*, **1**: 7–24 (1985) (in Portuguese).
11. **Rothenburg, R.B. et al.** Observations on the application of the EPI cluster survey method for estimating disease incidence. *Bulletin of the World Health Organization*, **63**: 93–99 (1985).
12. **Cutts, F.T.** The use of the WHO cluster survey method for evaluating the impact of the Expanded Programme on Immunization on target disease incidence. *Journal of tropical medicine and hygiene*, **91**: 231–239 (1988).
13. **Cutts, F.T. et al.** Field evaluation of measles vaccine efficacy in Mozambique. *American journal of epidemiology*, **131**: 349–355 (1990).
14. **Cliff, J.** Neonatal tetanus in Maputo, Mozambique. I. Hospital incidence and childbirth practices. *Central African journal of medicine*, **31**: 9–12 (1985).
15. **van Zwanenberg, T.D. & Hull, C.** Improving immunization: coverage in a province in Papua New Guinea. *British medical journal*, **296**: 1654–1656 (1988).