

Measles control in Maputo, Mozambique, using a single dose of Schwarz vaccine at age 9 months

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In Maputo city, immunization is available at government health facilities, all contacts being used to vaccinate children. Door-to-door mobilization is conducted to identify eligible children and refer them for immunization. Card-documented measles vaccine coverage, estimated by community surveys, rose from 48% in 1982 to 86% in 1986 and 92% in 1992. The median age at measles vaccination was 10.2 months in 1986 and 9.2 months in 1992. The reported measles incidence rates per 100 000 population fell by 92% from 569 in 1977–78 (pre-vaccination) to 44 in 1990–92, and the reported inpatient measles mortality fell from 19.8 to 0.7 per 100 000. Among children whose age at measles onset was known, the proportion of reported measles cases in children under 9 months of age fell from 2162 (20.3% of 10 636 cases) in 1982–85 to 1695 (17.8% of 9501 cases) in 1986–92. The proportion of cases in children aged ≥5 years increased from 15.2% to 32.8% in the corresponding periods. The global goals for measles control can be achieved by a single dose of Schwarz vaccine at 9 months of age.

Introduction

To attain the goal of reducing measles mortality by 95% and morbidity by 90% from pre-vaccination levels by the year 1995, WHO has recommended that all districts should achieve >90% immunization coverage and that emphasis be given to measles control in urban areas (1). This article describes the use of a single dose of Schwarz vaccine at 9 months of age to control measles in Maputo city, capital of Mozambique.

Measles vaccine was introduced in Maputo city (1992 population, approximately 1 356 000) in early 1979, during a nationwide campaign which reached an estimated 95% of children aged between 9 months and 5 years. The national Expanded Programme on Immunization (EPI) was launched in 1981. Since then, vaccination has been delivered daily at "well baby clinics" in 18 government health facilities, and since 1991 at a further health centre once per week.

To date, no private or nongovernmental health facilities operate in Maputo.

Since the launching of EPI, the Maputo health authorities have worked closely with community-based organizations associated with the governing FRELIMO party in order to mobilize communities for immunization. In 1983, door-to-door mobilization was initiated (2). A team of 18 municipal workers, with basic literacy but no formal medical training, conducted home visits to identify defaulters from immunization, antenatal care, or tuberculosis treatment, and to refer them to the nearest health centre.

In 1986, it was decided to decentralize the logistics and supervision of four health sectors in Maputo, each of which had a general hospital with a cold store and 4–6 health centres. Each health centre was responsible for the "health area" around it. With assistance from UNICEF, intensive health education was conducted through the mass media, puppet and film shows in city neighbourhoods, and school competitions, with well-publicized government support. The health centres, schools, firms, and health worker training institutes helped to conduct door-to-door visits in different neighbourhoods.

Materials and methods

Measles vaccination coverage and efficacy

The Ministry of Health (MOH) has been conducting EPI cluster surveys (3) to measure the immunization

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coverage in cities every 2–3 years. We accepted only card-documented doses of vaccine and applied the following criteria for appropriate vaccination: presence of a BCG scar, first dose of diphtheria–pertussis–tetanus (DPT) vaccine and oral poliomyelitis vaccine (OPV) at 6 weeks of age or later, intervals of at least 4 weeks between each dose of DPT/OPV, and measles vaccine at age 8.5 months or later.

In 1992, we used Lot Quality Assurance Sampling (LQAS) to look for potential pockets of low coverage (4). In each health area, we selected 13 *quarteiroes* (administrative subdivisions of approximately 50 households) randomly. We registered one child aged 12–23 months in each *quarteirao* selected, beginning from a randomly selected household. We classified health areas as “low coverage” (95% confidence that coverage was not more than 70%) if more than 2 out of 13 children had not received measles vaccine. We also computed the average coverage for the city, weighted for the population of each health area.

We monitored measles vaccine efficacy among the 9–23-month-olds, using the “screening” method (5), by comparing the proportion of measles cases among vaccinated children to the estimated vaccine coverage in the population.

Measles surveillance

All health facilities in Mozambique notify measles cases and deaths weekly to the local health authority and from there to the MOH; data for the years since 1977 were available to us. Prior to 1980, the year when Maputo city established a separate health department, cases were reported from both urban and rural areas of Maputo province. To estimate the number of measles cases in Maputo city for 1977–79, we applied the proportion of cases notified by the city in the years 1980–84 to the earlier year's total from the city and province. Since 1982, the city health facilities have also been submitting individual reports, including the age and vaccination status of measles cases, to the city preventive medicine office (CPMO). The CPMO gives feedback on surveillance at weekly health worker meetings, and the MOH describes progress in measles control in articles in the national epidemiology reviews.

For measles-associated mortality, we used data on hospital deaths reported to the CPMO by Maputo Central Hospital, which was the only hospital with paediatric beds until 1986, and by two other paediatric units, one of which opened in 1986 and the other in 1991. Prior to 1980, Maputo Central Hospital reported deaths occurring only in the infectious disease ward, but since 1980 the deaths in the emergency room have been included.

To estimate the reported measles incidence and mortality rates we used population data from the 1980 census (6). We applied a 3.59% annual growth rate for the years 1976–79 and a 5.0% growth rate for the years 1980–92 (National Planning Commission, Mozambique, unpublished estimates).

Results

Vaccine coverage

After the mass campaign, there was a lag while routine services became established and then coverage rose rapidly. Since 1986, measles vaccine coverage of 12–23-month-olds has been around 90% (Table 1). The median age at receipt of measles vaccine was 10.2 months in 1986 and 9.2 months in 1992. In the 1992 LQAS surveys, no health area had less than 70% estimated coverage for measles vaccine.

Estimated vaccine efficacy was somewhat low (74%) in 1982, but since then the estimates (84–91%) have been in the expected range for Schwarz vaccine at age 9 months (Table 2).

Measles surveillance

Approximately 16 months after the 1979 campaign, a large measles epidemic occurred. As measles vaccine coverage increased, the reported measles incidence subsequently declined, but smaller epidemics occurred at approximately two-year intervals until 1987/88 (Fig. 1). The 1989/90 epidemic, which occurred in the rest of Mozambique, did not affect Maputo city where coverage was highest. In 1992, only 97 cases were reported. Reported annual measles incidence rates per 100 000 population fell by 92% from 569 in 1977–78 (pre-vaccination) to 44 in 1990–92 (Fig. 2); the reported inpatient measles-associated death rates per 100 000 population fell by 97% from 19.75 to 0.67 over the same period. In Maputo Central Hospital, measles accounted for less than 4% of all paediatric

Table 1: Percentage vaccine coverage of children aged 12–23 months, Maputo city, 1982–92^a

	1982	1983	1986	1989	1992
BCG	72	83	85	95	98
DPT/OPV 1	74	84	96	90	99
DPT/OPV 2	66	80	94	89	97
DPT/OPV 3	56	76	93	87	92
Measles	48	70	86	90	92
Complete	39	68	84	81	85

^a Children without vaccination cards were considered unvaccinated. Data for 1982–89 were from cluster surveys using the EPI method; for 1992 the coverage is the weighted average from Lot Quality Assurance Sample surveys.

Table 2: Percentage measles vaccine coverage and efficacy, estimated by the screening method, Maputo city, 1982-92^a

	1982	1983	1986	1989	1992
Measles vaccine coverage	48	70	86	90	92
Percent of measles cases vaccinated	19	17	41	59	61
Measles vaccine efficacy	74	91	89	84	86

^a Estimated using the formula: $VE = \frac{(p-c) \times 100}{p(1-c)}$

where VE = vaccine efficacy;
 p = vaccine coverage in the population;
 c = proportion of cases in vaccinated children.

atric deaths in 1988-92, compared with 14% in 1977-80.

The absolute incidence fell in all age groups (Fig. 3). There was a temporary increase in measles cases among children aged ≥5 years in 1985-87, which subsequently decreased. The relative age distribution of measles cases changed (Fig. 4), the proportion of cases aged 9-23 months decreasing from the early years of the programme to the years after high coverage was achieved although the changes are not very consistent. The proportion of reported cases among children under 9 months of age decreased from 2162 (i.e., 20.3% of 10 636) cases in 1982-85) to 1695 (i.e., 17.8% of 9501) cases in 1986-92.

The reported measles-associated deaths also fell in all age groups (Fig. 5), with no consistent changes in the relative age distribution. Most reported deaths occurred in 9-23-month-old children; of those with information on vaccination status, two-thirds of deaths occurred in unvaccinated children. We have not presented age-specific case-fatality ratios because of the different sources of data on deaths and cases.

Deficiencies in the completeness of reporting are unlikely to be the reason for the reduced measles

Fig. 1. Number of reported measles cases by month, Maputo city, 1979-92, with percentage vaccine coverage.

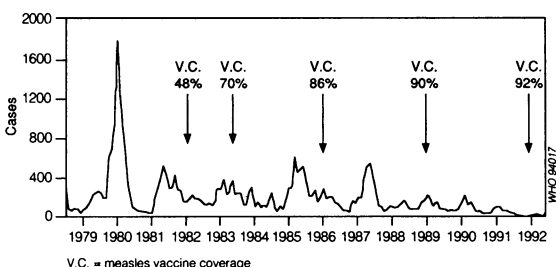
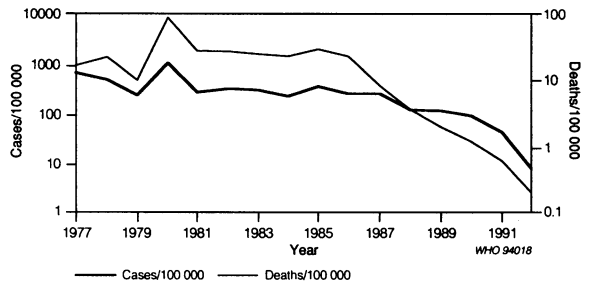


Fig. 2. Reported measles incidence and inpatient death rates per 100 000 population, Maputo city, 1977-92.



incidence. This is because the reporting of measles has probably improved since 1982, when individual case reports and weekly meetings to discuss surveillance data were introduced. In 1989 and 1990 all the Maputo health facilities submitted 100% of their due reports; in 1991, only two health centres failed to submit reports during two weeks.

Discussion

The WHO goal for measles control has been achieved in Maputo city with a sustained coverage of around 90% of 9-23-month-old children. Vaccination is timely, with estimated high efficacy, and we did not identify pockets of low coverage. This achievement is due to the use of all health centre contacts to vaccinate, close supervision of cold chain and vaccination practices, regular discussion of surveillance information, close collaboration with community groups, and door-to-door visits to identify and refer eligible children, including migrants.

The somewhat greater impact on reported measles-associated mortality than on morbidity is to be expected because of the reduced severity of measles among older children (7) and vaccinated cases (8),

Fig. 3. Reported measles cases by age group, Maputo city, 1982-92.

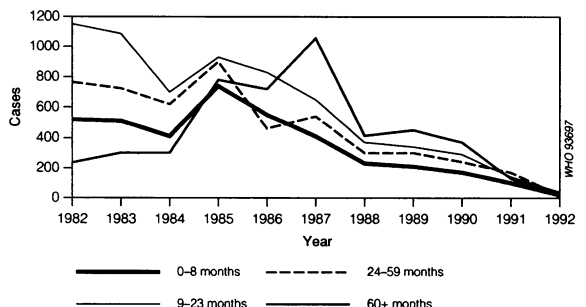
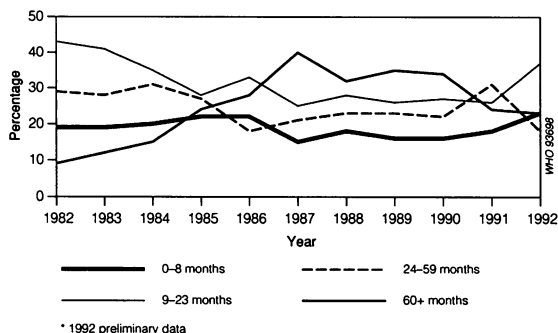


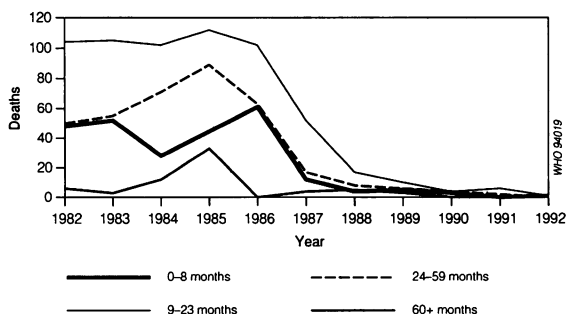
Fig. 4. Percentage of reported measles cases, by age group, Maputo city, 1982-92.



both these groups now forming a larger proportion of cases in Maputo. Severity may also have decreased because the intensity of infection decreases when high coverage is attained (9).

Measles incidence and mortality decreased in all age groups, including children under 9 months of age. Although we do not have information on potential delayed mortality after early exposure (10, 11), measles among infants under 9 months of age no longer appears to be a significant public health problem. Other authors have suggested that measles vaccines which protect children under 9 months of age are needed to control measles in large cities (12, 13). Kinshasa, Zaire, which has a population approximately three times larger than Maputo, introduced universal vaccination at age 6 months with Edmonston-Zagreb (EZ) vaccine in 1989, and achieved over 90% reduction in reported measles incidence, with a fall in the proportion of cases under 9 months of age from 32% to 23% (14). However, the programme's efforts also increased measles vaccine coverage to 89% after the introduction of EZ, and it was difficult to assess the independent effect of earlier vaccination in Kinshasa. It is important to evaluate the impact of

Fig. 5. Reported measles inpatient deaths by age group, Maputo city, 1982-92.



high coverage using current vaccines on the incidence rates among infants under 9 months old in other cities in developing countries.

The experience of other countries and predictions from mathematical models suggest that the period of low measles incidence in Maputo may be followed by measles outbreaks (15). Countries aiming for measles elimination have therefore used additional strategies including the adoption of a routine two-dose measles vaccine schedule (16), or the conduct of mass campaigns to interrupt measles transmission (17). The cost of these additional strategies must be balanced against competing public health priorities in a period of economic decline and reduced public sector spending. Measles control, if not elimination, can be achieved with a single dose of measles vaccine if the coverage is uniformly high, timely, and sustained and the quality of vaccination practices is high. Surveillance has been an important component of the efforts in Mozambique to date, and will continue to play a crucial role in sustaining enthusiasm and in helping to detect any increase in incidence sufficiently early to permit remedial action.

Acknowledgement

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Résumé

Vaccination contre la rougeole à Maputo (Mozambique): une dose unique de vaccin Schwarz à l'âge de neuf mois

La vaccination antirougeoleuse a été introduite à Maputo (1 356 000 habitants en 1992) au début de 1979, lors d'une campagne nationale qui a permis de vacciner 95% des enfants âgés de neuf mois à cinq ans. Depuis 1981, la vaccination antirougeoleuse est pratiquée quotidiennement dans 18 centres de santé de l'Etat; un autre centre offre ce service une fois par semaine depuis 1991. Aucune occasion de vaccination n'est négligée et une équipe d'auxiliaires municipaux effectue des visites à domicile pour recenser les enfants à vacciner et les aiguiller vers les centres de santé. Les médias sont mis à contribution pour rappeler l'importance de la vaccination.

Tous les deux ou trois ans, le Ministère de la Santé effectue des enquêtes selon la technique du sondage par grappes du PEV pour évaluer la couverture vaccinale dans les villes. Les cas de

rougeole et les décès dus à cette maladie sont notifiés chaque semaine aux autorités sanitaires locales qui transmettent ces données au Ministère; en outre, des rapports individuels indiquant l'âge et le statut vaccinal des cas de rougeole sont transmis au Bureau de Médecine préventive de la ville. L'efficacité de la vaccination est évaluée en comparant la proportion de cas de rougeole parmi les enfants vaccinés à la couverture vaccinale de la population. Le Bureau de Médecine préventive présente les résultats de la surveillance aux réunions hebdomadaires des agents de santé et le Ministère décrit les progrès de la lutte contre la rougeole dans des articles qui paraissent dans les revues nationales d'épidémiologie.

Depuis 1986, la couverture vaccinale des enfants âgés de 12 à 23 mois avoisine 90%. L'âge médian de la vaccination antirougeoleuse était de 10,2 mois en 1986 et de 9,2 mois en 1992. On estime que l'efficacité de la vaccination est de l'ordre de 84 à 91% depuis 1983. Avec l'amélioration de la couverture vaccinale, le nombre de cas de rougeole signalés a diminué, mais de petites flambées sont survenues à intervalles d'environ deux ans depuis la dernière épidémie de 1987-1988. Le taux d'incidence annuel pour 100 000 habitants est passé de 569 en 1977-1978 (avant la vaccination) à 44 en 1990-1992, ce qui représente une baisse de 92%. Au cours de la même période, le taux de létalité de la maladie chez les patients hospitalisés a chuté de 97%, passant de 19,75 à 0,67 pour 100 000. L'incidence absolue de la rougeole a diminué dans tous les groupes d'âge. Il y a eu une augmentation temporaire chez les enfants âgés de cinq ans et plus en 1985-1987, mais le nombre de cas a diminué par la suite, même dans ce groupe d'âge. La proportion des cas survenus chez les enfants de 9 à 23 mois et de moins de 9 mois a également diminué. La plupart des décès signalés se sont produits chez les enfants non vaccinés âgés de 9 à 23 mois, mais on n'a rapporté que 24 décès liés à la rougeole au cours de la période 1990-1992.

Une seule dose de vaccin est suffisante pour contenir la maladie à condition que la couverture soit uniformément élevée, réalisée à temps et maintenue, et que la technique de vaccination soit bien au point. Jusqu'ici, le Mozambique a accordé une place importante à la surveillance et celle-ci continuera à jouer un rôle crucial. En effet, elle contribue à maintenir l'enthousiasme du personnel et permet de détecter une éventuelle recrudescence de la maladie suffisamment tôt pour que des mesures correctrices puissent être prises.

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