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Effect of an immunisation campaign in Natal and KwaZulu on vaccination coverage rates, 1990 - 1991

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In 1990 the Department of National Health and Population Development of South Africa launched a nationwide immunisation campaign targeted mainly at measles. In order to measure the effect of the campaign on vaccination coverage rates for children, pre- and post-campaign vaccination coverage surveys were undertaken using a modified Expanded Programme for Immunisation technique, stratified for race and urban/rural residence.

The results in KwaZulu-Natal showed no significant increase in measles vaccination coverage for any race rates after the campaign (as documented by Road-to-Health cards). There was a decrease in coverage of the black population. However, when a history of measles vaccination was accepted, the results showed an increase in coverage.

The results call into question the effectiveness of immunisation campaigns as a strategy for raising vaccination coverage levels, as well as their having a sustained impact on the incidence of measles. Alternative strategies, such as the strengthening and expansion of existing primary health care services, should be considered.

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In 1990 the Department of National Health and Population Development launched a nationwide immunisation campaign aimed primarily at measles, but which also emphasised the need to increase coverage rates of vaccination against all the diseases of the Expanded Programme for Immunisation (EPI).

Despite the progress of the EPI, only 59% of children worldwide under 1 year of age were estimated to have received the measles vaccine in 1988, and measles still causes an estimated 1.5 million deaths per year.[1] Before the campaign, coverage rates were estimated to be between 50% and 68% for the black population, and around 80% for white and coloured children aged between 12 and 23 months.[2] In 1989, the year before the campaign, 18 123 cases of measles were notified in South Africa.[3] This is probably an underestimate of the actual number of cases, not all having been notified; hence, the true incidence cannot be ascertained. However, given the notification data, estimates of annual incidence rates for blacks for 1989 varied from 1.9/100 000 in Bophuthatswana and 3.8/100 000 in the Orange Free State, to 72.9/100 000 in the Eastern Cape and 86.9/100 000 in Lebowa. Case fatality rates varied from 0.9% to 8.0% in the different regions.[4] In most regions the incidence appeared to be declining.

Because of the high childhood morbidity and mortality, the national immunisation campaign of May/June 1990 was launched. The intention was to reduce the incidence of measles and increase vaccination coverage rates through a high-profile campaign intended to direct attention and resources to preventive health care and immunisation services, thereby producing effects which would be sustained after the campaign proper was over. In KwaZulu-Natal the campaign took the form of widespread publicity to encourage vaccination at existing facilities. The availability of vaccinations was increased through their being offered at all times at clinics, mobile points and in hospital outpatient departments, which had not previously been the case. Few extra service points were introduced and defaulters and contacts were not followed up.

As one measure of the effectiveness of the campaign, it was deemed necessary to measure coverage rates in children before and after vaccination to see if a significant increase in coverage rates had occurred. The pre-campaign survey was undertaken in 1990. The survey reported here is the post-campaign survey, which aimed to ascertain the level of vaccination coverage of children aged from 9 months to 21 months in Natal and KwaZulu after the campaign, and to compare the levels with those recorded in the pre-campaign survey of February 1990. The detailed results of this survey have been reported elsewhere.[5]

The investigation was designed to meet requirements specified by the Department of National Health, along with the local requirements as agreed to by the Natal-KwaZulu Health Services Liaison Committee. The national requirements included that information on urban whites, urban Asians, urban blacks and rural blacks be gathered. The level of precision required was 5%. The regional requirements included information on the coloured community, and that separate information be made available for Natal and KwaZulu.

Method

The pre-campaign survey was conducted in February 1990. The measles campaign took place in May-June 1990 and the post-campaign survey in June 1991. The method was similar to the standard EPI technique.[6]

The sampling frame for the post-campaign survey consisted of children aged between 9 months and 21 months on June 1991 in Natal and KwaZulu, for each of the specified race groups. In the pre-campaign survey, children aged between 12 and 24 months were selected. The age range was changed for the post-campaign survey in order to select only those children who would have become eligible for measles vaccination during or after the campaign. Hence the children had to be a maximum of 1 year and 9 months old on 1 June 1991.

The sample consisted of 114 clusters of 7 children each of whites, Asians, rural blacks and urban blacks, and 30 clusters of 7 children from the coloured community, so that there were in total 798 white, 798 Asian, 798 rural black, 798 urban black and 210 coloured children in the sample. Cluster locations were selected by means of a multistage, sequential sampling technique, the primary sampling units being magisterial districts and the secondary sampling units being enumerator sub-districts (ESDs). Seven starting points for finding children within each cluster were randomly selected using 1:10 000 orthophoto maps of the relevant ESDs. This random selection of children enabled sub-analyses to be done for Natal and KwaZulu, which is not possible with the normal EPI cluster sampling method.

With regard to the white community, it was found necessary to deviate from this technique due to the scarcity of children in the required age range. In the 1990 survey field workers had visited up to 30 houses around the randomly selected starting point before finding a child. For this survey it was therefore decided to select children within the appropriate magisterial district using the registers of births kept at local clinics.

Interviewers visited the points identified on the orthophoto maps and went to the nearest houses until a child of the correct age was found. Standard pre-coded questionnaires were administered to the parent/guardian of each child identified. The Road-to-Health card (RTHC) was requested and details of vaccinations given were recorded. In the absence of a card, a history of measles vaccination was requested and a BCG scar looked for. No attempt was made to verify immunisation status from, for example, clinic records.

Data were analysed on computer using SAS. The chi-square test of significance was applied to compare the results of the 1990 survey with those of 1991.

Results

Of the sample sought, the percentages of respondents obtained (with or without RTHCs) was high for the white (97.5%), coloured (100%) and Asian communities (96.4%), and lower for the urban black (72.9%) and rural black (86.8%) communities. A relatively low response rate was obtained for the urban blacks because of high levels of violence that prevented access by interviewers. The same townships had to be abandoned by researchers in both 1990 and 1991.

Table I shows the vaccination coverage rates by RTHC for all vaccines as found in the 1991 survey for all races. These range from 83% to 97.9% for Asians, coloureds and whites, and from 64.4% to 76.0% for blacks.

Table I. RTHC vaccination coverage survey — Natal and KwaZulu, 1991 (%)

	Race				
Vaccine	Asians (*N* = 769)	Urban black (*N* = 582)	Rural black (*N* = 693)	Coloured (*N* = 210)	White (*N* = 778)
BCG	96.1	71.5	76.0	94.9	96.7
Polio — birth	93.4	66.7	64.4	93.5	95.0
Polio — 1	96.1	72.9	77.5	94.4	97.9
Polio — 2	95.4	70.1	72.9	94.4	97.3
Polio — 3	94.1	66.0	66.1	93.1	95.8
Measles	93.1	64.8	65.2	89.8	83.0
DWT — 1	96.1	72.2	76.6	94.4	97.6
DWT — 2	95.7	70.4	72.2	94.4	96.8
DWT — 3	94.4	65.6	65.2	93.1	95.2

Table II shows the change in measles vaccination coverage from 1990 to 1991 on the basis of RTHCs only, and including historical data ('worst case' and 'best case' scenarios). Among whites, coloureds and Asians, only the 'best case' scenario for Asians showed a significant increase in coverage. For blacks, the results differed markedly according to whether or not historical data were included. This was also evident when sub-analyses for Natal and KwaZulu were performed (Table III). The results for BCG coverage for blacks in Natal and KwaZulu show a similar pattern (Fig. 1). The differences between the 'best case' and 'worst case' scenarios are particularly dramatic for KwaZulu.

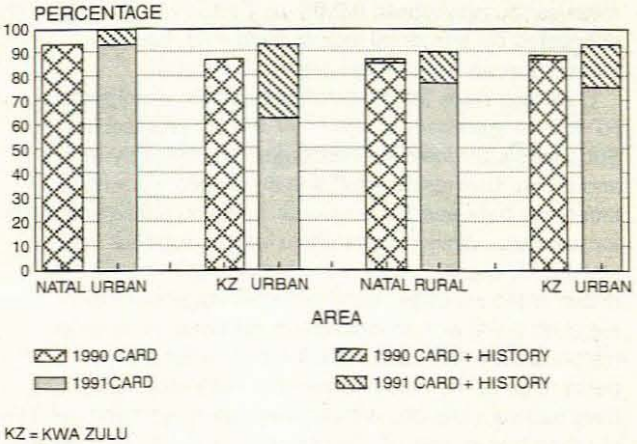

Fig. 1. BCG vaccination coverage — Natal and KwaZulu, rural and urban blacks, 1990 and 1991.

Table II. Changes in measles vaccination coverage, 1990 - 1991, by card and card and history for all races (%)

	Card				Card and history			
	1990	1991	Change	*P*-value*	1990	1991	Change	*P*-value
Asians	90.9	93.1	+2.2	NS ($P = 0.12$)	91.2	96.6	+5.4	S ($P = 0.01$)
Whites	80.3	83.0	+2.7	NS ($P = 0.16$)	81.0	84.0	+3.0	NS ($P = 0.12$)
Coloureds	88.8	89.8	+1.0	NS ($P = 0.74$)	91.3	92.1	+0.8	NS ($P = 0.75$)
Urban blacks	71.2	64.8	–6.4	S ($P = 0.022$)	71.8	79.6	+7.8	S ($P = 0.003$)
Rural blacks	67.3	65.2	–2.1	NS ($P = 0.41$)	69.2	76.2	+7.0	S ($P = 0.0034$)

* Chi-square test.

Table III. Changes in measles vaccination coverage of the black population, Natal and KwaZulu, 1990 - 1991 (%)

	Card				Card and history			
	1990	1991	Change	*P*-value*	1990	1991	Change	*P*-value*
Natal urban	81.0	85.1	+4.1	NS ($P = 0.37$)	81.0	88.8	+7.8	NS ($P = 0.068$)
KwaZulu urban	68.3	57.0	–11.3	S ($P = 0.0009$)	69.1	76.0	+6.9	S ($P = 0.028$)
Natal rural	67.3	74.8	+7.5	NS ($P = 0.19$)	70.0	79.3	+9.3	NS ($P = 0.094$)
KwaZulu rural	67.3	63.4	–3.9	NS ($P = 0.16$)	69.0	75.6	+6.6	S ($P = 0.012$)

* Chi-square test.

In the rural areas the documented measles vaccination coverage rates were significantly higher ($P < 0.05$) in Natal than KwaZulu (74.8% v. 63.4%, $P < 0.05$). For the urban areas there was a significant difference for all vaccines, with the documented coverage in Natal being 20 - 30% higher for all vaccines. This difference is greater than that noted in 1990.

Discussion

As shown in Table I the vaccination coverage rates are very good for the white, coloured and Asian populations, being over 93% for all vaccines except measles. The measles vaccination coverage rate increased slightly from 1990 to 1991 (Table II). This was only statistically significant if the best case scenario for the Asian community was considered (5.4% increase, $P = 0.01$), but the already high coverage rates precluded any dramatic improvements in these groups. The coverage rate for the white population is relatively low at 83%; this may be due to mothers waiting for measles/mumps/rubella (MMR) vaccination at 15 months as suggested by anecdotal reports from interviewers. Information on this vaccine was not collected.

Coverage rates for the black population, according to RTHCs, ranged from 64.4% to 77.5% for all vaccines. Subanalysis for measles vaccination coverage by territory and urban/rural residence (Table III) reveals a dramatic difference between the best case and worst case scenarios for KwaZulu. While in Natal there was a slight but not statistically significant increase in coverage, in KwaZulu documented measles vaccination coverage rates fell, although there was an increase in coverage rates when historical data were included. It may be that a large percentage of the black population, both urban and rural, have had vaccinations without their being recorded, as 23% of urban blacks and 16.9% of rural blacks had BCG scars (Fig. 1) as proof of vaccination, but no documentary evidence thereof. Similarly with measles (Table II), 14.8% of urban and 11.0% of rural blacks gave a history of vaccination but had no documentary proof. BCG scars serve as objective evidence of vaccination; they corroborate the histories and suggest that historical data for measles immunisation may also be correct, although it has been found elsewhere that parents significantly overestimate the immunisation status of children.[7] The true vaccination coverage rates could therefore be 10 - 20% higher than those on the RTHCs, which would give a more acceptable 75 - 90% coverage rate for measles vaccination.

The difference in coverage rates between Natal and KwaZulu may indicate differences in the availability of health services. The differences between the best case and worst case scenarios in KwaZulu may also suggest a lack of documentation of vaccinations in this territory. RTHCs may also have been lost, stolen, kept outside the home or misplaced as a consequence of the violence and resulting displacement of people which particularly affects KwaZulu.

These results call into question the value of vaccination campaigns as a strategy for the control of infectious diseases through the raising of immunisation coverage rates. While the inclusion of historical data did show significant increases in coverage rates, and the number of measles cases notified in South Africa after the campaign did fall (from 18 123 in 1989[3] to 9 959 in 1990[8] and 4 777 in 1991[9]), the number of cases notified in 1992 increased to 15 056.[9] This implies that the campaign produced neither an increase in documented vaccination coverage rates nor a sustainable reduction in the incidence of measles, although the rapid drop in measles notifications immediately after the campaign may indicate the usefulness of campaigns as a form of crisis intervention. In an analysis of the increased notifications for 1992, it was found that in Natal, as elsewhere in South Africa, older children were affected proportionately more than under-5s, and that Asians and whites were particularly affected. It was concluded that the outbreak nationally would probably have been much worse without the preventive impact of the measles strategy,[10] the campaign having saved many younger children from infection.

However, as increased cases were notified for all ages and races, and in the absence of significant recorded increases in vaccination coverage rates, it is not possible to confirm such a beneficial effect of the campaign in KwaZulu-Natal from this study. Coetzee *et al.*[11] suggested that the epidemic in Cape Town affected older children, possibly as a consequence of primary and secondary vaccine failure. They found a vaccine efficacy of only 74% for the MMR which may, to some extent, explain the increased number of cases among older white children, many of whom have received only this vaccine.[11]

The use of campaigns has been questioned since 1971[12] on account of their cost, inefficiency[13] and the elaborate operational structures involved. Following the evaluation of an immunisation campaign in Senegal, Unger[14] concluded that the management characteristics of intensive campaigns (centralisation, short time scales, lack of administrative integration and extension by activity) lead to low sustainability and interference with the other activities of the services. Increases in coverage rates are usually short-lived, and may even stabilise at levels lower than before the campaign. Deficiencies in the quality of care have also been found during intensive campaigns. In Nigeria, quality of care indicators were compared in a mass immunisation setting with routine services. Important differences were noticed, each of them to the detriment of the intensive campaign: checked immunisation records — 70% v. 95%; assessment of child's general health — 5% v. 50%; mother informed of return date — 35% v. 62%.[15] Our finding that there was a large percentage of children whose mothers claimed they had been vaccinated against measles, yet were unable to produce a completed RTHC, suggests that a decrease in the quality of care could have occurred in the KwaZulu-Natal campaign, with immunisations not being recorded as zealously as usual.

Alternative strategies for decreasing the incidence of measles should now be examined. Cutts[16] suggests that attention be focused on underserved urban slums and settlements because these account for 30 - 50% of urban populations in developing countries, usually provide low access to health services, carry a large burden of disease mortality and act as sources of infection for the city and rural areas. The above may well apply in South Africa, and the high population density in these areas may mean earlier exposure of susceptible children to measles, consequently with a higher case-fatality ratio. Factors affecting the use of immunisation services have been found to include employment of mothers outside the home and long waiting times at clinics.[17] A study in Mozambique showed that children whose nearest clinic offered vaccinations only once a week had a relative risk of incomplete vaccination of 8.5 compared with children whose nearest clinic offered vaccinations on three or more days per week.[18] Numerous studies have shown the importance of identifying these and other causes of missed opportunities for immunisation at health facilities.[19]

Innovative ways must be found to increase the availability and accessibility of immunisation services, designing them around the needs of the mothers rather than the staff and employers. This should include provision of services at weekends and evenings, which would be facilitated by the introduction of 'flexitime' for health workers. Urban programmes in other African countries are increasingly adopting a house-to-house approach with a view to increasing community motivation and immunisation coverage, with systems of registration and follow-up tracing of defaulters.[20,21] These home visits may also be used to identify and refer defaulters from other services, such as tuberculosis, family planning and sexually transmitted diseases. Methods of providing services in sparsely populated areas other than the monthly 'mobile clinic' should be explored, e.g. the giving of immunisations at the local store by medically unqualified people — specifically trained for that task. Perhaps now is the time for health authorities and professional bodies to think laterally and develop imaginative strategies to channel South Africa's substantial resources into addressing these problems.

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