# Maternal and child health indicators in a rural South African health district

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*Objective.* To measure important maternal and child health indicators in a rural health district as part of the process of developing a comprehensive district health information system.

*Design.* A modified Expanded Programme on Immunisation cluster sample survey.

*Setting.* Hlabisa health district, KwaZulu-Natal.

*Participants.* 480 mothers (or carers) of children aged 12 - 35 months surveyed in 32 clusters.

*Interventions.* A questionnaire was administered and Road-to-Health cards were examined.

*Main outcome measures.* Proportion of women receiving antenatal care and delivering in a health facility; knowledge and understanding of vaccination; and recall of vaccination history. Proportion of children with a Road-to-Health card, overall coverage of each vaccine, coverage at 12 months of age and proportion receiving an immunogenic dose.

*Results.* Most mothers (91%) had attended antenatal care, 77% had received tetanus toxoid and 83% delivered in a health facility. Only 14 children (3%) had never received a Road-to-Health card and 73% had one available at the time of the survey. Overall immunisation coverage was high (80 - 98%), as was the proportion receiving an immunogenic dose of each vaccine (78 - 98%). However, only 76% had received all the vaccines due to a 12-month-old child, and only 88% of these had received all doses by 12 months of age.

*Conclusions.* While the key maternal health indicators measured here are reassuring, there is still room for improvement in the child health indicators. The proportion of women receiving antenatal care and delivering in a health facility is very high, but the proportion of children receiving all vaccines can be improved upon, as can the timing of immunisation. The results of this survey are being used to strengthen further the primary health care services in the district.

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Both the National Health Plan and the Reconstruction and Development Programme have prioritised the delivery of high-quality maternal and child health services in South Africa.[1,2] It is, however, difficult to assess what improvements remain to be implemented as maternal and child health status, particularly in rural areas, is poorly documented. While comprehensive immunisation surveys at a national level have been conducted,[3] less is known about other aspects of child health and even less about maternal health.[4]

At the district level — the level at which action to improve maternal and child health status will be taken[5] — even fewer data are available. Health managers need to monitor the key health indicators in their district if they are to direct resources and manage a service appropriately, yet district health information systems barely exist. In the Hlabisa health district of KwaZulu-Natal efforts have been underway for several years to gather data on various key health indicators, and to improve on them. Published examples include the perinatal mortality rate,[6] tuberculosis caseload,[7] and the prevalence of HIV infection.[8] The collection of these data has led to important reductions in, for example, perinatal mortality,[9] and improvements in tuberculosis case management.[10]

In this paper we report on another important part of this process: the determination of important maternal health (antenatal clinic attendance, delivery practices) and child health (immunisation coverage) indicators through a modified Expanded Programme on Immunisation (EPI) cluster sample survey. These data were collected with the direct aim of using them to improve the service further.

## Methods

### Setting

Hlabisa health district is situated in northern KwaZulu-Natal. The 450-bed district hospital is staffed by 10 medical officers, there are 8 community clinics (most providing a 24-hour service), and 2 mobile clinic teams serving 20 mobile clinic points throughout the district. Comprehensive primary health care is delivered at each of these sites. Routine clinic statistics indicate that approximately 7 500 women book for antenatal care, and that several thousand vaccinations are given each year. However, no community-based surveys have been conducted to determine levels of usage of either maternal or child health services. The lack of an accurate population denominator and the generally poor quality of routine statistics mean that health service data cannot be used to determine service utilisation or coverage accurately.

### Cluster sample survey

A modication[11] of the EPI cluster sample survey for estimating immunisation coverage[12] was used. This technique has been used before in South Africa.[13] The basic survey methodology was the random selection of 32 clusters, based on Sub A school attendance lists, and the application of a questionnaire to carers of 20 children aged 12 - 35 months resident in each cluster.

Fieldwork took place in July and August 1995. A list of schools and the number of children attending each was

obtained from the Department of Education. The cumulative total was divided by 32 to obtain the sampling interval, k. A random number, I, between 1 and k was generated by computer and the school containing the child with this number constituted the first cluster. The addition of k to this number generated a second number and the school whose cumulative population contained this number constituted the second cluster, and so on.

Each school was visited and the co-operation of the principal invited. From the Sub A attendance list at each school 1 child was randomly selected, and he/she guided or directed the study team to his/her home. The household next to this one constituted the start of the cluster, and interviewers then proceeded from door to door. The aim was to recruit 20 children aged 12 - 35 months from each cluster, stopping only when this number was reached or if the topography so dictated. The age range 12 - 35 months was chosen when a pilot study indicated that it was unlikely that 20 children 12 - 23 months (the usual range used in such surveys) would be recruited in each cluster, simply because the kraals in this area are often very dispersed.

### Questionnaire

Carers were asked about their antental care attendance during their pregnancy with the index child, receipt of tetanus toxoid and place of delivery. They were then asked about their child's immunisation status, and finally the Road-to-Health card (RTHC), if available, was inspected and dates of immunisations were recorded.

### Analysis

Data were collected and analysed on Epi-Info version 6.02. To account for the design effect in cluster sampling and the unequal numbers of children in each sample the 'CSAMPLE' programme in Epi-Info was used; the design effect was calculated at 1.87 by comparing the confidence interval estimated after accounting for the cluster design with that obtained using the formula for a simple random sample. The 95% confidence intervals of the estimates reported below are therefore ±7.8%.

## Results

A total of 480 mothers (or carers) of 480 children aged 12 - 35 months were surveyed in 32 clusters. The number per cluster varied from 6 to 20 with a mean of 16 (SD = 9). Three hundred and fifteen (66%) of the children were aged 12 - 23 months, and 165 (34%) were aged 24 - 35 months; 248 (52%) were male.

### Key maternal health indicators

Of the 442 women who provided information on antenatal clinic attendance, 435 (98%) had attended an antenatal clinic at least once during the index child's pregnancy. Most of those (77%) known to have attended an antenatal clinic reported having received tetanus toxoid; 42 (10%) had never received it, and information was not available for the remainder. A total of 396 (83%) women delivered in a health facility (Table I).

**Table I. Health service utilisation for obstetric and immunisation services in Hlabisa**

| | Attendance for delivery | | Attendance for immunisation | |
|---|---|---|---|---|
| *Health service delivery point* | *No.* | *%* | *No.* | *%* |
| Hospital | 286 | 59.6 | | |
| Hlabisa | 226 | 47.1 | 49 | 10.7 |
| Other | 60 | 12.5 | 0 | |
| *Clinic* | *110* | *22.9* | | |
| Within Hlabisa district | 87 | 18.1 | 402 | 87.6 |
| Outside Hlabisa district | 23 | 4.8 | | |
| Private doctor | | 0 | 8 | 1.7 |
| Home | 84 | 17.5 | 0 | |
| Total | 480 | 100 | 459 | 100 |

### Key child health indicators

Most (74%) births had not been registered. Although 83 (17%) of the children had been born outside the Hlabisa health district, 79 (95%) of the 83 had lived most of their lives in Hlabisa after delivery. Of 269 children with siblings of an age eligible for admission to school at Sub A level, 249 (93%) had siblings who attended school in Hlabisa; 6 were not in school, and 14 were attending a school in another district.

#### Knowledge and understanding of vaccination

Only 18 (4%) mothers reported that their child had never been vaccinated, and 3 (0.6%) did not know. Most (76%) believed they had completed the schedule of vaccination; 92 (20%) believed they had not, and 8 did not know.

Of the 459 who reported any vaccinations, most (93%) reported that they had attended the same site each time. The commonest site attended for vaccination was a fixed clinic (66%), followed by a mobile clinic; only 1.7% obtained vaccination in the private sector (Table I).

Only 189 (40%) carers said that they would take their child for vaccination if he or she had fever, cough or diarrhoea; 273 (57%) said that they would not go for immunisation, and 18 did not know. The majority had never been turned away from a vaccination clinic (91%), and most (83%) had neither experienced nor heard of an adverse reaction to immunisation.

### Immunisation coverage

#### Road-to-health card

Only 14 (3%) of the 480 children surveyed had never received a RTHC; 352 (73%) had one available for inspection at the time of the survey, 61 reported that the card was locked away and therefore unavailable for inspection, and 53 that the card had been lost and not replaced.

#### Vaccination coverage in children with RTHC

Among 352 children with RTHCs, coverage of each vaccine was high, although there was a gradual drop-out with successive doses of DPT and polio (Table II). We calculated the proportion of children who received each vaccine at an age when the vaccine would be immunogenic ('valid doses'). DPT and polio were considered immunogenic if the first dose was given at age 6 weeks or later, and if subsequent

doses were given 4 weeks or more apart. Measles was considered immunogenic if given after 8.5 months. As shown in Table II, this proportion was generally high (76 - 99%).

**Table II. Documented and reported vaccination history and estimate of coverage**

| | Children with cards ($N$ = 352) | | | | No cards ($N$ = 114) | | Estimate of those vaccinated in total sample ($N$ = 466)† | |
|---|---|---|---|---|---|---|---|---|
| | Date of vaccination recorded | | Valid dose | | Verbal history of vaccination | | | |
| Vaccine | No. | % | No. | % | No. | % | No. | % |
| BCG | 344 | 97.7 | 344 | 97.7 | ‡ | | — | |
| OPV birth | 347 | 98.6 | 347 | 98.6 | 94 | 82.5 | 441 | 96 |
| DPT 1 | 329 | 93.5 | 324 | 92.0 | 89 | 78.1 | 413 | 89 |
| OPV 1 | 327 | 92.9 | 322 | 91.5 | 86 | 75.4 | 408 | 88 |
| DPT 2 | 320 | 90.9 | 302 | 85.8 | 80 | 70.2 | 363 | 78 |
| OPV 2 | 319 | 90.6 | 301 | 85.5 | 71 | 62.2 | 369 | 79 |
| DPT 3 | 283 | 80.4 | 275 | 78.1 | 69 | 60.5 | 316 | 68 |
| OPV 3 | 281 | 79.8 | 273 | 77.6 | 32* | 28.1 | 297 | 64 |
| Measles 1 | 306 | 86.9 | 269 | 76.4 | 91 | 79.8 | 360 | 77 |
| DPT 4 | 133 | 37.8 | 114 | 32.4 | 38 | 33.3 | 143 | 31 |
| OPV 4 | 128 | 36.4 | 110 | 31.3 | — | | — | |
| Measles 2 | 191 | 54.3 | — | | — | | — | |

* Denotes history of ≥ 3 doses of OPV.
† Best estimate is calculated as the total number of documented valid doses plus a variable proportion of verbally reported doses, estimated from the concordance between recalled and documented doses in children with cards.
‡ No verbal history of BCG was requested.

Although coverage was generally high for individual vaccines, only 266 (76%) children had received all the doses of the vaccines recommended for a 1-year-old child (BCG, polio 0, 1, 2, 3, DPT 1, 2, 3 and measles 1), and only 233 (88%) of these children had received all the doses by the time of their first birthday. Coverage for DPT 4 and measles 2 and 3 was low because many children surveyed had not reached an age to receive these vaccines. The drop-out rate between DPT 1 and 3 (13%) was higher than that between DPT 1 and measles (7%), indicating significant missed opportunities for DPT 3 vaccination. This may be due in part to the recent mass measles immunisation campaigns.

### Concordance between documented vaccination history and carers' recall

Of the 352 carers with a RTHC, 291 reported their child's receiving at least 1 dose of DPT, whereas 276 (95%) had at least 1 dose documented. However, of the 128 who reported receiving 3 doses or more, only 75 (59%) had these doses documented. Of 6 reporting no immunisation, 1 had received it and in the case of 59 carers who were unsure 53 of the children in question had received it. Carers consistently overreported doses of DPT actually received.

With regard to polio, of 295 who reported at least 1 dose, more (347) had at least 1 dose documented. This is probably because carers forgot or discounted the dose given at birth; however, 327 had at least 2 doses of polio documented. Of the 2 who reported no doses, both had received it and of 55 who did not know, 45 had received it. Carers consistently underreported doses of polio vaccine actually received.

All 306 carers who reported a dose of measles vaccine had this dose documented; of the 20 who reported no measles vaccination, 5 had been immunised; and of the 44 who did not know, none had been. Carers' history of measles immunisation was generally good. It was not possible to validate the history of carers without RTHC against other health service records.

### Estimate of vaccine coverage

In order to estimate the number of children immunised in the whole sample, for each vaccine the number with a valid (immunogenic) dose (from those with a RTHC) was added to a percentage of the reported doses from those without a RTHC. The percentage figure was an estimate of the accuracy of recall of carers without cards, based on the accuracy of recall of carers with cards. Results are shown in Table II. The vaccine with which the highest proportion were immunised was OPV 0 (96%), with a steady decline to 64 - 68% for OPV 3/DPT 3; 77% were vaccinated against measles.

## Discussion

Maternal and child health status, as measured by some key indicators in this survey, is reassuring. Almost all women attend antenatal care and most deliver under supervision of a health worker; most children are appropriately immunised for their age. However, there is room for improvement, especially in the extent of coverage and timing of immunisation.

This survey was large and carefully conducted, and a recognised methodology was used. The aim was to recruit 640 children (20 in each of 32 clusters) in order to provide accurate and stable estimates; however, only 480 children were recruited because of the often widely dispersed kraals in this area. The size of each cluster was limited only by the geography of the area and this is unlikely to have introduced significant bias into the survey. The CSAMPLE programme within Epi-Info deals with different sized clusters by weighting them, and produces estimates with 95% confidence intervals taking these and the cluster sample study design into account. This modification of the EPI cluster survey, using school attendance lists as the sampling frame, requires a 'high' (> 70%) level of school attendance to be valid.[11] In this survey, 93% of eligible children were in Sub A. We believe the results to be representative of the district as a whole. The low level of birth registration (74% not registered) illustrates why registered births cannot be used as a denominator for such a study. Health service immunisation data were not complete enough or reported in a format that could provide a numerator, and there was therefore a need for a community-based survey.

That most women attend antenatal care and deliver in a health facility is reassuring, and is consistent with other surveys in this province.[5] It is important that coverage be increased to the most isolated and marginalised women, to encourage earlier booking for antenatal care, and to develop the services more so that all women have the opportunity to deliver in a clinic or hospital. These services are now free, but we have shown elsewhere that free care did not increase antenatal clinic attendance;[14] it is likely that more dispersed

services will be required to increase access. Most women had received tetanus toxoid during their pregnancy, although the proportion should be higher. It is possible that some mothers forgot that they had received tetanus toxoid as very few antenatal cards seen in the clinics and hospital reflect omitted doses and, as we have shown, maternal recall of immunisation is often not accurate. The situation in Hlabisa is in sharp contrast to other nearby rural hospitals where tetanus toxoid vaccine has been difficult to provide.[15]

Only a few cases of neonatal tetanus are seen each year in the Hlabisa district. A key maternal health indicator not measured here is the maternal mortality rate; we are currently conducting a sisterhood survey to estimate this.

It was reassuring to find that most children had a RTHC available at the time of the study, and that most of those who did not reported that the card had not been lost. Most mothers recognised the need for immunisation — only 4% of the children surveyed had never been vaccinated. Most used the same site of health service delivery each time, and fixed community clinics were the most commonly used; only 2% obtained vaccination in the private sector. We know that many people attend the private sector for curative services and general practitioners represent another option for increasing coverage. More mothers need to understand that minor illness is not a contraindication to vaccination, but it is reassuring that 91% had never been turned away from a clinic and that 83% had never experienced or heard about an adverse reaction.

The picture for the key child health indicator of immunisation coverage is rather less reassuring. The EPI in South Africa has set a goal of 90% coverage for each vaccine by the year 2000. That target has been achieved in Hlabisa for BCG, DPT 1 and 2, and polio 0, 1, and 2, but not for DPT 3, polio 3 and, importantly, measles.

Furthermore, crude coverage does not give a complete picture of the immunisation programme; we found that only 76% of the children had received all the vaccines that they should have by 12 months of age, and that many (12%) had received some of them late. Therefore, while most vaccines given were valid and immunogenic doses, many children were left incompletely protected by an unnecessary delay between doses. A gradual drop-out between doses, as is often reported, was observed. At any time then, a substantial proportion of the children in the district are susceptible to infection. This is particularly true of measles which is highly infectious and requires a very high coverage to provide protection at a community level. Therefore while diphtheria, polio, childhood and adult tetanus and pertussis are extremely rare in this area several cases of measles do occur and the population is susceptible to epidemics.

Maternal recall of vaccination history was variable. For notable (e.g. measles) and early (e.g. OPV birth) vaccines, recall was more accurate. We were able to correlate recall with documented vaccination in those carers with cards, and used this to estimate the coverage in those without cards. This is a useful way of producing a good estimate of overall vaccination coverage and, as shown in Table II, the range of coverage is from 97.7% for BCG to 77% for measles and 64% for OPV 3.

In conclusion this survey has usefully defined the status of some key maternal and child health indicators in this health district. Utilisation of maternity services is high, and while immunisation coverage is encouraging, there is more to be done. These data provide clear indicators as to which aspects of the maternal and child health services need to be targeted for improvement in Hlabisa. More importantly, this survey demonstrated how a community-based survey is feasible to monitor maternal and child health status in a rural district.

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