

The accuracy of mothers' reports about their children's vaccination status

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Estimates of measles vaccination coverage in the Sudan vary on average by 23 percentage points, depending on whether or not information supplied by mothers who have lost their children's vaccination cards is included. To determine the accuracy of mothers' reports, we collected data during four large coverage surveys in which illiterate mothers with vaccination cards were asked about their children's vaccination status and their answers were compared with the information given on the cards.

Mothers' replies were very accurate. For example, for measles vaccination, the data supplied were both sensitive (87%) and specific (79%) compared with those on the vaccination cards. For both DPT and measles vaccination, accurate estimates of the true coverage rates could therefore be obtained by relying solely on mothers' reports. Within ± 1 month, 78% of the women knew the age at which their children had received their first dose of poliovaccine.

Ignoring mothers' reports of their children's vaccination status could therefore result in serious underestimates of the true vaccination coverage. A simple method of dealing with the problem posed by lost vaccination cards during coverage surveys is also suggested.

Introduction

Health workers involved in the Expanded Programme on Immunization (EPI) need to know whether mothers' reports of their children's vaccination status are reliable. This is especially true for cluster surveys if a considerable number of mothers have lost their children's vaccination cards. For example, a survey conducted in the Sudan demonstrated that in one region only 44% of children who had received measles vaccine had a card to prove it; however, based on the information supplied by mothers who did not have cards, the coverage was 72.5% (unpublished data, Ministry of Health, Sudan, 1988).

Also, it is important for health workers to know the accuracy of mothers' reports of their children's vaccination status before immunizing children who come to health facilities for curative care. In one study carried out in Khartoum (B.P. Loevinsohn et al., unpublished observations, 1988), only 9% of mothers brought their infant's vaccination card with them when they came to a health facility for reasons other than to attend an immunization clinic.

Many experienced health workers believe that mothers' reports of their children's vaccination status

are accurate. Much of this faith is based on comparisons of the presence or absence of a BCG scar with mothers' reports of their children having been vaccinated. However, this suffers from the weakness that a BCG scar is a visible reminder to the mother of previous vaccination. A more pessimistic view is provided by a study carried out by Comstock et al. in the USA (1), which reported that the information gathered in one household survey agreed with written paediatric records in only 43% of instances.

The present study was undertaken to determine the extent to which mothers in a developing country can be relied upon to provide accurate data about their children's vaccination status. A simple method of dealing with the problem presented by lost vaccination cards in coverage surveys is also suggested.

Methods

The data in this study were obtained from two sources: a series of four EPI coverage surveys; and a "missed opportunities" study carried out in Khartoum (B.P. Loevinsohn et al., unpublished observations, 1988).

As part of a survey to determine vaccination coverage and knowledge, attitude, and practices (KAP) in Um Rwaba District and in the Eastern, Central, and Northern Regions of the Sudan, mothers were asked to present their children's vaccination cards before being interviewed. They were then asked whether their children had been vaccinated against measles, the number of doses of diphtheria-pertussis-tetanus vaccine (DPT) their children had received, and the age at which their child had first been vaccinated against

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poliomyelitis. The children were also examined for the presence of a BCG scar.

The results of the coverage surveys presented below pertain principally to illiterate women who presented their children's vaccination cards for inspection. Whether mothers were illiterate was determined by simply asking whether they knew how to read and write, since the surveyors felt that it would be demeaning to the women to have their reading ability tested using a standard text.

We assumed that illiterate women would derive little benefit from possessing their children's vaccination cards and, hence, that asking them questions verbally would be a reasonable test of their memory. To check this assumption, 30 women who claimed not to be able to read were shown a mock vaccination card and asked how many doses of poliovaccine were recorded and whether measles vaccine had been administered. Of these women, 18 said they were unable to understand any information on the card, while the remaining 12 gave answers whose likelihood of being correct was no greater than chance.

The four KAP surveys from which data were obtained were conducted between March and December 1988. Based on information from the latest available census in the Sudan (1983), clusters (village councils or *hai* (urban neighbourhoods)) were randomly selected in proportion to the size of their population. Within each cluster, a random starting-point (house) was chosen using standard WHO methods. The second house visited was the one whose door was closest to the first house, and so on.

The survey was conducted in any household with a child aged 11-16 months and was carried out in the presence of the mother. The interview was performed by two experienced surveyors who followed a formal protocol for coding responses, and the questionnaire was printed and administered in colloquial Arabic.

The second source of data was a "missed opportunities" study of 236 mothers who came with their infant children for curative care to 11 randomly selected health facilities in Khartoum. As they were leaving the health facility, the mothers were asked, *inter alia*, about their children's vaccination status. The information provided by the women was then recorded and compared with the EPI records in the health facility.

Results

Comparison of BCG and DPT1 vaccination data

A total of 1009 children from the four coverage surveys had documentary evidence (vaccination cards) of having received BCG vaccine, and 97% had BCG scars. Furthermore, 99% of the children with such scars, and all of the 30 children without scars but who

had been vaccinated with BCG according to their cards, had evidence of having received their first dose of DPT (DPT1); 80% of the children who were vaccinated with BCG also received DPT1 at the same time. Hence, BCG scar rates and DPT1 coverage rates were almost identical for children with vaccination cards and should also be similar for those without cards. Of the 1887 children studied (both those with and without cards), 79% had BCG scars, yet only 54% had proof of DPT1 vaccination. By using mothers' reports of the vaccination status of their children, the DPT1 coverage rate was calculated to be 80%.

Mothers' reports of measles vaccination status

As shown in Fig. 1 and 2 and Tables 1 and 2, the illiterate mothers had remarkably good recollections of their children's measles vaccination status. Accurate estimates of this status would therefore have been obtained by relying solely on mothers' reports, irrespective of the assumptions made about mothers who were unsure about their children's vaccination status. For example, if the children of mothers who were unsure are assumed not to have received measles vaccine, the sensitivity of mothers' reports would be 87% and the specificity, 79% (Table 2). Conversely, if such women are taken to have vaccinated children, the coverage for measles vaccine reported by mothers would be 5.6 percentage points higher than that indicated from the vaccination cards ("true" coverage) (Fig. 1). The sensitivity of mothers' reports would then be 95% and the specificity would drop to 70%.

Mothers' reports of DPT vaccination status

Fig. 1 and 2 show that the mothers were also adept at remembering the number of doses of DPT that their child had received (data on 10 children were missing). However, more mothers were unsure about their children's status for DPT than they had been for measles, and any assumptions about these women would have considerably affected the reported coverage rates. For example, if mothers who were uncertain are taken to have unvaccinated children, DPT3 coverage would be underestimated by 16 percentage points.

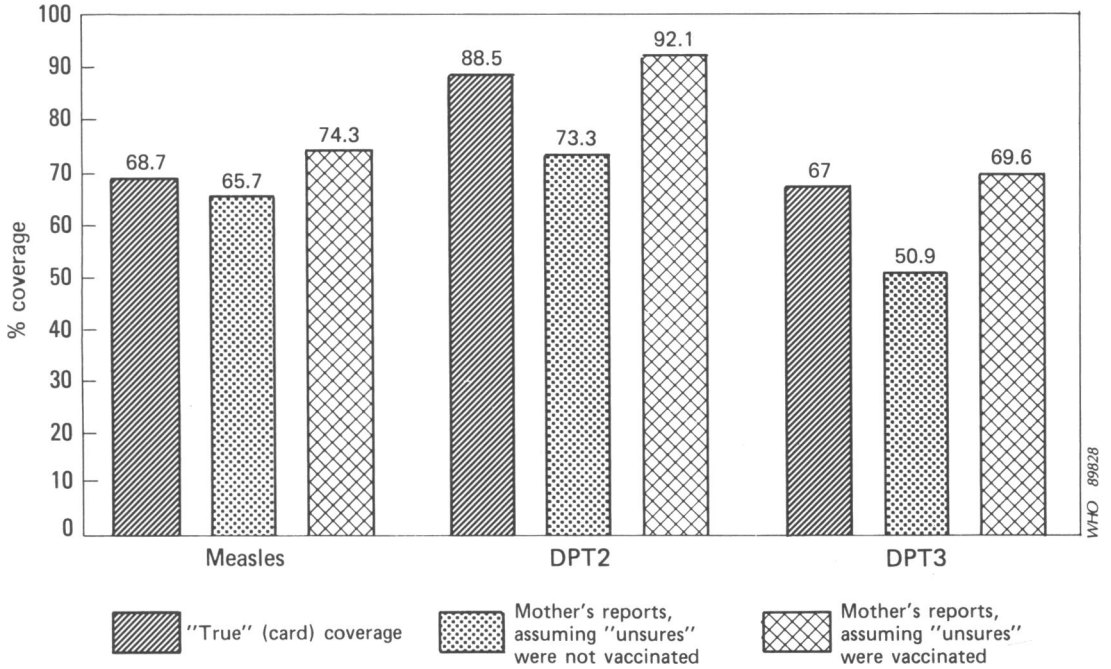
Age of children at their first polio vaccination

For the illiterate mothers, 78% of those whose children had vaccination cards could remember the age at which their children had received their first dose of poliovaccine within one month of that recorded on the card. The exact age of vaccination was known by 61% of the mothers.

Mothers who attended health facilities

In the course of the missed opportunities study, 236 mothers were interviewed. However, for only 34 of

Fig. 1. Indication of the accuracy of mothers' reports of their children's vaccination status for measles and diphtheria-pertussis-tetanus (DPT) compared with information on their vaccination cards. Shown are the percentages of all illiterate women who possessed their children's vaccination cards.



them could their children's vaccination records be located in the health facility where the mother had been surveyed. None the less, the results were similar

to those obtained in the coverage surveys: 76% (26 out of 34) of the women knew the number of doses of DPT their children had received, and 67% knew the age

Fig. 2. The effect on the estimated vaccination coverage of accepting mothers' reports of their children's vaccination status for measles and diphtheria-pertussis-tetanus (DPT).

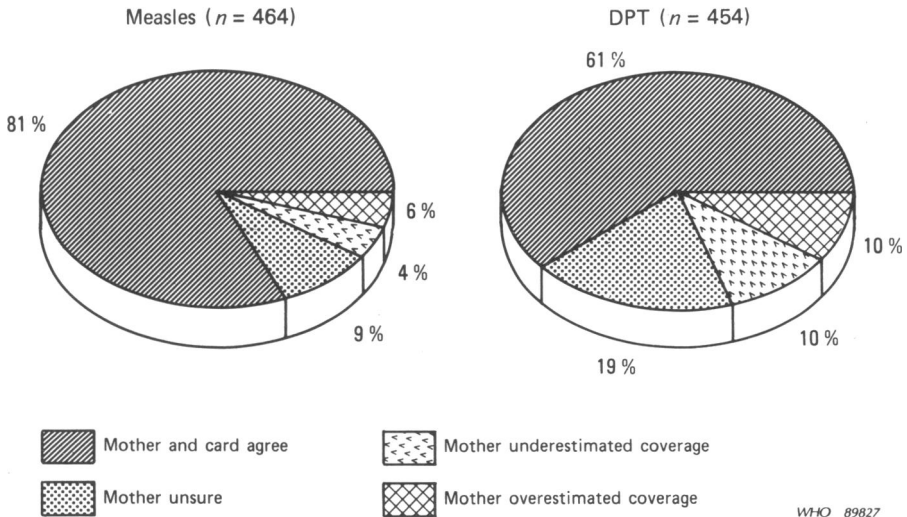


Table 1: Comparison of the reports made by illiterate mothers in the coverage surveys about their children's measles vaccination status and the information on their vaccination cards

Mothers' reports	Information on card		Total
	No. of children vaccinated	No. of children not vaccinated	
No. of children vaccinated	278	27	305
No. of children not vaccinated	17	102	119
No. of mothers unsure	24	16	40
Total	319	145	464

within one month at which their child had first been vaccinated against poliomyelitis.

Discussion

Analyses of the results of coverage surveys that rely only on documentary evidence of vaccination lead frequently to serious underestimation of the true coverage level. In the Sudan, for example, coverage for DPT1 was underestimated by 25 percentage points and that for measles vaccination by 23 percentage points. Our results also strongly indicate that even illiterate mothers can provide accurate information about their children's vaccination status.

Below are outlined a few methodological issues raised by the study.

- Only illiterate women who had their children's vaccination cards could be studied using the method employed in the coverage surveys, and such women may differ significantly from those who had lost their children's cards. For example, the former women may be more health conscious or responsible and hence better able to recall their children's vaccination status. Also, even although the mothers were illiterate, a literate person could recently have discussed the contents of their children's vaccination cards with them. Our findings are, however, comparable in four geographical areas that have distinct socioeconomic characteristics and are similar to the results from the mothers who had attended health care facilities. This indicates that any differences between illiterate mothers with cards and those who had lost them did not markedly affect our results.

- Our data apply only to mothers whose children had been vaccinated at least once. Clearly, the results provide no information about the proportion of mothers whose children had received no vaccines but who nevertheless claimed that their children had been vaccinated. The data on measles vaccination show, however, that a child who had not been vaccinated against the disease was reported as unvaccinated by his or her mother almost 80% of the time.

- Although the method of interviewing mothers at health facilities (missed opportunities study) is sound, the small number of vaccination records that could be found hampered the interpretation of our results from this source.

The women in our study were much better

Table 2: Accuracy of illiterate mothers' reports of their children's vaccination status compared with information on their vaccination cards^a

	Northern Region	Um Rwaba District	Eastern Region	Central Region	Total
No. of illiterate mothers with cards	68	105	107	184	464
Sensitivity (%) ^b	96	76	86	91	87
Specificity (%) ^c	86	79	73	81	79
Positive predictive value (%) ^d	94	89	86	92	90
Negative predictive value (%) ^e	90	60	73	79	74
<i>For all mothers surveyed:</i>					
Percentage who were literate	67	11	42	45	43
Percentage coverage determined only from vaccination cards	44	40	42	45	43
Percentage coverage determined from mothers' reports and vaccination cards	72	58	60	68	66

^a The figures for mother's accuracy were calculated assuming that the children of mothers who were unsure about their status had not been vaccinated.

^b Percentage of vaccinated children whose mothers said they were vaccinated.

^c Percentage of unvaccinated children whose mothers said they were not vaccinated.

^d Percentage of children reported to be vaccinated and whose cards indicated this to be correct.

^e Percentage of children reported not to be vaccinated and whose cards indicated this to be correct.

informants about their children's vaccination status than were the adults who were interviewed about their own vaccination status by Comstock et al. (1). This may have arisen because in the latter investigation the adults involved had been vaccinated many years before the survey was conducted, while our study involved mothers whose children had been vaccinated within the previous year.

As 1990, the target year for achieving universal childhood immunization, approaches, much attention will be focused on coverage surveys. It is therefore important to have available a reliable and standardized method to cope with the problem presented by mothers who have lost their children's vaccination cards. Our experience suggests that this can be overcome during large-scale coverage surveys by asking mothers the following questions:

- Has your child received measles vaccine?
- How many doses of oral poliovaccine (OPV) (making the gesture of giving the drops) has your child received?
- How many doses of DPT has your child received? (This question could be omitted if OPV and DPT are always given together; for example, in the Sudan this is the case 97% of the time).
- Are you able to read and write?

In addition, each child should be examined for the presence of a BCG scar, something that is already standard practice.

The accuracy of reports made by illiterate women with vaccination cards can then be used as a guide to interpreting the information provided by mothers without cards. Programme managers and individual health workers should be concerned more about overestimating rather than underestimating coverage. Hence, it is appropriate to make conservative assumptions and count as not vaccinated all children whose mothers are unsure about their status.

The method we have described has the disadvantage that it is unlikely to be useful for small coverage surveys; however, it is suitable for nationwide surveys. Furthermore, it has the advantages that mothers without cards are asked about their child's vaccination history in a standardized manner; and it can be used to test whether our conclusions for the Sudan apply also in other settings.

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Résumé

Exactitude des déclarations des mères de famille concernant l'état vaccinal de leurs enfants

Au Soudan, l'expérience montre que beaucoup de mères perdent les cartes de vaccination de leurs enfants. En conséquence, il existe une différence significative, pouvant atteindre 25 points de pourcentage, entre les résultats des enquêtes de couverture, selon que celles-ci sont basées uniquement sur les renseignements figurant sur les cartes, ou qu'elles tiennent compte également des déclarations des mères concernant l'état vaccinal de leurs enfants. La question se pose donc de savoir si l'on doit prendre en compte ces déclarations. Pour tenter d'y répondre, on a analysé les données recueillies à l'occasion de quatre grandes enquêtes de couverture et d'une étude sur les "occasions manquées" de vaccination. Les résultats obtenus sont exposés dans le présent article.

Lors des enquêtes de couverture, on a demandé aux mères de présenter les cartes de vaccination de leurs enfants et on les a interrogées pour savoir si ceux-ci avaient été vaccinés contre la rougeole, combien de doses de vaccins DCT (diphtérie, coqueluche, tétanos) ils avaient reçu et quand ils avaient été vaccinés pour la première fois contre la poliomyélite.

Les réponses des mères illettrées aux questions concernant l'état vaccinal de leurs enfants ont été comparées aux données figurant sur les cartes de vaccination. Ces comparaisons n'ont été faites que pour les mères qui se disaient illettrées, car on a estimé que celles-ci ne risquaient guère d'être influencées par les informations figurant sur les cartes. Cette hypothèse a été vérifiée sur 30 femmes illettrées et s'est avérée correcte: questionnées sur le contenu d'une carte fictive, plus de la moitié d'entre elles ont déclaré n'en avoir aucune idée, et les autres ont répondu au hasard.

Les déclarations des mères se sont révélées très précises lorsqu'on les a comparées aux données figurant sur les cartes. Pour la vaccination antirougeoleuse, l'information fournie par les mères présentait un degré élevé de sensibilité (87%) et de spécificité (79%). Toujours par comparaison avec les données des cartes de vaccination, on a constaté que les déclarations des mères concernant l'état vaccinal de leurs enfants donnaient une image précise de la couverture vaccinale anti-DCT et antirougeoleuse. Pour ce qui est de la vaccination antipoliomyélitique, 78% des

femmes connaissaient à un mois près l'âge auquel leur enfant avait reçu la première dose.

Au cours d'une enquête menée dans un centre de santé sur les enfants ayant "échappé" à la vaccination, 236 femmes ont été interrogées sur l'état vaccinal de leurs enfants. Leurs réponses ont ensuite été comparées aux dossiers du centre. Malheureusement, les dossiers de 34 enfants seulement ont pu être retrouvés. Toutefois, les résultats obtenus concordent avec ceux de l'enquête sur la couverture vaccinale: 76% des femmes connaissaient le nombre de doses de vaccin DCT reçues par leur enfant et 67% savaient à quel âge il avait reçu sa première dose de vaccin antipoliomyélitique.

On peut conclure de ce qui précède que les déclarations des mères concernant l'état vaccinal de leurs enfants sont d'une grande exactitude et que les réponses des femmes illettrées qui possèdent les cartes de vaccination de leurs enfants peuvent servir de guide pour interpréter les informations fournies par celles qui n'en ont pas.

Reference

1. **Comstock, G.W. et al.** Validity of interview information in estimating community immunization levels. *Public health reports*, **88**(8): 750-757 (1973).