Vaccine Reports 6 (2016) 8–12

Contents lists available at ScienceDirect

Vaccine Reports

journal homepage: www.elsevier.com/locate/vacrep

Original Article

Vaccination coverage and timely vaccination with valid doses in Malawi

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ARTICLE INFO

Article history:
Received 8 April 2016
Revised 24 May 2016
Accepted 24 June 2016

Keywords:
Vaccination coverage
Valid doses
Invalid doses
Malawi
Timely vaccination

ABSTRACT

Introduction: A cluster vaccination coverage survey was conducted in two districts, Dowa and Ntchisi, in Malawi to measure the vaccination coverage of children 12–23 months old and identify factors impacting the utilization of vaccination service.

Methods: A cross-sectional descriptive cluster survey with 30 clusters and 10 children per cluster was administered in each district including a total of 601 children surveyed. 57 village heads and 60 health surveillance assistants (HSAs) were also interviewed.

Findings: The vaccination card availability was very high in both districts (94%). Vaccination coverage by card plus history of mothers was very high, above 93% for all antigens, and the coverage by card alone was also high with a range of pentavalent$_1$ coverage of 91% in Ntchisi and 83% in Dowa to measles coverage of 81% and 83% in Dowa and Ntchisi respectively. However, the percentage of valid doses administered to fully immunized children was low (60% in Dowa and 49% in Ntchisi). About 10% of the pentavalent$_1$ doses in Dowa and 9% in Ntchisi were administered before six weeks of age and 7% and 8% of the pentavalent$_3$ doses in Dowa and Ntchisi districts respectively were administered in less than 28 days after pentavalent$_2$. Similarly, 15% of measles doses in both Dowa and Ntchisi districts were administered before 270 days. The main reason for no vaccination was vaccine stock outs at health facility level. The majority of village heads are satisfied with the vaccination service in their communities. Health surveillance assistants (HSAs), village heads and religious leaders all play major roles in mobilization for vaccination service in the two districts.

Conclusion: Dowa and Ntchisi districts have high vaccination coverage, however many children receive invalid doses. This finding calls for immediate action to educate the service providers on administration of valid doses.

1. Introduction

Vaccination is the most cost-effective public health intervention and Malawi has been successful in achieving high routine coverage. The WHO-UNICEF estimate for infant pentavalent$_3$ vaccination coverage was above 90% nationally for five consecutive years (2008–2012), with every district having achieved at least 80% coverage [1]. In 2006, Malawi conducted a multiple indicator coverage survey (MICS) for all districts and the national coverage using card plus history for pentavalent$_3$ was 84% and fully immunized children coverage was 61% [2]. Dowa district achieved infant pentavalent$_3$ coverage of 81% and fully immunized coverage of 71% while Ntchisi achieved pentavalent$_3$ coverage of 76% and fully immunized coverage of 60% [2]. Malawi also conducted a Demographic and Health Survey (DHS) in 2010 and the national coverage for pentavalent$_3$ and fully immunized children for children 12–23 months by card alone any time before the survey were 79% and 74% respectively [3]. A Millennium Development Goal (MDG) end line survey was conducted in 2014 and the national level pentavalent$_3$ coverage by card and plus history for children 12–23 months old was 91% and fully immunized by one year of age coverage was 72%. [4]. The fully immunized coverage from the MDG end line survey was lower than both the WHO/UNICEF estimated coverage in 2012 and 2013 and the DHS in 2010.

The fully immunized children coverage in all mentioned surveys indicated all doses by 12 months of age; however, there is no information on whether the invalid doses within one year of age, were considered as invalid doses and excluded. Research has shown that many children in Africa and other countries receive inappropriately timed vaccine doses [5–12]. Most of these studies examined delayed vaccinations, i.e. vaccinations administered at

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http://dx.doi.org/10.1016/j.vacrep.2016.06.001
2405-7843/

older ages than recommended which resulted in prolonged risk of exposure to infection. Other ways vaccines are administered in an untimely way are doses administered earlier than recommended, and vaccinations administered with inappropriately short intervals between vaccine doses. Both may result in a suboptimal vaccine response. The World Health Organization (WHO) classified those vaccination doses as invalid doses [13]. The validity of childhood vaccinations have been evaluated in studies conducted in South Africa [8], Kenya [12], Nigeria [10], Uganda [7], Ethiopia [6], China [9] and USA [11] and children received many invalid doses, including premature administration, short intervals between doses, and late administration of doses beyond 12 months of age.

The MOH of Malawi requested partners to support the vaccination program to improve vaccination coverage and the USAID funded Maternal and Child Survival Program (MCSP) was requested to provide support in two low performing districts, Dowa and Ntchisi, to implement the Reaching Every Community (REC) approach. This survey was conducted as a baseline for a new project with the objectives of measuring the vaccination coverage of children 12–23 months old and identifies factors impacting the utilization of vaccination service following the WHO cluster survey reference manual [13].

2. Methods

2.1. Study design

The survey was cross-sectional, descriptive, and used a two-stage cluster sampling. The first stage was the sampling of enumeration areas (EAs) and the second stage was the sampling of households for the interviews. EAs in each district were listed with their 2008 projected population and the sampling was done using random number and sampling interval.

2.2. Study area and sampling

The survey was conducted in Dowa and Ntchisi districts in the central region of Malawi. A total of 601 mothers with children of 12–23 months old were interviewed in the two districts. From each district, 30 clusters were sampled and from each of the clusters 10 children aged 12–23 months were sampled.

In each cluster, the first village to be visited was chosen at random after listing names of the villages in the EA and the first households in the village was chosen after determining the direction of movement following the spinning of a bottle. There is no list of households in the two districts and resource did not allow developing the list.

2.3. Data collectors training

Expanded Program on Immunization (EPI) officers from neighboring districts were trained as data collectors while the MOH/EPI team and the MCSP officers supervised the data collection. Each district had three teams comprising of a supervisor and two data collectors. Vaccination experts from the MOH/EPI, MCSP and a local consultant facilitated two day training for the data collectors including use of the data collection instruments, as well as data collection procedures, interview techniques, consent procedures and research ethics.

2.4. Data collection

Standard WHO Expanded Program on Immunization (EPI) cluster survey paper data collection forms were used for the coverage survey. Local chiefs and health surveillance assistants (HSAs), who provide vaccination services to those villages, were interviewed regarding the delivery of vaccination services in their communities. Mothers and/or caretakers of children aged 12–23 months were asked to show child health passports/vaccination cards for their child and the dates of vaccination were recorded from the cards on to the data collection forms. Where vaccination cards were reported not available, the maternal report of vaccination was recorded. Presence of a Bacillus Calmette-Guerin (BCG) scar was observed in the children who were surveyed. Reasons for not being immunized and/or not completing the vaccination schedule were asked for those not fully vaccinated.

2.5. Data analysis

The data were entered and cleaned using version 7 of EPI-Info while analysis of the data was done using STATA version 12.2.5.1.

The following operational definitions were used:

- *Vaccinated by card only*: Only doses documented inside the child health passport were considered.
- *Vaccinated by card plus history*: Both documented doses and doses reported by mother to be received were considered.
- *Valid doses*: Doses that were administered when the child had reached the minimum age for the vaccine, were administered with the proper spacing according to the national schedule, and before one year of age. (denominator = those with child health passport for that antigen).
- *Fully immunized child (FIC)*: A child who received all 13 doses included in the national schedule: a dose of BCG; 3 doses each of pentavalent, oral polio and pneumococcal; two doses of rotavirus; and one dose of measles vaccines.
- *Fully immunized child before one year of age*: A child who received all 13 doses before the age of one year as documented in the health passport.
- *Fully immunized child before one year of age with valid doses*: A child who received all 13 doses as valid doses as recorded in the child health passport. (denominator = children fully immunized with health passport before one year of age).

3. Findings

3.1. Child health passport/vaccination card

A total of 601 children 12–23 months old were included in the survey: 302 in Dowa and 299 in Ntchisi. There were equal number of boys and girls in the survey, 50% each. Card availability was very high (94%) in both districts. In Malawi, the vaccination card is referred to as a "health passport" and when the health facilities are out of stock of passports, private suppliers print and sell the cards with a reasonable price. This may have contributed to the high proportion of mothers with cards. Twenty-five (8.3%) children in Dowa and nine (3%) children in Ntchisi had health passports but with no recorded vaccination doses.

3.2. Vaccination coverage

Almost all children were vaccinated with card and history combined in both districts, ranging from 100% for BCG and pentavalent$_1$ to 93% for measles (Table 1). A BCG scar was also observed in 96% of children in Dowa and 93% in Ntchisi districts.

Access to vaccination service documented by first doses of multiple doses by card alone by the time of the survey was also high. Pentavalent$_1$ coverage was 83% in Dowa and 91% in Ntchisi and the coverages for PCV$_1$, OPV$_1$ and rota$_1$ were not different from the pentavalent$_1$ coverage (Table1). The utilization of the