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Vaccine

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

Review

Monitoring vaccination coverage: Defining the role of surveys

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ARTICLE INFO

Article history:

Received 12 November 2015

Received in revised form 13 June 2016

Accepted 16 June 2016

Available online xxx

Keywords:

Vaccination

Coverage

Surveys

Program monitoring

Health facility surveys

ABSTRACT

Vaccination coverage is a widely used indicator of programme performance, measured by registries, routine administrative reports or household surveys. Because the population denominator and the reported number of vaccinations used in administrative estimates are often inaccurate, survey data are often considered to be more reliable. Many countries obtain survey data on vaccination coverage every 3–5 years from large-scale multi-purpose survey programs. Additional surveys may be needed to evaluate coverage in Supplemental Immunization Activities such as measles or polio campaigns, or after major changes have occurred in the vaccination programme or its context.

When a coverage survey is undertaken, rigorous statistical principles and field protocols should be followed to avoid selection bias and information bias. This requires substantial time, expertise and resources hence the role of vaccination coverage surveys in programme monitoring needs to be carefully defined. At times, programmatic monitoring may be more appropriate and provides data to guide program improvement. Practical field methods such as health facility-based assessments can evaluate multiple aspects of service provision, costs, coverage (among clinic attendees) and data quality. Similarly, purposeful sampling or censuses of specific populations can help local health workers evaluate their own performance and understand community attitudes, without trying to claim that the results are representative of the entire population. Administrative reports enable programme managers to do real-time monitoring, investigate potential problems and take timely remedial action, thus improvement of administrative estimates is of high priority. Most importantly, investment in collecting data needs to be complemented by investment in acting on results to improve performance.

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1. Introduction

Vaccination coverage is a widely-used indicator of vaccination programme strengths and weaknesses and of access to health care [1,2]. High coverage of the first dose of diphtheria-tetanus-pertussis-containing vaccine (DTPCV1) indicates good access to primary health care facilities; by contrast a high proportion of zero-dose children suggest either low access to services or lack of acceptance of vaccination. High dropout between early and final doses of the primary vaccine series may indicate health system barriers to re-attendance, failure to educate mothers of the need to return, or inadequate tracking of children registered at the health facility. Missed opportunities to administer all vaccines scheduled at the same visit (“non-simultaneous vaccination”) may indicate vaccine stock-outs, mistakes in identifying which vaccines are due, reluctance to vaccinate a sick child or to administer multiple vaccines at the same visit, etc. [3–5]. Monitoring the age at receipt of each vaccine-dose (“time-liness”) helps verify that vaccines are not administered too early, which might reduce vaccine effectiveness, yet as soon as possible after the scheduled age to minimize the time that the child is at risk of infection [1,6–8].

Several methods are used to monitor coverage [9] each having advantages and disadvantages (Table 1, adapted from [10]). Electronic vaccination registries can provide continuous data for coverage measurement and for management activities such as monitoring vaccine supply and requisitions and sending vaccination reminders [11], but there are many challenges to their implementation [12,13]. Most low-income countries rely on paper-based systems to report vaccinations administered and divide by the estimated target population to derive “administrative coverage estimates”. Administrative estimates, however, are often unreliable

due to incomplete or inaccurate primary recording of vaccinations, mistakes in compiling monthly summaries of vaccinations, delayed or duplicate reporting and inaccurate estimates of population denominators [1,14–16].

Household surveys are often proposed because EPI managers or global partners do not trust administrative reports. Vaccination coverage is measured in the large-scale Multiple Indicators Cluster Survey (MICS) [17] and Demographic and Health Survey (DHS) [18] programmes which use probability sampling methods (i.e. one in which each individual has a known and non-zero chance of being selected) and strict quality control with substantial technical assistance [19]. The Expanded Programme on Immunization (EPI) cluster survey was developed over 30 years ago as a simple non-probability sampling method that could be implemented with little or no technical assistance [20,21]. Although the EPI survey has been a valuable programme management tool, the use of non-probability sampling and lack of standardized, well-documented quality control procedures may reduce confidence in the results [1,22,23]. The 2015 working draft of the EPI cluster survey manual recommends using a probability sample (for which excellent collaboration is needed with the National Statistics or Census Office to obtain the sampling frame and maps of enumeration areas (EAs)), designing the survey and its sample size according to the evaluation goals, conducting appropriately weighted analyses, rigorous quality control, and fully documenting survey design and implementation. This will increase the technical and financial resource needs for vaccination coverage surveys, which should therefore be used judiciously.

In this paper, we discuss issues that affect decisions to undertake household surveys and propose some alternative monitoring methods to answer programme questions at peripheral health

Table 1
Advantages and disadvantages of methods to measure vaccination coverage.

Method	Advantages	Disadvantages
Register-based (electronic)	<ul style="list-style-type: none"> Can give complete and accurate real-time data on cumulative vaccination status of individual persons and populations Can be used to set appointments and issue reminders and recalls Can be used for vaccine stock control, ordering and accountability Could reduce time spent on paper registers that are widespread in low-income countries and often not used Can facilitate printing or electronic access to home-based vaccination records Can provide data at most peripheral operational level 	<ul style="list-style-type: none"> Need good computer access Need complete birth registry for true denominator Need unique ID number throughout life Need procedures to identify and deal with potential duplicate records If held locally, difficult to track vaccination of migrants If held nationally, feedback/use at local level may be slow Requires adequate funding for proper maintenance Need sufficient, well-trained human resources at each level of the reporting system Need secure procedures to maintain confidentiality Need procedures to avoid losing data Difficult to use to measure coverage in SIAs
Routine reports of vaccinations delivered	<ul style="list-style-type: none"> Can be simple in conception Continuous information allows monitoring of cumulative coverage through the year and by district/health facility Can be used by local health workers to track coverage, missed opportunities, and dropout rates Usually part of a routine reporting system used for multiple health programmes 	<ul style="list-style-type: none"> Population denominators often inaccurate, especially at local levels Private sector often does not report Exaggeration of doses administered common, especially when linked to performance-based incentives Transcription errors at each health system level when paper-based systems used In SIAs, reports often give inflated estimates due to short time for recording, and vaccination of persons outside the target age group
Community-based surveys	<ul style="list-style-type: none"> If well-conducted, evaluate coverage in routine services and/or in SIAs Other indicators (eg, missed opportunities, caretaker demographics and knowledge/attitudes) can be assessed although this increases questionnaire length and complexity Can be used to classify coverage e.g. as “probably high”, “probably low” or “indeterminate” in subnational areas and highlight those with lowest coverage Can allow estimation of coverage in specific sub-groups if designed appropriately Involvement of health workers can be training opportunity 	<ul style="list-style-type: none"> Accessibility to populations to survey depends on geographic, climatic and security issues, and high-risk subgroups (e.g., migrants, street children) often missed, compromising representativeness of survey results Small samples give imprecise results; large samples are expensive and field work takes longer In some settings, it may be difficult to obtain accurate ages/dates of birth Accuracy of data depends on adequate survey design, training, supervision, and quality control, as well as availability of vaccination documentation Information bias likely if documents are missing, incomplete or inaccurate – verbal history increasingly difficult as more vaccines included in programmes under a range of different schedules Often subcontracted to private organisation hence health worker training opportunity lost Often long delays until results are known, and survey data relate to birth cohort at least one year prior to survey implementation

Adapted from Table 70-3 in [10].

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