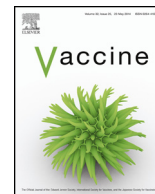




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# Home-based record prevalence among children aged 12–23 months from 180 demographic and health surveys

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## ARTICLE INFO

*Article history:*

Received 21 January 2015

Received in revised form 19 February 2015

Accepted 31 March 2015

Available online 14 April 2015

*Keywords:*

Record  
 Medical records  
 Health records, Personal  
 Home-based record  
 Vaccination card  
 Immunization card  
 Recording  
 Monitoring  
 Immunization  
 Vaccination  
 Immunization systems

## ABSTRACT

**Background:** There is currently a re-focus at the global level on the importance of the home-based record within vaccination service delivery as an important information resource but there are few reports of ever and current home-based record prevalence across countries.

**Methods:** We considered all Demographic and Health Surveys (starting with DHS round 3) conducted between 1993 and 2013 for which a final dataset was available in the public domain at the time of the analysis. Ever and current prevalence of home-based records for recording vaccination was estimated for children aged 12–23 months at the time of the survey through a secondary analysis of data from 180 Demographic and Health Surveys conducted in 67 countries derived from questions asked of women aged 15–49 years for their children on home-based record availability and retention. *Ever* home-based record prevalence is the proportion of children aged 12–23 months who have ever received a home-based record. *Current* home-based record prevalence is the proportion of children aged 12–23 months for whom a home-based record was available for viewing by the surveyor at the time of the survey.

**Results:** Estimated ever home-based record prevalence was  $\geq 90\%$  in 116 surveys from 52 countries and was  $< 70\%$  in 15 surveys from 7 countries. Estimated current home-based record prevalence was  $\geq 80\%$  in 31 surveys from 23 countries and was  $< 50\%$  in 51 surveys from 24 countries. Current home-based record prevalence was  $< 80\%$  as of the most recent survey during 2010–2013 for five (Bangladesh, Ethiopia, Nigeria, Indonesia and Pakistan) of the ten countries with the largest birth cohorts globally. Among 34 countries that conducted three or more DHS, we observed improvements in both ever and current home-based record prevalence of  $> 10\%$  points in six countries. Current home-based record prevalence increased  $> 10\%$  points in six countries where the ever prevalence was maintained at  $\geq 90\%$  across the period of observation. And, no meaningful change was observed in estimated ever and current home-based record prevalence in 11 countries, five of which maintained ever prevalence  $\geq 90\%$  across the period of observation. High home-based record loss rates were observed in many countries.

**Conclusions:** The results here show that despite improvements in the availability, utilization and retention of home-based records for recording vaccination history in some countries, opportunities remain to change the mind-set in many national immunization programmes around the importance of the home-based record, particularly in countries with large birth cohorts. Immunization programmes are encouraged to monitor ever and current home-based record prevalence. Nationally representative household surveys collecting information on immunization coverage should include ever and current home-based record prevalence in the standard survey reports and tables to better enable programme managers to identify problems and target corrective action.

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## 1. Introduction

There is currently a re-focus at the global level on the importance of the home-based record within vaccination service delivery

as an important information resource to enhance health professionals' ability to make clinical decisions and prevent unnecessary repetition of vaccination, to empower patients/caregivers around immunization services, and to support public health monitoring [1–3]. In the area of immunization performance monitoring, home-based records fill a gap where facility-based registers often fall short, such as for supporting outreach activities to vaccinate un-/under-immunized children and serving as a source of documented

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vaccination history in household coverage surveys [1]. In household coverage surveys, evidence of vaccination history is predominantly driven by confirmation of vaccination records maintained in the household. At the time of this writing, few household coverage surveys visit health facilities to document vaccination history (i.e., facility trace back) perhaps due to additional cost and challenges of incomplete health facility records.

The presence of documented vaccination history on home-based records at the time of a household survey is determined in part by (i) health workers providing a home-based record to an individual or her caregiver (ideally free-of-charge) at the first immunization encounter or before, (ii) the patient or caregiver bringing the document to every health encounter, (iii) the home-based record being appropriately and legibly updated with the vaccination history at the time of vaccination service delivery, and (iv) the successful retention of the home-based record, free of damage, in the household. Challenges persist, however, for national programmes and global monitoring efforts [4,5] that use surveys to estimate vaccination coverage when home-based records are not routinely employed as a result of reporting errors that occur when caregivers misclassify a child's vaccination history during recall in lieu of documentation. Cutts and colleagues [6] note the latter may become an increasing problem as recommended immunization schedules become more complex with multiple injectable and oral vaccines administered at the same clinic visit.

To monitor success in providing home-based records to newborns or their caregivers at birth or the first immunization encounter in order to meet the above needs, immunization programmes (or health systems) are encouraged to track the proportion of children who have ever received a home-based record, i.e., *ever* home-based record prevalence. Low *ever* home-based record prevalence indicates system problems around assuring availability and access to this basic recording tool, including failures in forecasting needs for printed quantities or more broad logistics management issues as well as presence of barriers (e.g., financial) to access [3]. Beyond assuring the availability of the record, immunization programmes are also encouraged to track *current*

home-based record prevalence, i.e., the proportion of children for whom a home-based record is available for viewing at any given point in time. Current home-based record prevalence is a function of availability of a record and retention of a record once received. Low current home-based record prevalence levels may indicate problems among caregivers with regards to acceptance or value placed on the document as well as suboptimal record design and/or durability.

Prior reports [1] have highlighted *current* home-based record prevalence derived from surveys, but we are unaware of prior work describing *ever* home-based record prevalence across countries. In this report, we present estimated country-specific *ever* and *current* home-based record prevalence from nationally representative household surveys.

## 2. Methods

We considered all Demographic and Health Surveys (DHS) (starting with DHS round 3) conducted between 1993 and 2013 for which a final dataset was available in the public domain at the time of the analysis. Two surveys (Senegal, 1997 and Ukraine, 2007) conducted during the period were not analysed because they did not include the immunization module. A detailed description of the Demographic and Health Survey programme is available online at [www.dhsprogram.com](http://www.dhsprogram.com)

For this analysis, we estimated *ever* and *current* prevalence of home-based records for recording vaccination through a secondary analysis of data from 180 Demographic and Health Surveys conducted in 67 countries. Because of the rapid release of new survey results by the DHS programme, the 180 surveys included here may not reflect all DHS conducted during this period, particularly for 2012 and 2013. A detailed listing of all surveys included is shown in Annex 1 and a summary of the number of surveys and survey sample size is shown in Table 1.

In each survey, questions on home-based record availability and retention were asked of women aged 15–49 years for their children aged 0–59 months (and who were alive) at the time of the

**Table 1**

Summary\* of estimated *ever* and *current* prevalence of home-based records for vaccination among children aged 12–23 months at the time of survey from 180 Demographic and Health Surveys conducted between 1993 and 2013 by World Health Organization regional classification.

	AFR	AMR	EMR	EUR	SEAR	WPR
No. of surveys	90 (conducted in 35 countries)	35 (conducted in 10 countries)	11 (conducted in 4 countries)	15 (conducted in 9 countries)	19 (conducted in 6 countries)	10 (conducted in 3 countries)
Survey sample size**						
Median value	1281	1564	2030	371	1402	1397
Minimum	369 (COM, 1996)	75 (DOM, 1999)	1154 (MCO, 2003)	253 (KAZ, 1999)	843 (MDV, 2009)	467 (VNM, 2002)
Maximum	5834 (NGA, 2013)	3435 (COL, 2010)	2746 (EGY, 2005)	1024 (TJK, 2012)	10,209 (IND, 1998)	1812 (PHL, 1993)
Ever HBR prevalence						
Median value (%)	92	98	99	98	84	91
Minimum	42% (TCD, 2004)	79% (BOL, 1994)	75% (PAK, 2006)	81% (AZE, 2006)	64% (NPL, 1996)	59% (VNM, 1997)
Maximum	100% (STP, 2008)	99% (HND, 2005)	99% (JOR, 1997)	99% (KAZ, 1999)	99% (MDV, 2009)	97% (PHL, 2013)
Current HBR prevalence						
Median value (%)	66	72	73	90	39	42
Minimum	19% (NGA, 1999)	35% (BOL, 1994)	24% (PAK, 2006)	39% (TUR, 1998)	16% (NPL, 2001)	13% (VNM, 1997)
Maximum	93% (STP, 2008)	90% (HND, 2011)	90% (JOR, 2007)	98% (ALB, 2008)	89% (MDV, 2009)	77% (KHM, 2010)
HBR loss rate***						
Median value (%)	27	24	26	9	51	51
Minimum	7% (STP, 2008)	9% (GUY, 2009)	9% (JOR, 2007)	0% (ARM, 2000)	11% (MDV, 2009)	18% (KHM, 2010)
Maximum	67% (NGA, 1999)	56% (BOL, 1994)	68% (PAK, 2006)	55% (TUR, 1998)	78% (NPL, 2001)	79% (VNM, 1997)

Note: The unit of analysis for the table is 180 survey. For the minimum and maximum values, the country and year of survey is reported in parentheses. Abbreviations: AFR, African Region; AMR, Region of the Americas; EMR, Eastern Mediterranean Region; EUR, European Region; SEAR, South-East Asia Region; WPR, Western Pacific Region; HBR, home-based record.

\* A complete listing of surveys and HBR prevalence values is available in Annex 1.

\*\* Unweighted.

\*\*\* HBR loss rate =  $\left( \frac{\text{ever home based record prevalence} - \text{current home based record prevalence}}{\text{ever home based record prevalence}} \right) \times 100\%$ .

survey. This analysis focuses on children aged 12–23 months at the time of the survey as this group reflects the youngest cohort of children who should have completed the recommended infant immunization schedule in most countries and therefore is most often the referent group of interest in immunization coverage surveys. In each survey, the mother is asked, “Do you have a home-based record/vaccination card where (NAME’S) vaccination history is written down?” If the response is ‘Yes’, the surveyor asks to see the document and records appropriately. If the mother responds that she does not have a home-based record for the child, the surveyor asks, “Did you ever have a home-based record/vaccination card for (NAME)?” From these questions, a dichotomous variable was created for ever home-based records taking the value ‘1’ if a mother reports having a home-based record, regardless of whether it is viewed, or a mother responds affirmatively to the question about ever receiving a home-based record for the child, and taking the value ‘0’ otherwise. Similarly a dichotomous variable was created for current home-based records taking the value ‘1’ if a mother having a home-based record and the record is viewed by the surveyor and taking the value ‘0’ otherwise.

From these data, we estimated ever and current home-based record prevalence. We also computed home-based record loss rates defined as the relative difference between ever and current home-based record prevalence (i.e.,  $HBR\ loss\ rate = ((\text{ever home based record prevalence} - \text{current home based record prevalence}) / (\text{ever home based record prevalence})) \times 100\%$ ). Analyses of DHS individual level data were completed using Stata v13 (College Station, Texas, USA) to account for the complex sample design and weighting. We report the estimated country-specific ever and current prevalence values and standard error in Annex 1. We report summaries of the estimated country-specific ever and current home-based record prevalence by World Health Organization (WHO) operational regional classifications (available at [www.who.int/about/regions](http://www.who.int/about/regions)). Regional averages of ever and current home-based record prevalence were not computed due to a lack of regional survey representation—coverage never exceeded 80% of the regional birth cohort in any five year period. Estimated total number of births was obtained from publicly available United Nations databases [7].

### 3. Results

Across the 180 surveys, median estimated country-specific ever home-based record prevalence was at least 90% in all regions except South-East Asia, and median estimated current home-based record prevalence was highest in the European region and lowest in the

South-East Asia and Western Pacific regions (Table 1). Correspondingly, median home-based record loss rate was lowest among countries in the European region and highest among those in the South-East Asia and Western Pacific regions (Table 1).

Estimated ever home-based record prevalence was  $\geq 90\%$  in 116 surveys from 52 countries and was  $< 70\%$  in 15 surveys from seven countries (Table 2). Estimated current home-based record prevalence was  $\geq 80\%$  in 31 surveys from 23 countries and was  $< 50\%$  in 49 surveys from 22 countries (Table 2 and Fig. 1). Among the group of countries with estimated ever home-based record prevalence values  $< 70\%$ , birth cohort size tended to be larger (median: 2.8 million births; min: 360,000, Chad 1996; max: 26 million, India 1998) than birth cohort size among the group of countries with estimated ever prevalence values  $\geq 90\%$  (median: 446,000 births; min: 6100, Sao Tome and Principe 2008; max: 4.8 million, Indonesia, 2012), although the former is heavily influenced by the presence of India in the subset (median birth cohort size across countries after excluding India, 2.2 million births). Similar patterns were observed for the subset of countries with current home-based record prevalence  $< 50\%$  with larger birth cohort sizes (median: 2.1 million births; min: 137,000, Liberia 2007; max: 26 million, India 1998) than among the subset of countries with current prevalence  $\geq 80\%$  (median: 250,000 births; min: 6100, Sao Tome and Principe 2008; max: 1.8 million, Tanzania, 2010) (Fig. 1). Among 32 countries in the analysis set with annual birth cohorts  $\geq 500,000$  (18 from Africa, three from the Americas, three from the Eastern Mediterranean, two from Europe, four from South-East Asia, two from Western Pacific), eight countries (Burkina Faso, Colombia, Ghana, Malawi, Mozambique, Peru, Tanzania, Uzbekistan) attained current home-based record prevalence levels  $\geq 80\%$  and nine countries (Democratic Republic of the Congo, Ethiopia, India, Indonesia, Mali, Nepal, Nigeria, Pakistan, Vietnam) had levels  $< 50\%$  as of the most recent DHS.

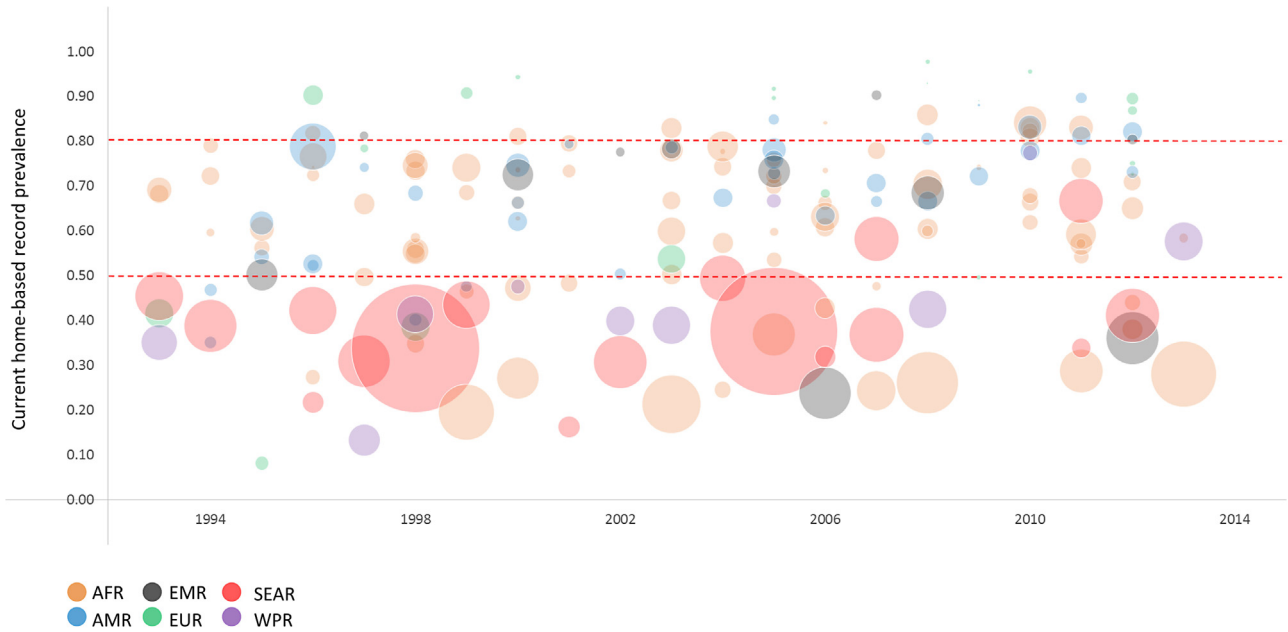
Among the 35 countries included in the analysis with a DHS during 2010–2013, ever home-based record prevalence among children aged 12–23 months  $\geq 90\%$  was observed in 28 countries (15 of 21 African countries, in all four countries from the Americas, one of two Eastern Mediterranean countries, three European countries, three South-East Asian countries, and two Western Pacific countries), and a current home-based record prevalence  $\geq 80\%$  was observed in 12 countries (five African countries, three countries from the Americas and Europe, and one country from the Eastern Mediterranean) as of the most recent DHS for each country.

Table 3 summarizes the change in estimated ever and current home-based record prevalence over time observed across 132 surveys (out of the 180 surveys included in the analysis) from 34 countries that conducted three or more DHS. Of the 132 surveys,

**Table 2**  
Categories of estimated ever and current home-based record prevalence among children aged 12–23 months at the time of survey from 180 Demographic and Health Surveys conducted between 1993 and 2013 by World Health Organization regional classification.

	AFR	AMR	EMR	EUR	SEAR	WPR
Ever HBR prevalence						
<50%	5 (5)	0	0	0	0	0
50–69%	6 (7)	0	0	0	2 (10)	2 (20)
70–79%	8 (9)	1 (3)	2 (18)	0	3 (16)	0
80–89%	19 (21)	3 (8)	0	4 (27)	9 (47)	0
$\geq 90\%$	52 (58)	31 (89)	9 (82)	11 (73)	5 (26)	8 (80)
Current HBR prevalence						
<50%	18 (20)	4 (11)	2 (18)	3 (20)	15 (79)	7 (70)
50–69%	34 (38)	12 (34)	2 (18)	2 (13)	3 (16)	2 (20)
70–79%	27 (30)	12 (34)	4 (36)	1 (7)	0	1 (10)
80–89%	10 (11)	6 (17)	2 (18)	2 (13)	1 (5)	0
$\geq 90\%$	1 (1)	1 (3)	1 (9)	7 (47)	0	0
No. of surveys	90 (100%)	35 (100%)	11 (100%)	15 (100%)	19 (100%)	10 (100%)

Note: The unit of analysis for the table is 180 surveys. Numbers in parentheses are percentages based on total number of surveys in each region. Abbreviations: AFR, African Region; AMR, Region of the Americas; EMR, Eastern Mediterranean Region; EUR, European Region; SEAR, South-East Asia Region; WPR, Western Pacific Region; HBR, home-based record.



**Fig. 1.** Country-specific estimated current home-based record prevalence among children aged 12–23 months at the time of survey from 180 Demographic and Health Surveys conducted between 1993 and 2013 and estimated birth cohort size by World Health Organization regional classification. Circle size is proportionate to the estimated national birth cohort size per UN Population Division estimates, 2012 [7] revision.

68 were conducted in the Africa region (by 20 countries), 27 were conducted in the Americas (by five countries), 15 were conducted in South-East Asia (by three countries), eight were conducted in the Eastern Mediterranean (by two countries), eight were conducted in the Western Pacific (by two countries), and six were conducted in the European region (by two countries). With the exception of four African countries (Ghana, Kenya, Madagascar and Zambia), each of the countries with at least three DHS had conducted the most recent survey during 2010–2013. Improvements in both estimated ever and current home-based record prevalence of >10% points were observed in six countries (Burkina Faso, Bangladesh, Bolivia, Ghana, Mozambique and Niger) with current prevalence levels observed in the most recent survey below 80% in two of the countries (Bangladesh and Niger). Meaningful, yet modest (i.e., a 5–10% point change) improvements in ever and current home-based record prevalence levels were observed in Indonesia although current prevalence levels remain below 80% as of the most recent DHS conducted in 2011. In six countries where the ever prevalence was maintained at  $\geq 90\%$  across the period of observation, current

home-based record prevalence increased >10% points (Cambodia, Colombia, Dominican Republic, Egypt, Peru, Rwanda) although current prevalence as of the most recent DHS was <80% in Egypt. And, no meaningful change was observed in estimated ever and current home-based record prevalence in 11 countries, five (Jordan, Kenya, Senegal, Zambia, Zimbabwe) of which maintained ever prevalence  $\geq 90\%$  across the period of observation. A range of patterns were observed for the remaining 10 countries (Table 3).

Trends in country-specific estimated ever and current home-based record prevalence and home-based record loss rates are shown in Fig. 2 for Bangladesh, Benin, Cambodia, Haiti, Nepal and Philippines. In Cambodia and the Philippines, ever home-based record prevalence has remained stable since the mid-1990s at levels  $\geq 90\%$  with steady increases in the current home-based record prevalence over time. Despite improvements in the Philippines, less than two-thirds of children from the 2012 birth cohort had a home-based record one-year after birth. In Nepal, ever home-based record prevalence has increased since the mid-1990s yet retention of the document has changed little with more than half of children

**Table 3**

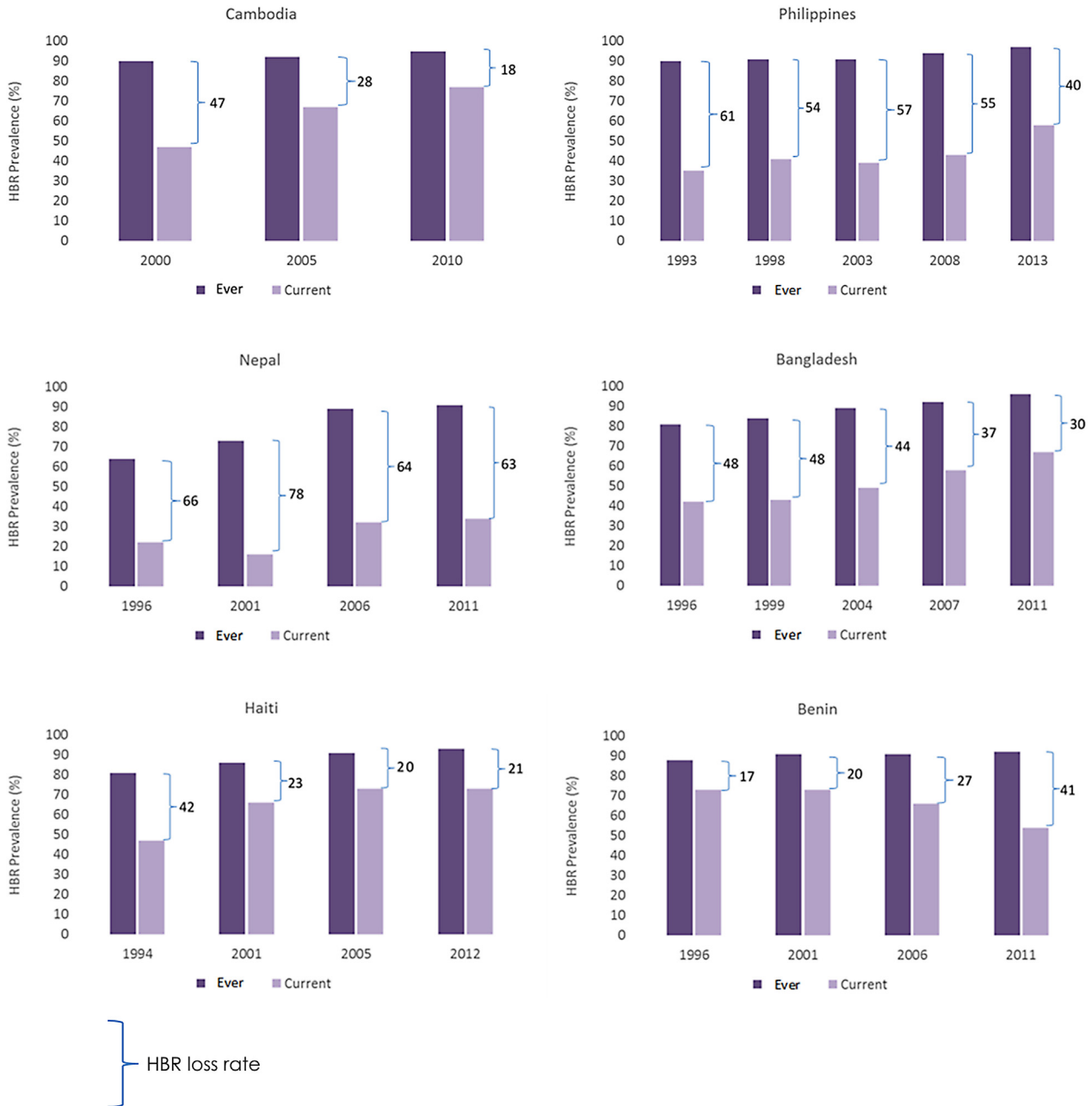
Changes in ever and current home-based record prevalence observed across 132 Demographic and Health Surveys conducted in 34 countries that conducted three or more surveys.

		Ever HBR prevalence change over time		
		No meaningful change	5–10% Point change	>10% Point change
Current HBR prevalence over time	No meaningful change	<b>AFR:</b> BEN, GIN, KEN, MLI, MWI, NGA, SEN, ZMB, ZWE <sup>*</sup> <b>EUR:</b> ARM <b>EMR:</b> JOR <sup>*</sup> <b>AFR:</b> TZA <sup>*</sup>	<b>AFR:</b> CIV, <sup>**</sup> CMR, <sup>**</sup> UGA <sup>**</sup>	<b>AFR:</b> ETH <sup>**</sup>
	5–10% Point change	<b>AFR:</b> TZA <sup>*</sup>	<b>SEAR:</b> IDN <sup>**</sup>	<b>AFR:</b> MDG <sup>**</sup> <b>EUR:</b> TUR <sup>**</sup> <b>SEAR:</b> NPL <sup>**</sup>
	>10% Point change	<b>AFR:</b> RWA <sup>*</sup> <b>AMR:</b> COL, <sup>*</sup> DOM, <sup>*</sup> PER <sup>*</sup> <b>EMR:</b> EGY <sup>**</sup> <b>WPR:</b> KHM <sup>*</sup>	<b>AMR:</b> HTI <sup>**</sup> <b>WPR:</b> PHL <sup>**</sup>	<b>AFR:</b> BFA GHA MOZ NER <sup>**</sup> <b>AMR:</b> BOL <b>SEAR:</b> BGD <sup>**</sup>

**Abbreviations:** AFR, African Region; AMR, Region of the Americas; EMR, Eastern Mediterranean Region; EUR, European Region; SEAR, South-East Asia Region; WPR, Western Pacific Region; HBR, home-based record. Countries are presented by their ISO3 code. Refer to Annex 1 for a listing of ISO3 codes and country names.

<sup>\*</sup> Ever prevalence of home-based records is  $\geq 90\%$  throughout time series.

<sup>\*\*</sup> Current prevalence level remains <80% despite improvement over time.



**Fig. 2.** Trends in country-specific estimated ever and current home-based record prevalence among children aged 12–23 months at time of survey and home-based record loss rates in selected countries. *Abbreviations:* HBR; home-based record. The HBR loss rate is indicated on the graphic as follows:  $HBR\ loss\ rate = ((\text{ever home based record prevalence} - \text{current home based record prevalence}) / (\text{ever home based record prevalence})) \times 100\%$ .

from the 2011 birth cohort having no home-based record one-year after birth. In Bangladesh and Haiti, meaningful improvements are observed in both ever and current home-based record prevalence with reductions in home-based record loss rate, although opportunities for improvement remain. And in Benin, ongoing challenges are evidenced by increases in home-based record loss rate between the mid-1990s and 2010 despite largely unchanged ever prevalence.

**4. Discussion**

The ever and current home-based record prevalence levels observed here provide both a sense of optimism and concern. In many countries, ever home-based record prevalence has attained

high ( $\geq 90\%$ ) levels and in many places these levels have been sustained over time; although challenges with stock-outs exist [3], the results demonstrate that immunization systems are able to make home-based records available to large proportions of successive annual birth cohorts. In contrast, the number of countries with a current home-based record prevalence  $< 80\%$ , a threshold that in our opinion represents a *minimum* acceptable level, is disproportionate. Of particular concern are the number of countries with annual birth cohorts  $\geq 500,000$  where current home-based record prevalence is low and home-based record loss rate is high. The implications for such countries in terms of missed opportunities to stimulate demand for immunization services and risk of suboptimal communication and coordination of care, risk of unnecessary and costly re-vaccinations, and risk of information bias in survey and public health monitoring efforts are noteworthy and highlight much

needed in-country operational research to better understand the underlying causes and potential corrective actions.

For example, Nigeria (7.1 million births), Indonesia (4.7 million), Pakistan (4.6 million), Bangladesh (3.1 million) and Ethiopia (3.1 million) – five of the ten countries with the largest birth cohorts in 2013 according to United Nations estimates [7] – had current home-based record prevalences of <80% in their most recent surveys, respectively. Home-based record loss rates were high in all five countries and low current prevalence values partly reflected home-based record access problems in Ethiopia, Nigeria and Pakistan. If the most recent current prevalence values accurately reflect the situation in these countries, then these immunization programmes lacked appropriate vaccination history documentation for a collective total of 14.1 million children born during 2013—an amount equal to 10% of all births worldwide! This should be of extreme concern and serve as a call-to-action around recording given the missed opportunities that it represents vis-à-vis the functions of the home-based record and knowing that health facility record systems are often lacking to serve their function.

Some countries are making progress. In Burkina Faso, Bolivia, Ghana, and Mozambique, evidence suggests substantial improvements in both ever and current home-based record prevalence levels during the past 10–15 years. Improvements in Cambodia and Haiti are also recognizable. Further work is needed to document the progress made in these countries and others, such as Colombia and Tanzania where high ever prevalence levels have been sustained while also improving retention levels, and to understand the factors and environments that bolster advancements so that they can be replicated elsewhere. These may include changes to the home-based record content and/or design [8]; use of hybrid synthetic papers that will accept ink and pencil while remaining extremely durable against harsh environments, both inside and outside the household, and that resist moisture, fire, pests, bacteria and tearing; interventions to incentivize retention of the home-based record [9]; or, bundling with supply chain management of vaccines and other commodities in vaccines service delivery.

This report of estimated country-specific ever home-based record prevalence levels is one of the only presentations of this measure of which we are aware. Prior focus on current home-based record prevalence is driven by the information collected in household surveys such as those from DHS and UNICEF-supported Multiple Indicator Cluster Surveys (MICS) and the reports generated from these surveys. Additionally, because information on ever prevalence is not part of the standard reports, valuable information about home-based record loss rate – necessary for assessing where problems with home-based record availability, utilization and retention may reside – remains inaccessible to the vast majority of survey result users with the exception of those who conduct secondary data analyses. We encourage the coordinators of these household survey programmes, as well as those in the countries commissioning the surveys, to include the immunization module in the surveys and to include ever and current home-based record prevalence in the standard survey reports and tables. The inclusion of ever home-based record prevalence in the presentation of vaccination coverage by background characteristics would enable programme managers to identify discrepancies between ever and current home-based record prevalence levels and to target interventions more effectively where action is needed to resolve problems. At present, this is only possible through secondary data analysis of these household surveys' micro-data.

The results in this study do not address the quality of vaccination history information recorded in the home-based record. Many home-based records do not facilitate health worker workflow, and in fact may unnecessarily complicate recording processes [10]. Complex home-based records that include excess information that will never be used not only wastes time that could otherwise

be spent listening and providing health education to the caregiver but also may impact the quality of recorded information. We are unaware of studies of the benefits of health worker continuing education on good recording practices for immunization data. Further investigation is needed to understand the quality of currently recorded information and how home-based record design and in-service training may impact on immunization data quality.

In summary, home-based records play an important role in (i) improving programme monitoring by increasing the availability of documented evidence thereby reducing information bias in coverage surveys, (ii) providing a relatively inexpensive and effective means for promoting immunization and stimulating demand, (iii) improving communication and coordination of high-quality, patient-centred care while (iv) educating caregivers about their child's vaccination history, and (v) decreasing unnecessary and costly re-vaccinations [11]. The results here show that despite improvements in the availability, utilization and retention of home-based records for recording vaccination history in some countries, opportunities remain to change the mind-set in many national immunization programmes around the importance of the home-based record. National immunization programmes and health systems are encouraged to include ever and current home-based record prevalence measures in their monitoring frameworks in order to identify gaps in access, utilization and retention. Countries are encouraged to conduct operational research to better understand the reasons underlying identified gaps and to develop targeted corrective actions at the appropriate levels. In addition, nationally representative household surveys (such as the DHS and MICS) collecting information on immunization coverage should include ever and current home-based record prevalence in the standard survey reports and tables to better enable programme managers to identify problems and target corrective action. Next steps also include the need to establish a business case for investment in home-based records [11] and improved recording and monitoring systems within immunization programmes more broadly. From a public health monitoring stance, the credibility of immunization coverage assessments using coverage surveys will continue to be challenged by low current home-based record prevalence until such time as the proportion of documented evidence reaches levels more comparable to the levels of vaccination.

## Authors' statements

### Disclaimer

The findings and views expressed herein are those of the authors alone and do not necessarily reflect those of their respective institutions.

## Contributions

MGD and DWB conceived the study; DWB carried out the data summarization; MGD and DWB were involved in the interpretation of these data. MGD and DWB drafted and critically revised the manuscript for intellectual content. All authors read and approved the final manuscript. MGD and DWB are guarantors of the paper.

## Funding

This work was supported in part by a grant from the Bill and Melinda Gates Foundation to the World Health Organization [No. OPP1055811].

**Ethical approval**

Not required.

**Competing interests**

None declared.

**Acknowledgements**

The authors wish to thank Stacy Young for review and comments on prior drafts of this manuscript. The authors wish to

thank Aluisio JD Barros, Luis Paulo Vidaletti and Cesar G Victora at the International Center for Equity in Health at the Federal University of Pelotas in Brazil for abstraction and re-analysis of DHS data.

**Annex 1.**

Country-specific estimated ever and current home-based record prevalence and loss rate among children aged 12–23 months at the time of survey from 180 Demographic and Health Surveys conducted between 1993 and 2013.

Country	ISO3	WHO region	Survey year	N (12–23 m)	Ever HBR		Current HBR		HBR loss rate
					%	(s.e.)	%	(s.e.)	
Albania	ALB	EUR	2008	276	99.6	(0.3)	97.8	(1.0)	2
Armenia	ARM	EUR	2000	305	94.3	(1.4)	94.3	(1.4)	0
			2005	278	99.1	(0.8)	91.8	(2.3)	7
			2010	324	97.6	(1.0)	95.6	(1.5)	2
Azerbaijan	AZE	EUR	2006	439	81.2	(2.7)	68.4	(3.2)	16
Bangladesh	BGD	SEAR	1993	1145	82.3	(1.5)	45.4	(1.8)	45
			1996	1080	81.1	(1.9)	42.2	(2.1)	48
			1999	1303	84.3	(1.8)	43.5	(2.0)	48
			2004	1247	89.0	(1.5)	49.4	(1.8)	44
			2007	1161	92.4	(1.0)	58.2	(1.9)	37
			2011	1546	95.6	(0.9)	66.7	(1.6)	30
Benin	BEN	AFR	1996	895	87.6	(1.8)	72.5	(2.2)	17
			2001	941	91.2	(1.3)	73.3	(2.0)	20
			2006	3037	90.9	(0.9)	66.2	(1.2)	27
			2011	2532	91.7	(0.9)	54.3	(1.3)	41
Bolivia	BOL	AMR	1994	1105	79.4	(1.8)	35.1	(1.9)	56
			1998	1333	87.4	(1.2)	40.2	(1.6)	54
			2003	1889	97.1	(0.5)	78.6	(1.2)	19
			2008	1722	98.5	(0.4)	80.6	(1.3)	18
Brazil	BRA	AMR	1996	978	97.2	(0.6)	78.9	(1.5)	19
Burkina Faso	BFA	AFR	1998	1001	74.5	(2.4)	55.9	(2.7)	25
			2003	1824	82.5	(1.9)	66.7	(2.3)	19
			2010	2791	97.4	(0.5)	83.1	(1.0)	15
Burundi	BDI	AFR	2010	1524	99.0	(0.3)	61.9	(1.6)	37
Cambodia	KHM	WPR	2000	1329	90.4	(1.2)	47.5	(2.0)	47
			2005	1585	92.3	(1.0)	66.7	(1.7)	28
			2010	1619	94.5	(0.9)	77.4	(1.5)	18
Cameroon	CMR	AFR	1998	703	80.9	(2.1)	54.9	(2.2)	32
			2004	1543	85.2	(1.5)	57.3	(1.8)	33
			2011	2286	87.6	(1.3)	57.0	(1.6)	35
Central African Republic	CAF	AFR	1994	805	82.8	(1.9)	59.6	(2.3)	28
Chad	TCD	AFR	1996	1179	43.7	(3.2)	27.3	(2.5)	37
			2004	901	42.4	(3.6)	24.5	(3.1)	42
Colombia	COL	AMR	1995	1031	96.3	(0.7)	61.8	(1.7)	36
			2000	914	98.5	(0.5)	74.7	(1.6)	24
			2005	2919	98.8	(0.2)	78.0	(1.0)	21
			2010	3435	99.7	(0.1)	83.2	(0.9)	17
Comoros	COM	AFR	1996	369	90.2	(2.0)	74.3	(2.8)	18
			2012	630	93.2	(1.5)	72.7	(2.1)	22
Congo	COG	AFR	2005	901	85.0	(2.1)	59.8	(2.6)	30
			2011	1884	90.2	(1.2)	57.2	(1.9)	37
Cote d'Ivoire	CIV	AFR	1994	1166	87.5	(1.6)	72.3	(2.0)	17
			1998	390	87.2	(2.5)	73.4	(2.8)	16
			2011	1417	94.6	(0.9)	74.1	(1.4)	22
Democratic Republic of the Congo	COD	AFR	2007	1632	70.2	(2.5)	24.3	(2.0)	65
Dominican Republic	DOM	AMR	1996	931	96.5	(0.6)	52.3	(2.1)	46
			1999	75	99.1	(0.9)	47.5	(7.0)	52
			2002	2273	98.3	(0.3)	50.3	(1.5)	49
			2007	2077	98.3	(0.4)	66.6	(1.6)	32

Country	ISO3	WHO region	Survey year	N (12–23 m)	Ever HBR		Current HBR		HBR loss rate
					%	(s.e.)	%	(s.e.)	
Egypt	EGY	EMR	1995	2223	99.0	(0.3)	50.1	(1.5)	49
			2000	2198	99.6	(0.2)	72.5	(1.3)	27
			2005	2746	99.6	(0.1)	73.3	(1.0)	26
			2008	2205	98.1	(0.4)	68.5	(1.2)	30
Ethiopia	ETH	AFR	2000	1845	45.9	(2.3)	27.1	(1.9)	41
			2005	1697	63.9	(2.0)	36.9	(1.9)	42
			2011	1927	64.9	(2.4)	28.7	(2.0)	56
Gabon	GAB	AFR	2000	889	93.5	(0.9)	62.8	(2.0)	33
			2012	1197	95.5	(0.8)	75.1	(1.9)	21
Ghana	GHA	AFR	1993	651	88.3	(1.6)	68.2	(2.2)	23
			1998	651	92.2	(1.2)	76.0	(1.8)	18
			2003	735	95.7	(0.9)	83.0	(1.5)	13
			2008	569	99.6	(0.3)	85.9	(1.7)	14
Guatemala	GTM	AMR	1995	1960	91.8	(0.8)	54.2	(1.6)	41
			1998	929	96.2	(0.9)	68.4	(2.5)	29
Guinea	GIN	AFR	1999	921	76.9	(2.1)	46.5	(2.1)	40
			2005	1115	80.0	(2.4)	53.5	(2.4)	33
			2012	1302	82.1	(1.9)	44.0	(2.1)	46
Guyana	GUY	AMR	2009	426	96.6	(1.0)	88.1	(1.9)	9
Haiti	HTI	AMR	1994	654	81.3	(2.4)	46.8	(2.6)	42
			2000	1268	85.9	(2.0)	66.3	(2.3)	23
			2005	1186	91.2	(1.4)	72.8	(2.2)	20
			2012	1370	93.2	(1.1)	73.2	(1.7)	21
Honduras	HND	AMR	2005	2103	99.9	(0.1)	84.9	(1.0)	15
			2011	2277	99.8	(0.1)	89.7	(0.8)	10
India	IND	SEAR	1998	10,209	69.6	(0.8)	33.7	(0.7)	52
			2005	9582	74.1	(0.9)	37.5	(0.8)	49
Indonesia	IDN	SEAR	1994	3241	79.7	(1.4)	38.7	(1.7)	51
			1997	3329	84.3	(1.3)	30.9	(1.5)	63
			2002	3097	83.6	(1.4)	30.7	(1.7)	63
			2007	3487	85.9	(1.0)	36.8	(1.5)	57
			2012	3502	90.7	(0.8)	41.1	(1.4)	55
Jordan	JOR	EMR	1997	1290	99.8	(0.1)	81.2	(1.2)	19
			2002	1198	99.7	(0.2)	77.6	(1.6)	22
			2007	1980	99.5	(0.2)	90.3	(1.1)	9
			2012	2030	99.7	(0.2)	80.4	(1.6)	19
Kazakhstan	KAZ	EUR	1995	294	100.0		NA		
			1999	253	99.8	(0.2)	90.7	(2.3)	9
Kenya	KEN	AFR	1993	1116	97.3	(0.6)	69.2	(1.6)	29
			1998	1127	96.6	(0.6)	55.4	(1.8)	43
			2003	1099	91.8	(1.2)	59.9	(2.1)	35
			2008	1119	98.0	(0.5)	70.4	(2.3)	28
Kyrgyzstan	KGZ	EUR	1997	371	87.5	(2.6)	78.4	(3.0)	10
			2012	879	99.6	(0.4)	86.8	(1.9)	13
Lesotho	LSO	AFR	2004	673	98.8	(0.5)	77.7	(2.0)	21
			2009	797	98.8	(0.4)	74.2	(2.3)	25
Liberia	LBR	AFR	2007	996	79.7	(2.9)	47.6	(2.7)	40
			2013	1433	95.2	(1.0)	58.4	(2.2)	39
Madagascar	MDG	AFR	1997	1125	71.4	(2.2)	49.7	(2.3)	30
			2003	1063	75.8	(3.0)	50.2	(3.1)	34
			2008	2183	84.7	(1.3)	60.4	(1.6)	29
Malawi	MWI	AFR	2000	2216	98.1	(0.4)	81.1	(1.1)	17
			2004	2233	98.7	(0.3)	74.3	(1.3)	25
			2010	3808	99.5	(0.1)	80.8	(1.1)	19
Maldives	MDV	SEAR	2009	843	99.8	(0.2)	89.0	(1.5)	11
Mali	MLI	AFR	1995	1583	76.7	(1.9)	56.2	(2.1)	27
			2001	2258	70.3	(1.9)	48.3	(1.9)	31
			2006	2562	86.5	(1.3)	60.8	(1.6)	30
			2012	1844	86.3	(1.3)	38.0	(1.8)	56
Moldova	MDA	EUR	2005	343	98.4	(0.7)	89.6	(1.9)	9
Morocco	MAR	EMR	2003	1154	98.3	(0.5)	78.3	(1.5)	20



Country	ISO3	WHO region	Survey year	N (12–23 m)	Ever HBR		Current HBR		HBR loss rate
					%	(s.e.)	%	(s.e.)	
Mozambique	MOZ	AFR	1997	1218	82.8	(3.3)	66.0	(4.4)	20
			2003	1875	91.4	(1.2)	78.0	(1.6)	15
			2011	2225	95.2	(0.7)	83.1	(1.2)	13
Namibia	NAM	AFR	2000	808	98.5	(0.5)	73.6	(2.2)	25
			2006	1020	97.3	(0.7)	73.4	(1.7)	25
Nepal	NPL	SEAR	1996	1402	64.1	(2.4)	21.7	(1.8)	66
			2001	1299	72.6	(2.4)	16.2	(1.5)	78
			2006	1063	88.6	(1.8)	31.8	(2.4)	64
			2011	945	91.3	(2.1)	33.9	(2.7)	63
Nicaragua	NIC	AMR	1997	1564	97.4	(0.5)	74.1	(1.4)	24
			2001	1452	97.6	(0.6)	79.4	(1.4)	19
Niger	NER	AFR	1998	1386	44.9	(2.7)	34.8	(2.5)	23
			2006	1674	56.4	(2.7)	42.8	(2.5)	24
			2012	2151	89.6	(1.1)	65.0	(1.8)	27
Nigeria	NGA	AFR	1999	1167	58.9	(2.7)	19.5	(1.6)	67
			2003	1015	45.3	(3.1)	21.3	(2.1)	53
			2008	5022	50.1	(1.5)	26.1	(1.1)	48
			2013	5834	51.1	(1.7)	28.0	(1.2)	45
Pakistan	PAK	EMR	2006	1541	74.9	(1.5)	23.7	(1.5)	68
			2012	2039	75.5	(2.0)	36.0	(1.8)	52
Peru	PER	AMR	1996	3301	97.7	(0.3)	52.6	(1.3)	46
			2000	2594	97.9	(0.4)	62.1	(1.3)	37
			2004	514	99.0	(0.4)	67.4	(2.8)	32
			2005	546	98.5	(0.8)	75.9	(2.6)	23
			2006	597	97.6	(0.9)	63.4	(3.0)	35
			2007	515	98.9	(0.5)	70.7	(2.7)	29
			2008	1261	99.6	(0.1)	66.6	(2.2)	33
			2009	2004	98.4	(0.4)	72.2	(1.4)	27
			2010	1860	99.2	(0.2)	77.9	(1.3)	21
			2011	1773	99.0	(0.3)	81.3	(1.3)	18
			2012	1861	99.0	(0.2)	82.1	(1.2)	17
Philippines	PHL	WPR	1993	1812	89.9	(0.9)	35.1	(1.4)	61
			1998	1554	90.6	(0.9)	41.4	(1.5)	54
			2003	1370	91.3	(0.9)	38.9	(1.5)	57
			2008	1320	93.8	(0.8)	42.5	(1.6)	55
			2013	1423	96.8	(0.5)	57.6	(1.5)	40
Rwanda	RWA	AFR	2000	1310	98.1	(0.4)	66.3	(1.6)	32
			2005	1624	97.7	(0.7)	75.9	(1.4)	22
			2010	1596	99.3	(0.2)	82.2	(1.2)	17
Sao Tome and Principe	STP	AFR	2008	377	100.0		93.0	(1.5)	7
Senegal	SEN	AFR	2005	2138	95.8	(0.6)	70.0	(1.4)	27
			2010	2377	96.4	(0.6)	66.4	(1.6)	31
			2012	1329	97.3	(0.6)	70.9	(1.7)	27
Sierra Leone	SLE	AFR	2008	1032	90.1	(1.5)	60.0	(1.9)	33
South Africa	ZAF	AFR	1998	971	98.8	(0.4)	74.6	(1.7)	25
Swaziland	SWZ	AFR	2006	538	99.6	(0.3)	84.1	(1.6)	16
Tajikistan	TJK	EUR	2012	1024	98.2	(0.6)	89.5	(1.2)	9
Tanzania	TZA	AFR	1996	1297	97.8	(0.6)	76.6	(1.7)	22
			1999	561	91.8	(3.4)	74.1	(3.5)	19
			2004	1613	97.0	(0.7)	78.8	(1.5)	19
			2010	1549	95.1	(0.8)	84.2	(1.2)	11
Timor-Leste	TLS	SEAR	2009	1803	78.0	(1.5)	49.6	(1.8)	36
Togo	TGO	AFR	1998	1191	78.7	(1.8)	58.4	(2.0)	26
Turkey	TUR	EUR	1993	716	85.3	(2.2)	41.6	(2.5)	51
			1998	707	85.5	(2.0)	38.5	(2.2)	55
			2003	807	100.0		53.7	(2.5)	46
Uganda	UGA	AFR	1995	1475	85.9	(1.3)	60.5	(1.9)	30
			2000	1400	84.3	(1.4)	47.3	(1.8)	44
			2006	1573	93.3	(0.8)	63.1	(1.5)	32
			2011	1427	95.9	(0.7)	59.2	(1.5)	38
Uzbekistan	UZB	EUR	1996	438	98.6	(0.6)	90.3	(1.6)	8
Vietnam	VNM	WPR	1997	615	59.0	(3.8)	13.3	(2.0)	77
			2002	467	69.1	(4.3)	39.9	(3.8)	42

Country	ISO3	WHO region	Survey year	N (12–23 m)	Ever HBR		Current HBR		HBR loss rate
					%	(s.e.)	%	(s.e.)	
Zambia	ZMB	AFR	1996	1348	98.3	(0.4)	81.8	(1.2)	17
			2001	1329	97.7	(0.4)	79.5	(1.3)	19
			2007	1266	98.8	(0.3)	77.9	(1.4)	21
Zimbabwe	ZWE	AFR	1994	709	97.2	(0.7)	79.1	(1.7)	19
			1999	724	94.6	(1.2)	68.6	(2.5)	28
			2005	989	95.5	(0.9)	72.3	(1.5)	24
			2010	1059	93.8	(1.1)	67.8	(1.9)	28

Abbreviations: AFR, African Region; AMR, Region of the Americas; EMR, Eastern Mediterranean Region; EUR, European Region; SEAR, South-East Asia Region; WPR, Western Pacific Region; HBR, home-based record; HBR loss rate = ((ever home based record prevalence – current home based record prevalence) / (ever home based record prevalence)) × 100%.

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