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Data Update: A Summary of Global Immunization Coverage Through 2011

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Abstract: This paper summarizes the 2011 revision (completed July 2012) of the WHO and UNICEF estimates of national immunization coverage (WUENIC) for select antigens. Globally, DTP_3 coverage was 83% during 2011, an increase from 74% during 2000, and MCV_1 coverage was 84% during 2011, an increase from 72% during 2000. Among 49 countries in Sub-Saharan Africa, 17 countries attained DTP_3 coverage levels > 90% and 15 countries attained MCV_1 coverage > 90% during 2011. Only eight Sub-Saharan African countries maintained DTP_3 coverage levels > 90% since 2005. Although there have been enormous and increasingly successful efforts to address the global burden of vaccine preventable diseases and to improve immunization coverage, an estimated 22.4 million children were unimmunized with DTP_3 globally during 2011.

Keywords: Vaccination, vaccination coverage, immunization, immunization coverage, monitoring, statistics.

INTRODUCTION

Each year since 2000, the United Nations Children's Fund (UNICEF) and the World Health Organization (WHO) have jointly reviewed, prepared and published estimates of national immunization coverage for selected vaccine preventable diseases. This paper summarizes the 2011 revision (completed July 2012) of the WHO and UNICEF estimates of national immunization coverage (WUENIC) made for 195 countries or territories and updates estimates previously reported in the Journal [1].

METHODS

Among other recommendations, the WHO recommends that all children receive one dose of Bacille Calmette-Guérin vaccine (BCG), three doses of diphtheria–tetanus–pertussis containing vaccine (DTP), three doses of either oral polio vaccine (OPV) or inactivated polio vaccine (IPV), three doses of hepatitis B vaccine (HepB), and one dose of a measles containing vaccine (MCV) [2]. Each year WHO and UNICEF jointly review reports by national authorities regarding national immunization coverage for these and other antigens as well as survey data from the published and grey literature. Based on these data, with due consideration to potential biases and the views of local experts (primarily national immunization system managers and WHO/UNICEF regional and country office staff), WHO and UNICEF attempt to distinguish between situations where the available empirical data accurately reflect immunization system performance and those where the data are likely to be compromised and present a misleading view of immunization coverage while jointly estimating the most likely immunization coverage levels for each country or territory.

The WHO and UNICEF estimates are country-specific; that is to say, each country's data are reviewed individually and data are not borrowed from other countries in the absence of data. The WUENIC are not based on *ad hoc* adjustment to reported data; in some instances empirical data are available from a single source, usually the national reports to WHO or UNICEF. In cases where no data are available for a given country-year-antigen combination, data are considered from earlier and later years and interpolated to estimate coverage for the missing year. In cases where data sources are mixed and show large variation, an attempt is made to identify the most likely estimate with consideration of the possible biases in the available data. Finally, the WUENIC, while informed by data from national authorities, constitute an independent technical assessment by WHO and UNICEF of national routine immunization system performance. A detailed explanation of the WUENIC estimation methods is provided elsewhere [3, 4]. Country-specific coverage data are available online at www.childinfo.org/immunization.html and www.who.int/immunization_monitoring/data/en/index.html

In this report, we present data on global and regional coverage for BCG, first and third dose of DTP (DTP_1, DTP_3), third dose of polio (Pol_3), third dose of HepB ($HepB_3$), third dose of *Haemophilus influenzae* type B (Hib_3) vaccine and first dose of MCV (MCV_1) during 2011 as well as for decennial estimates from 1980. We also report the estimated number of children unimmunised with three doses of DTP. Immunization coverage levels are presented as the percentage of a target population that has been vaccinated.

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For example, DTP_3 coverage is calculated by dividing the number of children receiving the third dose of DTP vaccine by the number of children who survived to their first birthday. To the extent possible, the WUENIC refer to immunizations given during routine immunization services to children less than 12 months of age where such services are recorded; supplementary immunization activities such as polio, tetanus and measles campaigns are not included to the extent possible.

Global and regional (Millennium Development Goal [MDG] regions) averages are obtained by multiplying the country-specific coverage and a target population weight for each country where the weight is equal to the country-specific number of children in the target population (number of births for BCG, number of births surviving to their first birthday for all other vaccines) divided by the sum of the children in the target population across all countries either globally or regionally. The estimated number of births and surviving infants for each country is obtained from the United Nations Population Division [5]. The number of children unreached with DTP_3 is obtained by multiplying the proportion not vaccinated (1 – coverage level; e.g., 0.85) for each country and the estimated number of surviving infants for each country obtained from the United Nations Population Division [5].

RESULTS

Global and MDG regional averages for BCG, DTP_1, DTP_3, Pol_3, $HepB_3$, Hib_3 and MCV_1 coverage during 2011 are shown in the Table **1**. Globally, DTP_3 coverage was 83% during 2011, an increase from 74% during 2000. Similarly, global MCV_1 coverage increased from 72% during 2000 to 84% during 2011. Among 49 countries in Sub-Saharan Africa, 17 countries attained DTP_3 coverage levels > 90% and 15 countries attained MCV_1 coverage > 90% during 2011. Only eight Sub-Saharan African countries (Botswana, Cape Verde, Eritrea, the Gambia, Mauritius, Rwanda, Seychelles, Sao Tome and Principe)—accounting for less than 5% of the total birth cohort for the 49 countries in the region during 2011—maintained DTP_3 coverage levels > 90% since 2005. Coverage with three doses of HepB vaccine, which had been introduced in 180 countries by 2011, was 75% globally in 2011. Similarly, coverage with three doses of *Haemophilus influenzae* type b (Hib) vaccine, which had been introduced in 177 countries by 2011, was 43% globally and ranged from <10% in Eastern Asia (where only Mongolia has included the vaccine in its national immunization schedule) to 93% in Latin America.

Improvements in coverage levels were observed among the countries classified as least developed countries (note: least developed country classification based on classifications used by the United Nations in the World Economic Social Survey 2011, available online at www.un.org/en/development/desa/ policy/wess/ ; there is no established convention for the designation of "developed", "developing", "least developed" countries or areas in the United Nations system). Among 48 countries classified least developed for 2011, 17 countries attained > 90% DTP_3 coverage (regional average DTP_3 coverage in 2011=79%) compared to 4 countries (Bhutan, Kiribati, Rwanda, and Samoa) during 2000 (regional average DTP_3 coverage in 2000=58%). Similarly, 13 of 48 least developed countries reached 90% MCV_1 coverage (regional average MCV_1 coverage in 2011=77%) during 2011 compared to only one country (Samoa) during 2000 (regional average MCV_1 coverage in 2000=57%).

During 2000-2011, improvements in vaccination coverage translated into decreases in the number of children who remain unimmunized (Fig. **1**). For example, the number of children unimmunized with DTP_3 decreased by 93% in East Asia (from 2.9 million in 2000 to < 200,000 in 2011 following on an increase in coverage from 85% in 2000 to 99% in 2011), 32% in Southern Asia (from 12.8 million in 2000 to 8.7 million in 2011 following on an increase in coverage from 65% in 2000 to 76% in 2011) and by 27% in Sub-Saharan Africa (from 11.9 million in 2000 to 8.7 million in 2011; DTP_3 coverage increase from 52% in 2000 to 71% in 2011) regions, three regions which account for almost two-thirds of the global target population for routine immunization. Despite these gains, an estimated 22.4 million children did not receive three doses of DTP containing vaccine before their first birthday during 2011.

COMMENTS

The WUENIC are updated annually and incorporate new empirical data including revisions to previous administrative and/or government official coverage reports and new survey results [3, 4]. As such, each annual revision of the WHO and UNICEF estimates supersedes prior data releases and coverage levels from earlier revisions are not comparable. This may be of particular importance in certain regions, such as Sub-Saharan Africa, where national immunization coverage surveys and other national household surveys (e.g., Demographic and Health Surveys or Multiple Indicator Cluster Surveys) are frequently conducted thereby influencing the availability of empirical data that serve as inputs to the WHO and UNICEF estimates. It is also important to note that within a given revision, year-to-year changes at global, regional and national levels may or may not suggest meaningful differences in coverage levels and occur against a backdrop of a long-term trend of increasing coverage levels. Changes in WUENIC between revisions may reflect either a change in empirical data or a true change in immunization programme performance. At national levels, fluctuations in WUENIC (within a given revision) typically represent new leadership, stock-outs, changes in donor support, or shocks to the immunization delivery or health system more broadly (e.g., conflict, natural disasters, decentralization).

In summary, the annual collection and review of national immunization coverage data plays an important role in further reducing the morbidity, disability and mortality associated with vaccine preventable diseases and is critical to evaluating progress toward the Global Immunization Vision and Strategy (GIVS) [6]. Although there have been enormous and increasingly successful efforts to address the global burden of vaccine preventable diseases and to improve immunization coverage, the benefits of vaccination continue to elude many of the world's children and opportunities remain to improve routine immunization coverage globally. While global coverage with three doses of

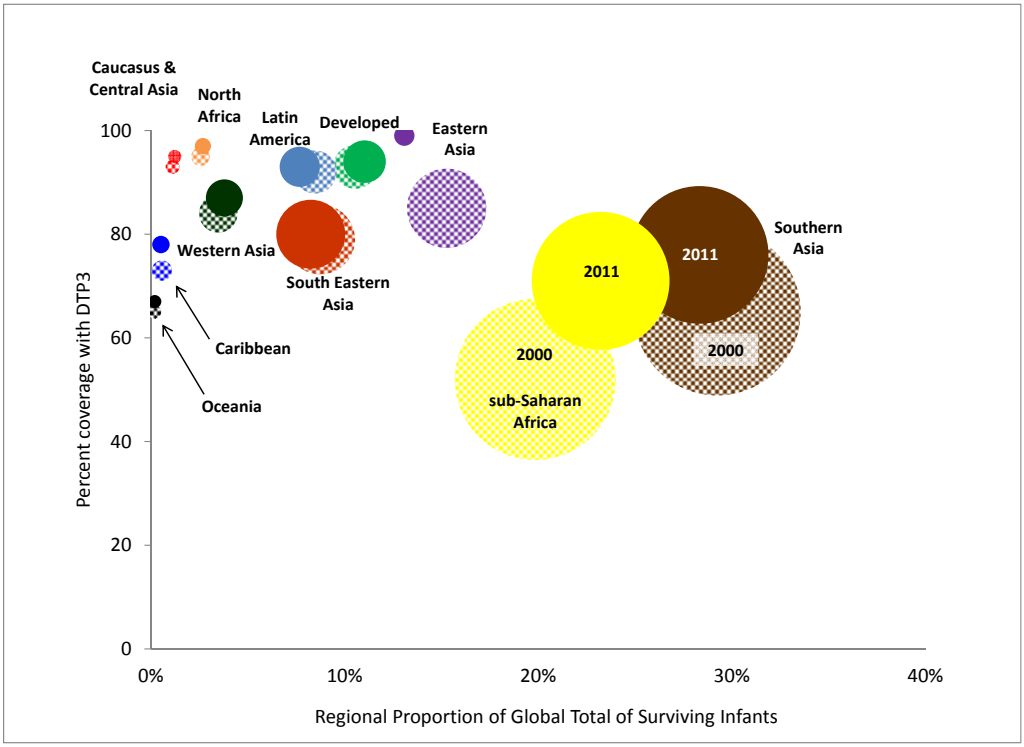
Table 1. WHO and UNICEF Estimates of National Routine Immunization Coverage (%) for Select Antigens by Millennium Development Goal (MDG) Region: 1980 – 2011

	BCG						DTP_1					
MDG Region*	**1980**	**1990**	**2000**	**2005**	**2010**	**2011**	**1980**	**1990**	**2000**	**2005**	**2010**	**2011**
Sub-Saharan Africa	10	73	67	74	85	79	<10	76	66	73	84	79
Northern Africa	27	93	97	97	98	98	41	95	97	97	98	98
Western Asia	22	93	92	87	89	88	51	94	92	91	94	93
Caucasus & Central Asia	—	—	96	88	96	96	—	—	95	96	96	96
Eastern Asia	<10	98	84	86	99	99	<10	98	93	95	99	99
South-Eastern Asia	46	84	88	88	87	88	24	89	90	90	89	90
Southern Asia	<10	71	76	83	88	87	24	86	72	81	86	86
Oceania	65	91	83	76	81	85	60	97	86	82	83	86
Caribbean	36	80	85	88	89	89	53	84	88	91	91	90
Latin America	54	79	97	97	96	96	61	86	97	97	97	97
Developed	20	83	92	91	94	92	76	91	97	98	98	97
Global	16	81	81	84	90	88	30	88	83	86	90	89
	DTP_3						$HepB_3$					
MDG Region*	**1980**	**1990**	**2000**	**2005**	**2010**	**2011**	**1980**	**1990**	**2000**	**2005**	**2010**	**2011**
Sub-Saharan Africa	<10	56	52	62	74	71	—	—	<10	39	72	71
Northern Africa	29	87	95	96	97	97	—	—	68	95	97	96
Western Asia	28	86	84	84	88	87	—	<10	68	82	88	86
Caucasus & Central Asia	—	—	93	93	94	95	—	—	24	89	92	92
Eastern Asia	<10	96	85	87	99	99	—	—	60	85	99	99
South-Eastern Asia	15	75	79	82	79	80	—	<10	41	68	78	75
Southern Asia	<10	68	65	72	77	76	—	—	<10	23	52	59
Oceania	36	74	65	66	63	67	—	18	64	67	63	68
Caribbean	32	68	73	78	79	78	—	—	41	58	56	54
Latin America	37	68	92	94	94	93	—	—	67	90	93	93
Developed	70	83	93	96	94	94	—	<10	50	70	73	73
Global	20	75	74	79	84	83	—	<10	30	54	74	75
	Hib_3						Pol_3					
MDG Region*	**1980**	**1990**	**2000**	**2005**	**2010**	**2011**	**1980**	**1990**	**2000**	**2005**	**2010**	**2011**
Sub-Saharan Africa	—	—	<10	17	59	61	<10	56	53	65	78	76
Northern Africa	—	—	—	4	41	43	34	87	95	96	97	96
Western Asia	—	—	<10	38	71	69	37	86	86	85	88	88
Caucasus & Central Asia	—	—	—	—	81	89	—	—	94	94	94	96
Eastern Asia	—	—	—	<10	<10	<10	<10	97	87	87	99	99
South-Eastern Asia	—	—	—	<10	17	25	12	75	81	85	82	82
Southern Asia	—	—	—	—	21	22	<10	65	67	64	75	74
Oceania	—	—	10	10	61	65	32	74	56	58	67	65
Caribbean	—	—	23	58	55	51	45	74	73	80	79	79
Latin America	—	—	72	94	93	93	61	70	93	94	94	93
Developed	—	—	61	67	71	72	69	85	94	95	94	94
Global	—	—	13	21	41	43	22	75	75	77	84	84

(Table 1) contd…..

	MCV_1					
MDG Region*	**1980**	**1990**	**2000**	**2005**	**2010**	**2011**
Sub-Saharan Africa	<10	56	53	61	75	74
Northern Africa	22	84	93	95	96	96
Western Asia	17	79	86	84	86	86
Caucasus & Central Asia	—	—	93	94	94	95
Eastern Asia	<10	98	84	87	99	99
South-Eastern Asia	<10	70	80	84	90	89
Southern Asia	<10	57	58	69	77	77
Oceania	<10	70	67	66	60	64
Caribbean	20	64	76	77	76	76
Latin America	43	77	94	94	94	94
Developed	63	84	92	94	92	92
Global	16	73	72	77	85	84

BCG, Bacille Calmette-Guérin vaccine; DTP_3, third dose of diphtheria–tetanus–pertussis containing vaccine; Pol_3, third dose of polio vaccine; $HepB_3$, third dose of hepatitis B vaccine; MCV_1, first dose of measles containing vaccine.
Source: WHO and UNICEF estimates of national routine immunization coverage, 2011 data revision (July 2012).
* Millennium Development Goal region, available at http://www.un.org/millenniumgoals/index.shtml.



Note: Circle size proportional to the number of children unimmunized with three doses of DTP during 2000 and during 2011.
Source: WHO and UNICEF estimates of national routine immunization coverage, 2011 data revision (July 2012); United Nations, Department of Economic and Social Affairs, Population Division (2011). *World Population Prospects: The 2010 Revision, CD-ROM Edition.*

Fig. (1). Coverage levels with three doses of DTP containing vaccine and estimated number of children unimmunized with three doses of DTP during 2000 and 2011 by Millennium Development Goal region.

DTP containing vaccine has improved greatly since the 1980s, improvements at the global level since 2000 have been more modest suggesting the need for a renewed commitment and investment in routine immunization programmes worldwide. UNICEF and WHO, along with other partners in the GAVI Alliance (www.gavialliance.org), continue to work with governments to ensure appropriate coordinated and coherent action is taken to improve routine immunization programmes in order to have maximal impact on children's lives.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflicts of interest.

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Declared none.

DISCLAIMER

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

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