

## Immunization Coverage in WHO Regions: A Review Article

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### Abstract

In 1974, the World Health Organization (WHO) established the Expanded Program on Immunization (EPI) to ensure that all children have access to routinely recommended vaccines. Since then, global coverage with the four core vaccines (Bacille Calmette Guérin vaccine [for protection against tuberculosis], Diphtheria-tetanus-pertussis vaccine [DTP], Polio vaccine, and Measles vaccine) has increased from <5% to  $\geq 84\%$ . Coverage with the third dose of DTP vaccine (DTP3) by age 12 months is a key indicator of immunization program performance.

Estimated global DTP3 coverage has remained at 83%- 84% since 2009, with estimated 2013 coverage at 84%. Global coverage estimates for the second routine dose of Measles-containing Vaccine (MCV2) are reported for the first time in 2013; global coverage was 35% by the end of the second year of life and 53% when including older age groups. Results showed that more than 111 million infants received vaccines in 2013 to protect them from deadly diseases. These infants account for about 84 percent of the world's children, but an estimated 21.8 million infants remained unvaccinated, according to new estimates from WHO. Three of WHO's regions reported very high immunization coverage: the Western Pacific with 96 percent; the European Region with 96 percent; and the Region of the Americas with 90 percent. Coverage was slightly lower in the: Eastern Mediterranean Region at 82 percent; in the South-East Asia Region at 77 percent; and in the African Region at 75 percent. Improvements in equity of access and use of immunization services will help ensure that all children are protected from vaccine-preventable diseases.

**Key Words:** Immunization coverage, Vaccine, WHO regions, Worldwide.

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## Introduction



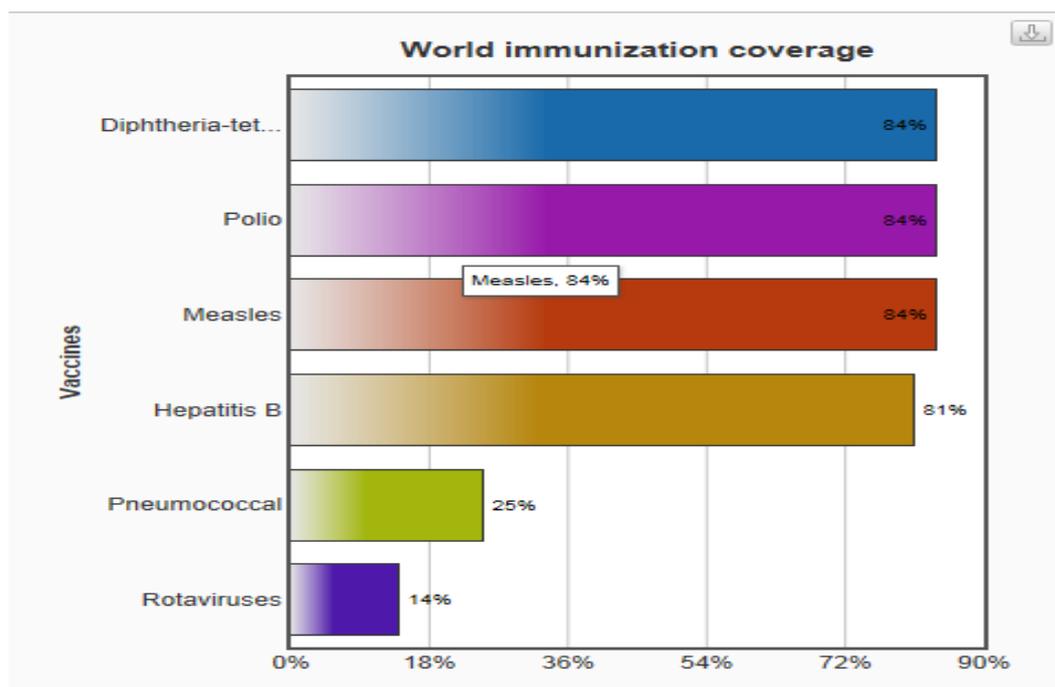
In 1974, the World Health Organization (WHO) established the Expanded Program on Immunization (EPI) to ensure that all children have access to routinely recommended vaccines (1, 2). Since then, global coverage with the four core vaccines: Bacille calmette-guérin (BCG) vaccine [for protection against tuberculosis], Diphtheria-tetanus-pertussis vaccine (DTP), Polio vaccine, and Measles vaccine) has increased from <5% to  $\geq 84\%$ , and additional vaccines have been added to the recommended schedule. Coverage with the third dose of DTP vaccine (DTP3) by age 12 months is a key indicator of immunization program performance. Estimated global DTP3 coverage has remained at 83%–84% since 2009, with estimated 2013 coverage at 84%. Global coverage estimates for the second routine dose of Measles-containing Vaccine (MCV2) are reported for the first time in 2013; global coverage was 35% by the end of the second year of life and 53% when including older age groups. Improvements in equity of access and use of immunization services will help ensure that all children are protected from vaccine-preventable diseases.

DTP3 coverage by age 12 months is a major indicator of immunization program performance; coverage with other vaccines, including the third dose of polio

vaccine and the first dose of measles-containing vaccine is also assessed. Vaccination coverage is calculated as the percentage of persons in a target age group who received a vaccine dose. Administrative coverage is the number of vaccine doses administered to those in a specified target age group divided by the estimated target population. Countries report administrative coverage annually to WHO and the United Nations Children's Fund (UNICEF) (3). Vaccination coverage surveys estimate vaccination coverage by visiting a representative sample of households with children in a specified target age group (e.g., 12–23 months). Dates of vaccination are transcribed from the child's home-based record or are recorded based on caregiver recall. WHO and UNICEF derive national coverage estimates through an annual country-by-country review of all available data, including administrative and survey-based coverage. As new data are incorporated, revisions of past coverage estimates (4, 5) and updates are published on their websites (6–8).

### *Key facts*

- ❖ Immunization prevents illness, disability and death from vaccine-preventable diseases including cervical cancer, diphtheria, hepatitis B, measles, mumps, pertussis, pneumonia, polio, rotavirus diarrhoea, rubella and tetanus.
- ❖ Global vaccination coverage is holding steady.
- ❖ Immunization currently averts an estimated 2 to 3 million deaths every year.
- ❖ But an estimated 21.8 million infants worldwide are still missing out on basic vaccines (9) (Figure.1).



**Fig.1:** Global immunization coverage in 2013

## Materials and Methods

The current study is a review survey which was conducted to evaluate of children's immunization by studying WHO website, UNICEF website and scientific texts about this subject. To evaluate the texts, the singular or combination forms of the following keywords were used: "Vaccine", "Immunization", "Children", "Worldwide" and "WHO regions".

To evaluate the electronic databases the following websites were searched: Google, Ministry of healthcare, Google Scholar, Scopus and PubMed. Also, library search was performed by referring to the journal archives of libraries, and evaluating the available Persian and English references, and also articles of research-scientific journals, and articles of the annual seminar of medicine and Public health.

## Results

**Haemophilus influenzae type b (Hib)** causes meningitis and pneumonia. Hib vaccine had been introduced in 189 countries by the end of 2013. Global coverage with 3 doses of Hib vaccine is estimated at 52%. There is great variation between regions. In the Americas, coverage is estimated at 90%, while it is only 18% and 27% in the Western Pacific and South-East Asia regions respectively.

**Hepatitis B** is a viral infection that attacks the liver. Hepatitis B vaccine for infants had been introduced nationwide in 183 countries by the end of 2013. Global coverage with 3 doses of hepatitis B vaccine is estimated at 81% and is as high as 92% in the Western Pacific.

**Human papillomavirus**, the most common viral infection of the reproductive tract, can cause cervical cancer, and other types of cancer and genital warts in both men and women. Human papillomavirus vaccine was

introduced in 55 countries by the end of 2013.

**Measles** is a highly contagious disease caused by a virus, which usually results in a high fever and rash, and can lead to blindness, encephalitis or death. By the end of 2013, 84% of children had received 1 dose of measles vaccine by their second birthday, and 148 countries had included a second dose as part of routine immunization.

**Meningitis A** is an infection that can cause severe brain damage and is often deadly. By the end of 2013, 3 years after its introduction, more than 150 million people in African countries affected by the disease had been vaccinated with MenAfriVac, a vaccine developed by WHO and global health organization (PATH).

**Mumps** is a highly contagious virus that causes painful swelling at the side of the face under the ears (the parotid glands), fever, headache and muscle aches. It can lead to viral meningitis. Mumps vaccine had been introduced nationwide in 120 countries by the end of 2013.

**Pneumococcal** diseases include pneumonia, meningitis and febrile bacteraemia, as well as otitis media, sinusitis and bronchitis. Pneumococcal vaccine had been introduced in 103 countries by the end of 2013, and global coverage was estimated at 25%.

**Polio** is a highly infectious viral disease that can cause irreversible paralysis. In 2013, 84% of infants around the world received 3 doses of polio vaccine. Targeted for global eradication, polio has been stopped in all countries save 3, Afghanistan, Nigeria and Pakistan. Polio-free countries have been infected by imported virus, and all countries, especially those experiencing conflict and instability, remain at risk until polio is fully eradicated.

**Rotaviruses** are the most common cause of severe diarrhoeal disease in young children throughout the world. Rotavirus vaccine was introduced in 52 countries by the end of 2013, and global coverage was estimated at 14%.

**Rubella** is a viral disease which is usually mild in children, but infection during early pregnancy may cause fetal death or congenital rubella syndrome, which can lead to defects of the brain, heart, eyes and ears. Rubella vaccine was introduced nationwide in 137 countries by the end of 2013.

**Tetanus** is caused by a bacterium which grows in the absence of oxygen, e.g. in dirty wounds or in the umbilical cord if it is not kept clean. It produces a toxin which can cause serious complications or death. The vaccine to prevent maternal and neonatal tetanus had been introduced in 103 countries by the end of 2013. An estimated 82% of newborns were protected through immunization. Maternal and neonatal tetanus persist as public health problems in 25 countries, mainly in Africa and Asia.

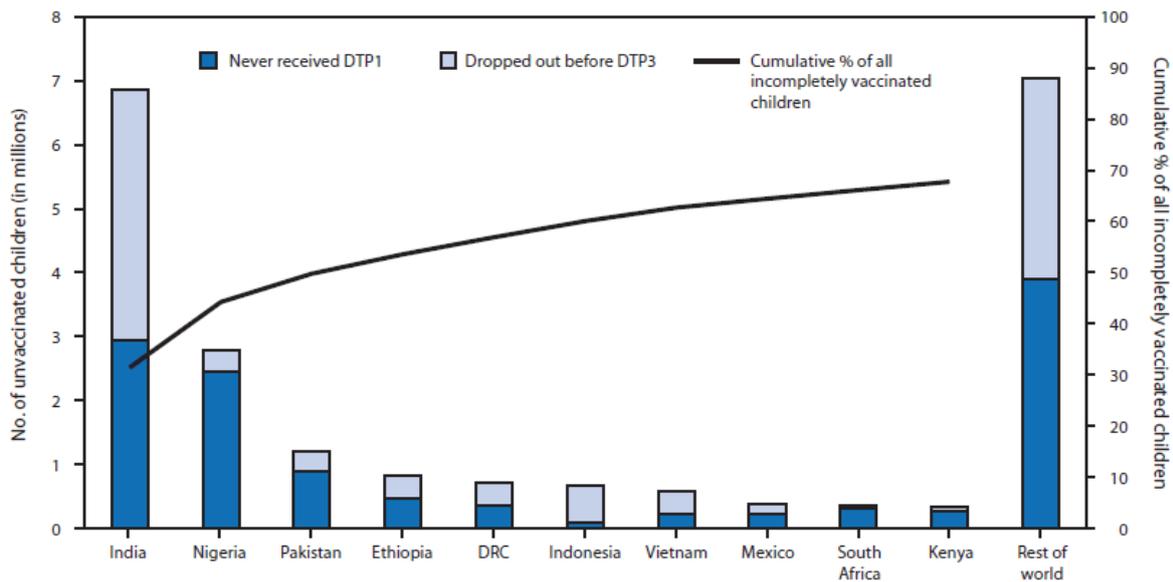
**Yellow fever** is an acute viral haemorrhagic disease transmitted by infected mosquitoes. As of 2013, yellow fever vaccine had been introduced in routine infant immunization programmes in 35 of the 44 countries and territories at risk for yellow fever in Africa and the Americas and coverage was estimated at 41% (3-11).

### **Summary: Global immunization coverage in 2013**

Estimated global DTP3 coverage among children aged <12 months in 2013 was 84%, ranging from 75% in the WHO African Region to 96% in the Western Pacific and European regions, and representing 111.8 million vaccinated children (Table.1).

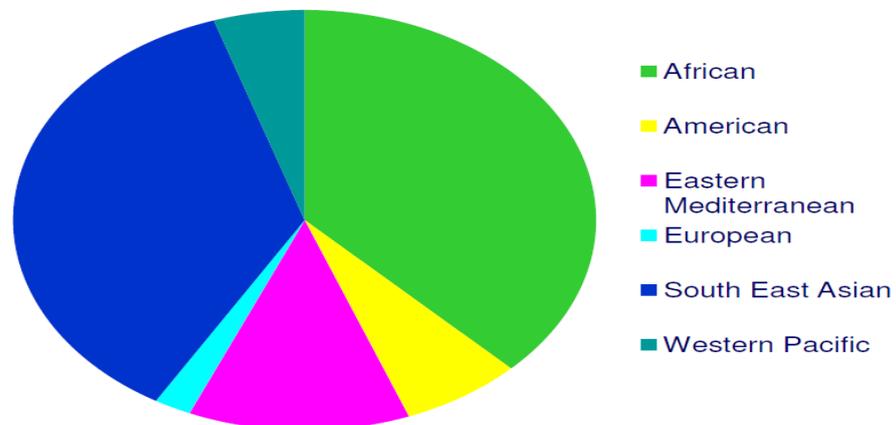
Approximately 21.8 million eligible children did not complete the 3-dose series; among them, 12.2 million (56%) did not receive the first DTP dose, and 9.6 million (44%) started, but did not complete, the 3-dose series. Estimated global coverage with Bacille calmette-guérin vaccine, the third dose of polio vaccine, and the first dose of measles-containing vaccine were 90%, 84%, and 84%, respectively. During 2013, a total of 129 of 194 WHO member states achieved

≥90% national DTP3 coverage, and 56 achieved ≥80% DTP3 coverage in every district. DTP3 coverage was 80%–89% in 31 countries, 70%–79% in 16 countries, and <70% in 18 countries. Among the 21.8 million children who did not receive 3 DTP doses during the first year of life, 10.9 million (50%) lived in three countries (India [31%], Nigeria [13%] and Pakistan [6%]); 14.8 million (68%) lived in 10 countries (Figure.1,2) (3,9).



**Abbreviations:** DTP1 = 1 dose of diphtheria-tetanus-pertussis vaccine; DRC = Democratic Republic of the Congo.

**Fig.1:** Estimated number of children who did not receive 3 doses of diphtheria-tetanus-pertussis vaccine (DTP3) during the first year of life among 10 countries with the largest number of incompletely vaccinated children and cumulative percentage of all incompletely vaccinated children worldwide accounted for by these 10 countries, 2013



Source: WHO/UNICEF coverage estimates 2013 revision, July 2014 / United Nations, Population Division. The World Population Prospects - the 2012 revision". New York, 2013. Immunization Vaccines and Biologicals, (IVB), World Health Organization. 194 WHO Member States. Date of slide: 28 July 2014.

**Fig.2:** 21.8 million infants not immunized (DTP3), 2013

WHO region	Vaccination coverage (%)									
	BCG	DTP3	Polio3	MCV1	MCV2	HepB BD	HepB3	Hib3	Rota last	PCV3
<b>Total (worldwide)</b>	<b>90</b>	<b>84</b>	<b>84</b>	<b>84</b>	<b>53</b>	<b>38</b>	<b>81</b>	<b>52</b>	<b>14</b>	<b>25</b>
African	83	75	77	74	7	11	76	72	12	35
Americas	94	90	90	92	46	71	89	90	70	77
Eastern Mediterranean	88	82	82	78	65	24	83	60	22	36
European	95	96	96	95	82	41	81	83	3	43
South-East Asia	90	77	76	78	53	26	74	27	0	0
Western Pacific	97	96	97	97	92	79	92	18	4	1

**Abbreviations:** BCG = Bacille Calmette-Guérin; DTP3 = 3 doses of diphtheria-tetanus-pertussis vaccine; Polio3 = 3 doses of poliovirus vaccine; MCV1 = first dose of measles-containing vaccine; MCV2 = second dose of measles-containing vaccine; HepB BD = birth dose of hepatitis B vaccine; HepB3 = 3 doses of hepatitis B vaccine; Hib3 = 3 doses of *Haemophilus influenzae* type b vaccine; Rota last = last dose of rotavirus series; PCV3 = 3 doses of pneumococcal conjugate vaccine.

\* Weighted regional average.

Additional vaccines are increasingly being introduced into national immunization programs. By the end of 2013, hepatitis B vaccine was included in the Routine Immunization (RI) schedule in 183 (94%) countries; in 93 (58%) countries, a birth dose administered within 24 hours of birth was included to prevent perinatal hepatitis B virus transmission. Worldwide (including countries that have not introduced the vaccine), coverage with 3 doses of hepatitis B vaccine was 81%, and by region ranged from 74% in the South-East Asia Region to 92% in the Western Pacific Region (Table.1). A hepatitis B vaccine birth dose was given to 38% of newborns globally, ranging from 11% in the African Region to 79% in the Western Pacific Region. Rubella vaccine as part of the RI schedule has been introduced in 137 (71%) countries, with an estimated coverage of 44% globally. Coverage with 3 doses of *Haemophilus influenzae* type b vaccine, which had been introduced into 189 (97%) countries\* by 2013, was 52% globally, ranging from 18% in the Western

Pacific Region to 90% in the Americas Region. By 2013, rotavirus vaccine was introduced in 52 (27%) countries, and Pneumococcal Conjugate Vaccine (PCV) was introduced in 103 (53%) countries. Coverage with the completed rotavirus vaccination series (2 or 3 doses, depending on vaccine used) was 14% globally and reached 70% in the Americas Region. Coverage with 3 doses of PCV was 25% globally and was highest (77%) in the Americas Region. MCV2 was included in the RI schedule in 148 (76%) countries; global coverage in 2013 was 53%. MCV2 and booster doses for DTP and polio vaccine are administered during the second year of life or later. A total of 159 (82%) countries now have at least one vaccination in the RI schedule during the second year of life. The most common vaccines administered during these visits are MCV2 (57 countries), diphtheria-tetanus (DT)-containing boosters (105 countries), and polio vaccine boosters (78 countries)(Table.2)(3,9).

**TABLE 2. Number and percentage of member states with vaccination recommended in immunization schedule during the second year of life, by vaccine and World Health Organization (WHO) region – worldwide, 2013**

WHO region	No. of member states (%)						
	Total no. of member states	MCV2	DT-containing vaccine	Polio	PCV	Other vaccines	≥1 health care visit during second year
Total (worldwide)	194	57 (29)	105 (54)	78 (40)	14 (7)	40 (21)	159 (82)
African	47	11 (23)	10 (21)	10 (21)	0	0	24 (51)
Americas	35	4 (11)	31 (89)	28 (80)	3 (9)	11 (31)	34 (97)
Eastern Mediterranean	21	15 (71)	16 (76)	15 (71)	3 (14)	5 (24)	20 (95)
European	53	8 (15)	36 (68)	20 (38)	4 (8)	18 (34)	49 (92)
South-East Asia	11	6 (55)	4 (36)	2 (18)	0	1 (9)	9 (82)
Western Pacific	27	13 (48)	8 (30)	3 (11)	4 (15)	5 (19)	23 (85)

**Abbreviations:** MCV1 = first dose of measles-containing vaccine; MCV2 = second dose of measles-containing vaccine; DT = diphtheria-tetanus; PCV = pneumococcal conjugate vaccine.

## Conclusion

Immunization coverage is a key measure of immunization system performance. Tracking, evaluating and sharing information provides a vital tool for understanding immunization coverage. Statistics on levels and trends are used to monitor the performance of services at local, national and international levels.

They guide campaigns to eradicate polio, control measles and eliminate neonatal tetanus. They identify areas of weak system performance and reveal areas where focused attention and extra resources may be required. And, when deciding whether to introduce a vaccine, immunization levels and trends are one important consideration.

Despite improvements in global vaccine coverage during the past decade, there continue to be regional and local disparities resulting from:

- limited resources; competing health priorities;

- poor management of health systems; and
- inadequate monitoring and supervision.

In 2013, an estimated 21.8 million infants worldwide were not reached with routine immunization services, of whom nearly half live in 3 countries: India, Nigeria and Pakistan. Priority needs to be given to strengthening routine vaccination globally, especially in the countries that are home to the highest number of unvaccinated children. Particular efforts are needed to reach the underserved, especially those in remote areas, in deprived urban settings, in fragile states and strife-torn regions. Three of WHO's Regions reported very high immunization coverage: the Western Pacific with 96 percent; the European Region with 96 percent; and the Region of the Americas with 90 percent. Coverage was slightly lower in the: Eastern Mediterranean Region at 82 percent; in the South-East Asia Region at 77 percent; and in the African Region at 75 percent. The Global Vaccine Action Plan (GVAP) is a roadmap to prevent millions of deaths

through more equitable access to vaccines. Countries are aiming to achieve vaccination coverage of  $\geq 90\%$  nationally and  $\geq 80\%$  in every district by 2020.

**Conflict of interests:** None.

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