Pneumonia and Diarrhea Progress Report 2013

EXECUTIVE SUMMARY

According to the latest estimates of child mortality issued by the United Nations Children's Fund (UNICEF), pneumonia and diarrhea continue to be the leading killers of children under the age of five worldwide. Pneumonia and diarrhea, respectively, are responsible for 17% and 9% of global child deaths, together claiming the lives of more than 1.7 million under-five children in 2012 alone.[1] These diseases predominantly affect developing countries and are highly concentrated in just a few countries. Despite having roughly half of the world's under-five population, these 15 countries account for 75% of global pneumonia and diarrhea deaths.[1,2]

In 2013, the Global Action Plan for the Prevention and Control of Pneumonia and Diarrhea (GAPPD) was developed and issued by the World Health Organization (WHO) and UNICEF, outlining key interventions that should be universally adopted, with the goal of ending preventable pneumonia and diarrhea mortality in children by 2025. GAPPD set forth coverage targets of 90% for vaccinations, 90% for access to pneumonia and diarrhea treatments, and 50% for exclusive breastfeeding of children during their first six months of life.[3] **This Pneumonia and Diarrhea Progress Report evaluates the 15 countries with the highest numbers of child deaths from pneumonia and diarrhea, based on UNICEF's latest 2013 estimates, and reports on their progress in implementing GAPPD interventions with respect to coverage targets.**

This report reveals gradual increases in the utilization and coverage of evidence-based interventions

Great strides have been made in the global reduction of pneumonia and diarrhea mortality, but implementation of vaccines, such as pneumococcal and rotavirus vaccines, as well as improved access to treatment are critical to eliminating preventable child deaths.

by many of the high-burden countries, while challenges persist for others. Seven countries achieved some, but not all GAPPD coverage targets and eight others failed to reach any of the targets. India and Nigeria, the countries with the two largest pneumonia and diarrhea disease burdens, continue to have low coverage levels for prevention and treatment interventions, causing them to also have the lowest GAPPD scores, which are calculated averages of countries' coverage rates for key GAPPD interventions. Although Tanzania is among the 15 countries with highest mortality, it is the country that achieved the most (four) GAPPD coverage targets and received one of the highest GAPPD intervention scores.

1. UNICEF. (2013). *Committing to Child Survival: A Promise Renewed. Progress Report 2013.* Retrieved from http://www.unicef.org/publications/files/APR_Progress_Report_2013_9_Sept_2013.pdf
2. UNICEF. (2013). *State of the World's Children 2013 Report.* Retrieved from http://www.unicef.org/sowc2013/
3. WHO/UNICEF. (2013). *Ending Preventable Child Deaths from Pneumonia and Diarrhea by 2025. The Integrated Global Action Plan for Pneumonia and Diarrhea (GAPPD).* Geneva. Retrieved from http://www.unicef.org/media/files/Final_GAPPD_main_Report-_EN-8_April_2013.pdf

Findings from this report lend further support to GAPPD recommendations and reinforce the need for countries to address child pneumonia and diarrhea using an integrated strategy that builds on synergies and maximizes efficiencies. Early successes can already be seen in countries, such as Uganda and Tanzania, which have achieved relatively higher coverage of interventions that impact both pneumonia and diarrhea, as they are countries that rank lower on the mortality scale and have higher GAPPD scores compared to the other high-burden countries. By adopting a comprehensive and combined approach to pneumonia and diarrhea, countries can amplify the impact of individual interventions and achieve accelerated progress in the years to come.

Currently, lack of available data for some interventions prevents a truly complete assessment of countries' performance. Creating robust monitoring and evaluation systems should be a priority for countries, as these will provide stakeholders the necessary information for key decision making. Furthermore, development of targeted strategies to address country-specific gaps and barriers in access to appropriate care and treatment for pneumonia and diarrhea, as well as prioritization of resources for prevention and treatment efforts are needed to promote increased use of evidence-based pneumonia and diarrhea interventions that will significantly improve the chances of children reaching their fifth birthday.

INTRODUCTION

Over the past few decades, global, regional, national, and local efforts to improve child health have been immensely successful in slashing child mortality worldwide; rates of child mortality have consistently decreased each year since the 1990s. However, deaths of children under the age of five still surpassed six million in 2012, the majority of which were from preventable causes.[1] Among the leading causes of child mortality were pneumonia and diarrhea, which collectively killed more than 1.7 million children under the age of five.[1] Nearly 75% of deaths due to pneumonia and diarrhea occur in just 15 countries, even though only half of the world's under-five population resides in these countries.[1]

This 2013 edition of the International Vaccine Access Center's (IVAC) Pneumonia and Diarrhea Progress Report is the fourth annual progress report and is an extension of previous Pneumonia Progress Reports, now including a diarrhea evaluation component. This report provides the latest assessment of countries' use of evidence-based pneumonia and diarrhea interventions outlined by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) in the Global Action Plan for the Prevention and Control of Pneumonia and Diarrhea (GAPPD). GAPPD emphasizes the need for an integrated approach to ending preventable deaths due to pneumonia and diarrhea and promotes the use of interventions that are known to be effective. These include interventions that **protect** child health, **prevent** children from falling ill to pneumonia and diarrhea, and **treat** affected children appropriately.[3]

The primary GAPPD coverage targets for these interventions are:

- 90% coverage for each of the following vaccines: pertussis, measles, *Haemophilus influenzae* type B (Hib), pneumococcal, and rotavirus vaccines
- 90% treatment access for children with pneumonia, including care by an appropriate health care provider and antibiotics
- 90% coverage of treatment with oral rehydration salts (ORS) for children with diarrhea
- 50% rate of exclusive breastfeeding within the first six months of a child's life

Using the most recently available data on key interventions laid out in GAPPD, this report provides updates on the progress in the 15 highest burden countries with regard to child pneumonia and diarrhea interventions.

GAPPD INTERVENTION SCORING

GAPPD intervention scores were developed as an indicator of countries' overall performance in adopting and implementing high-impact interventions and meeting the coverage targets set forth by GAPPD. Scores are calculated from an average of *available* data on coverage rates for each of the nine main interventions for which GAPPD set measurable targets. The **nine** intervention measures are coverage rates for pertussis (DTP3), measles, Hib, pneumococcal, and rotavirus vaccines (reported separately); access to an appropriate health care provider and antibiotic treatment for children with pneumonia; treatment with oral rehydration salts (ORS) for children with diarrhea; and exclusive breastfeeding in the first six months of a child's life.[3] The overall GAPPD scores take into account interventions that impact both pneumonia and diarrhea, as well as those that only affect pneumonia or diarrhea.

These scores are further broken down into GAPPD-Pneumonia and GAPPD-Diarrhea scores. These illness-specific GAPPD scores are calculated from only those interventions that impact pneumonia or diarrhea.

Since the 2012 Pneumonia Progress Report, IVAC has modified its method of calculating intervention scores. We are now including, rather than excluding, 0% vaccine coverage rates in the average calculation for countries that have either not introduced a particular vaccine into their national immunization program, or have introduced the vaccine and still have a reported coverage rate of 0%. This could be the case if vaccine introduction happens late in the year or if there is a slow roll-out of vaccination programs.

Note that GAPPD scores calculated for countries with more available data offer more accurate assessments of their performance against GAPPD targets, since missing data values are excluded from the average and could potentially skew the scores.

INTERPRETING GAPPD INTERVENTION SCORES

Because of methodological limitations, GAPPD intervention scores should be interpreted with several key considerations in mind. First, annual data are unavailable for some interventions and some countries. Second, estimates of vaccine coverage are updated annually, whereas breastfeeding and treatment coverage rates are provided for the latest year for which data are available within a multi-year period. In calculating the 2013 GAPPD scores, we used the most recent year of available data between 2007 and 2011 for the exclusive breastfeeding component, the most recent year of data between 2007 and 2012 for treatment coverage rates, and 2012 estimates for vaccine coverage. These scores should be treated as estimates to assess overall trends in countries' performance, which could help inform programming and policy making in high-burden countries.
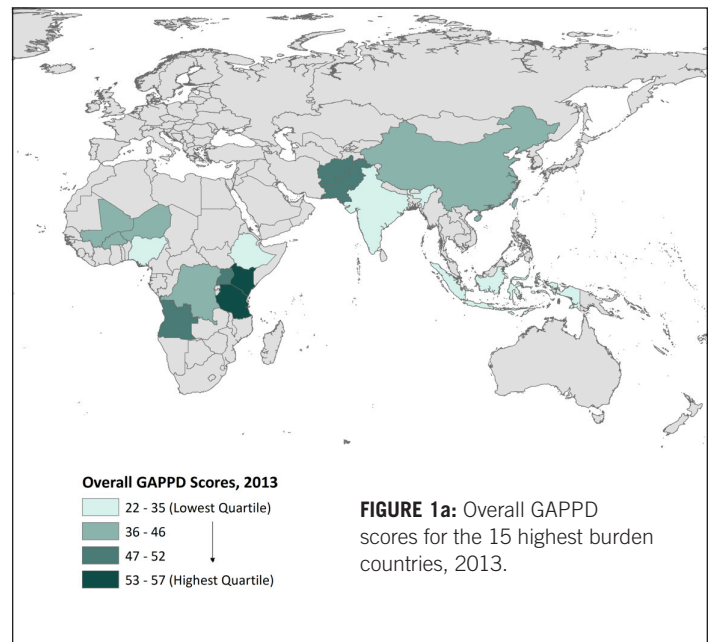
While there may be a multitude of reasons for countries scoring high or low, the GAPPD scores could reflect countries' efforts and inputs, or lack thereof, to make these interventions possible, such as political commitment, adequate health infrastructure, and trained health workers. However, this report does not attempt to make comprehensive claims about countries' performance, but uses GAPPD scores as a proxy to estimate relative progress. These scores primarily focus on GAPPD interventions with measurable coverage targets for which data are publicly available.
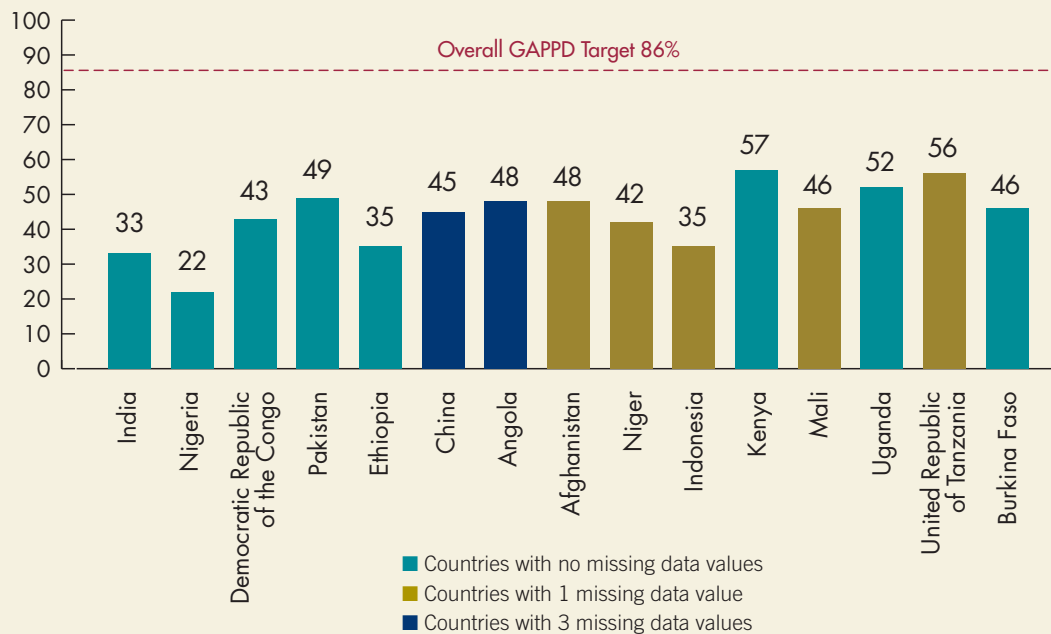
KEY FINDINGS: GAPPD PACKAGE COVERAGE

Overall GAPPD intervention scores for the 15 countries with the highest pneumonia and diarrhea mortality ranged from 22-57%, with Nigeria having the lowest score and Kenya having the highest. (See Fig. 1a and 1b.) When examining scores based on pneumonia and diarrhea interventions separately (Fig. 1c), the range for GAPPD-Pneumonia scores (25-68%) was relatively higher than that of the GAPPD-Diarrhea scores (20-48%). To put these numbers into perspective, countries would have had a GAPPD-Pneumonia score of at least 84% and a GAPPD-Diarrhea score of 80% if they met all the minimum coverage targets for the respective pneumonia and diarrhea interventions. None of the 15 countries profiled in this report reached such GAPPD-Pneumonia or GAPPD-Diarrhea scores. In fact, for eight of the 15 countries, none of the GAPPD coverage targets were met. For these high-burden, low-performing countries, much work remains in the areas of breastfeeding, child immunization, and health care delivery. The United Republic of Tanzania reached the greatest number of coverage targets (4), and their high-performing interventions included exclusive breastfeeding and coverage of pertussis, measles, and Hib vaccines.

Compared to the 2012 Pneumonia Progress report, which focused only on countries with the highest child pneumonia mortality, the 15 countries featured in this report are largely the same, even after taking into account diarrhea mortality. The main differences are Sudan and South Sudan (listed as one) (no longer among the 15 countries) and the United Republic of Tanzania (ranking in the top 15 highest burden countries in 2013). In addition to reporting on countries' 2013 intervention scores, the current report also provides recalculated 2012 GAPP scores based on the revised method to allow comparisons between the 2012 GAPP scores and the 2013 GAPPD-Pneumonia scores. Such comparisons do not truly illustrate countries' progress over time, as scores are calculated from the most recently available data, not necessarily from consecutive years.

Countries with a higher 2013 GAPPD-Pneumonia score than their 2012 GAPP score included Ethiopia, Angola, Afghanistan, Mali, Uganda, Tanzania, and Burkina Faso. Burkina Faso showed the greatest improvement in their pneumonia-specific intervention scores between 2012 and 2013 (+11%). Slightly lower 2013 GAPPD-Pneumonia scores were seen in a few countries, including Nigeria, Democratic Republic of the Congo (DRC), Niger, Indonesia, and Kenya. In the case of India, Pakistan, and China, there were no changes in their pneumonia intervention scores between 2012 and 2013. India and Nigeria, the top two countries with the highest burden of child mortality from pneumonia and diarrhea, continue to have low overall GAPPD intervention scores (33% and 22%, respectively). In general, GAPPD-Pneumonia scores were higher than GAPPD-Diarrhea scores for all 15 countries (Fig. 1c). This is attributed in part to the relatively recent availability of rotavirus vaccine in developing countries compared to the vaccines that prevent pneumonia. In addition, GAPPD-Diarrhea scores are calculated based on fewer intervention coverage rates (three) than the GAPPD-Pneumonia scores (six), and thus are more heavily impacted by missing data.

Overall GAPPD Scores, 2013
- 22 - 35 (Lowest Quartile)
- 36 - 46
- 47 - 52
- 53 - 57 (Highest Quartile)

FIGURE 1a: Overall GAPPD scores for the 15 highest burden countries, 2013.

Overall GAPPD Intervention Scores, 2013

FIGURE 1b: 2013 GAPPD intervention scores for countries shown from left to right in order of highest child pneumonia and diarrhea mortality. Note: Not all countries have data for all nine interventions. See Table 1 for more details.

INDIA'S CONTINUED COMMITMENT TO PROTECTING CHILDREN FROM PNEUMONIA AND DIARRHEA THROUGH VACCINATIONS

After coming together with the governments of Ethiopia and the United States, along with UNICEF in 2012 to launch a global effort called "Committing to Child Survival: A Promise Renewed", India reaffirmed its commitment to child survival at a national event, "India's Call to Action Summit for Child Survival and Development" in February 2013. In addition to the high burden of neonatal health problems, pneumonia and diarrhea were clearly identified as diseases that must be addressed in order to meet national and international goals for reducing child deaths and improving wellbeing and quality of life for India's children.

One key priority coming out of the child survival event was vaccination – including improvements in routine immunization and introduction of new vaccines. India made progress on several vaccine efforts this year. Namely, the Hib-containing pentavalent vaccine, which protects children from one of the leading causes of pneumonia, has now been introduced in 8 states and Delhi.[4] Based on successes in early adopter states, the government of India recently announced plans to roll out pentavalent vaccine nationally.[4] Dr. Jacob John, infectious disease expert and former professor at Christian Median College in Vellore shares his enthusiasm about the positive news. "Pneumonia is one of the leading causes of deaths in children below the age of five years. Availability of the pentavalent vaccine through the universal immunization programme will help not only prevent morbidity associated with pneumonia and meningitis, but also avert thousands of deaths annually."

At the same time, a recently developed Indian vaccine is showing promise for protecting children from the leading cause of severe diarrhea – rotavirus. This indigenous Indian vaccine, developed through a unique partnership between the government of India and Bharat Biotech, as well as several international partners, successfully completed phase III trials this spring. It demonstrated 56% efficacy in the first year of life against severe rotavirus diarrheal disease, as well as a good safety profile. The vaccine is now being reviewed for licensure and, pending licensure, will be considered by the National Technical Advisory Group on Immunization (NTAGI) for addition to India's Universal Immunization Programme (UIP). If introduced into the UIP, the rotavirus vaccine will be a cost-effective intervention to reduce the toll that severe diarrhea takes on India's children and families.

This progress in vaccination must be combined with efforts to increase access to treatment and improve coverage rates of other protective interventions, such as breastfeeding and sanitation, in order to protect all Indian children.

4. GAVI Alliance. (2013, October 10). *India to scale-up pentavalent nationally.* Retrieved from http://www.gavialliance.org/library/news/press-releases/2013/india-to-scale-up-pentavalent-nationally/

GAPPD–Pneumonia and Diarrhea Intervention Scores, 2013
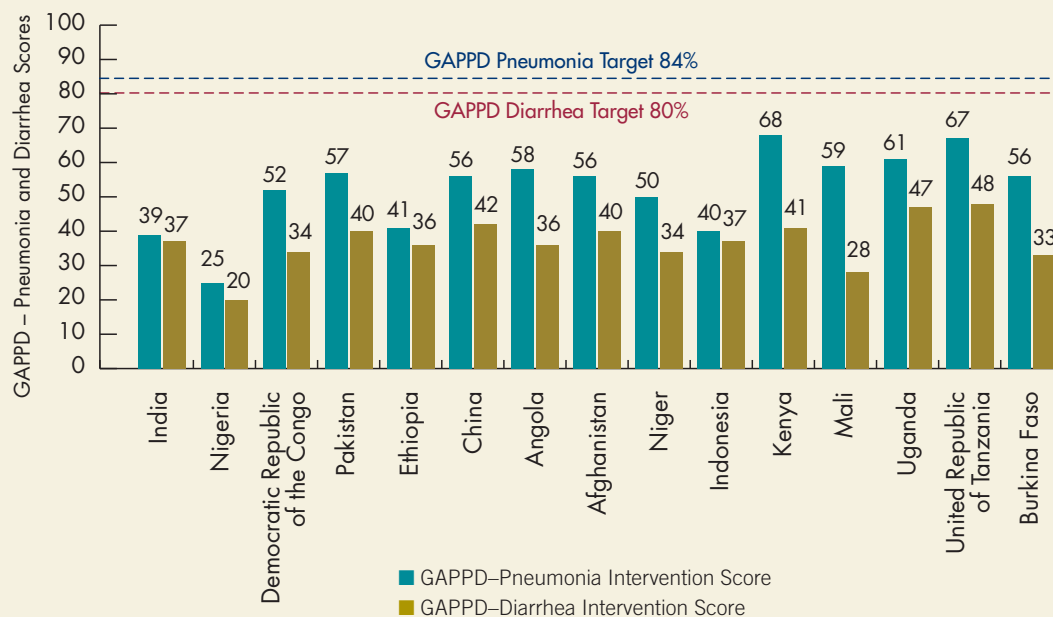
FIGURE 1c: 2013 GAPPD-Pneumonia and GAPPD-Diarrhea intervention scores for countries shown from left to right in order of highest child pneumonia and diarrhea mortality.

KEY FINDINGS: PREVENTION THROUGH VACCINATION

Immunization is a safe, effective, and cost-effective strategy for reducing preventable child deaths and is key to reaching the international community's Millennium Development Goal (MDG) 4 of decreasing the 1990 under-five mortality rate by two-thirds by 2015.[5] For pneumonia, the leading cause of global child mortality, there are several vaccines that protect against the disease, including pertussis, measles, Hib, and pneumococcal vaccines, all of which are recommended by the WHO for inclusion in routine childhood immunization programs.[6] Rotavirus vaccine, which is highly effective in protecting against the most common cause of vaccine-preventable severe diarrhea, is also one of the vaccines that the WHO has recommended for global use since 2009.[7]

Despite the widespread use of pertussis and measles vaccines in most of the world, only four of the 15 highest burden countries (China, Angola, Tanzania, and Burkina Faso) met the 90% GAPPD vaccination target for pertussis and four countries (China, Angola, Kenya, and Tanzania) met the target for measles vaccine. Coverage for these two vaccines in the 15 countries ranged widely from 41% to 99%. Between 2011 and 2012, coverage rates for pertussis and measles vaccines stagnated for some countries and even fell

for others. For example, India continues to have no change in the coverage of DTP3 and measles-containing vaccines (MCV) since 2010. Nigeria suffered a sharp decline in its measles vaccine coverage, from 71% in 2011[8] to 42% in 2012. The reasons for this decline are multifactorial, but include misconceptions about vaccine safety, regional supply shortages, and vaccine refusals.[9]

Low coverage of these low-cost vaccines could indicate limited capacity to deliver routine immunizations, for reasons such as weak health systems and internal displacement due to political unrest, which is quite prevalent in the West and Central African countries.[10] Recognizing the challenge that weak health systems pose to the delivery of life-saving vaccines to children, the GAVI Alliance has invested more than USD 500 million to assist and support countries' efforts to strengthen their health service delivery systems.[11]

Overall, progress was seen in most of the 15 countries, albeit modest, with three countries (Ethiopia, Angola, and Afghanistan) having at least 5% increases in their coverage of the three-dose diphtheria-tetanus-pertussis (DTP3) vaccine in 2012.[8] Ethiopia had the greatest increase of 10%.[8]

Two other important vaccines that prevent pneumonia are Hib and pneumococcal conjugate vaccines (PCVs), targeted at *Haemophilus*

5.   WHO. (2013). MDG 4: *Reduce child mortality.* Retrieved from http://www.who.int/topics/millennium_development_goals/child_mortality/en/
6.   WHO. (2013, August 1). *WHO recommendations for routine immunization - summary tables.* Retrieved from http://www.who.int/immunization/policy/immunization_tables/en/
7.   WHO. (2009, June 5). *Global use of rotavirus vaccines recommended.* Retrieved from http://who.int/mediacentre/news/releases/2009/rotavirus_vaccines_20090605/en/
8.   International Vaccine Access Center (IVAC) at Johns Hopkins Bloomberg School of Public Health. (2012). *Pneumonia Progress Report 2012.* Retrieved from http://www.jhsph.edu/research/centers-and-institutes/ivac/resources/IVAC-Pneumonia-Progress-Report-2012.pdf
9.   IRIN. (2013, March 13). *Vaccine suspicion aggravates measles outbreak in Nigeria.* Retrieved from http://www.irinnews.org/report/97636/vaccine-suspicion-aggravates-measles-outbreak-in-nigeria
10. UNICEF. (2013, July 16). *West and Central Africa.* Retrieved from Humanitarian Action for Children: http://www.unicef.org/appeals/wcaro.html
11. GAVI Alliance. (n.d.). *Health system strengthening support.* Retrieved from http://www.gavialliance.org/support/hss/

TABLE 1: Current levels of coverage for interventions that prevent (vaccination), protect (exclusive breastfeeding) and treat (access to care, antibiotic treatment, and ORS) pneumonia and diarrhea in the 15 countries with the most child pneumonia and diarrhea deaths

Global Mortality Rank in Pneumonia & Diarrhea Deaths in Children Under 5[1]	Country	Pneumonia & Diarrhea Deaths in Children Under 5 Years (in 1000s) 2013[1]	Vaccine Coverage (%)				
			Pertussis (DTP3) 2012[2]	Measles 2012[2]	Hib3 2012[2] (Year Introduced) & Vaccine Use Status	PCV 2012[2] (Year Introduced) & Vaccine Use Status	Rota 2012[2] (Year Introduced) & Vaccine Use Status
1	India	436	72	74	0[4]	0 No Decision	0 Non-GAVI introduction planned
2	Nigeria	231	41	42	10[5]	0 Approved by GAVI for assistance	0 Non-GAVI introduction planned
3	Democratic Republic of the Congo	121	72	73	72	26 (2011)	0 No Decision
4	Pakistan	111	81	83	81	0 (Oct 2012)	0 Plan to apply for GAVI support
5	Ethiopia	62	61	66	61	12 (2011)	0 (Nov 2013)
6	China	50	99	99	Private market coverage	0 No Decision	0 No Decision
7	Angola	48	91	97	91	0 (2013)	0 Approved by GAVI for assistance
8	Afghanistan	33	71	68	71	0 Approved by GAVI for assistance	0 Approved by GAVI for assistance
9	Niger	29	74	73	74	0 Approved by GAVI for assistance	0 Approved by GAVI for assistance
10	Indonesia	29	64	80	0[6] (2013)	0 No Decision	0 Non-GAVI introduction planned
11	Kenya	28	83	93	83 (2011)	82 (2011)	0 Approved by GAVI for assistance
12	Mali	26	74	59	74 (2011)	74 (2011)	0 Approved by GAVI for assistance
13	Uganda	25	78	82	78	0 (2013)	0 Conditional approval by GAVI for assistance
14	United Republic of Tanzania*	21	92	97	92	0 (Dec 2012)	0 (Dec 2012)
15	Burkina Faso	18	90	87	90	0 (Oct 2013)	0 (Oct 2013)

1. UNICEF. (2013). *Committing to Child Survival: A Promise Renewed. Progress Report 2013.* Retrieved from http://www.unicef.org/publications/files/APR_Progress_Report_2013_9_Sept_2013.pdf
2. WHO/UNICEF. (2013, July 13). WHO/UNICEF Immunization Coverage Estimates. Retrieved from http://www.who.int/immunization_monitoring/data/data_subject/en/
4. Kerala and Tamil Nadu introduced pentavalent vaccine in 2011. Seven additional states introduced in 2013.
5. Nigeria is currently in its third phase of pentavalent vaccine roll-out. All states will introduce by the end of 2013.
6. Indonesia introduced pentavalent in August 2013.
*Not profiled in the 2012 Pneumonia Progress Report; not formerly in the 15 countries with the highest number of child deaths from pneumonia.

Country	% of Children under 5 years with suspected pneumonia (2007-2012)		% of Children with diarrhea receiving ORS[3] (2007-2012)	% Exclusive breastfeeding in first 6 months[3] (2007-2011)	# Interventions that met GAPPD targets	2013 Overall GAPPD Intervention Score	2013 GAPPD-Pneumonia Intervention Score	2013 GAPPD-Diarrhea Intervention Score	2012 GAPP Intervention Score (recalculated)
	Taken to an appropriate health care provider[3]	Receiving antibiotics[3]							
India	69	13	26	46	0	33	39	37	39
Nigeria	45	23	26	13	0	22	25	20	28
Democratic Republic of the Congo	40	42	27	37	0	43	52	34	55
Pakistan	69	50	41	37	0	49	57	40	57
Ethiopia	27	7	26	52	1	35	41	36	33
China	—	—	—	28	2	45	56	42	56
Angola	—	—	—	11	3	48	58	36	54
Afghanistan	61	64	53	—	0	48	56	40	49
Niger	51	—	34	27	0	42	50	34	57
Indonesia	66	—	35	32	0	35	40	37	42
Kenya	56	50	39	32	1	57	68	41	69
Mali	38	—	14	38	0	46	59	28	55
Uganda	79	47	44	62	1	52	61	47	60
United Republic of Tanzania*	71	—	44	50	4	56	67	48	66
Burkina Faso	56	47	21	25	2	46	56	33	45

3. UNICEF. (2013, May). *State of the World's Children 2013 Report.* Retrieved from http://www.unicef.org/sowc2013/files/SWCR2013_ENG_Lo_res_24_Apr_2013.pdf

influenzae type B and *Streptococcus pneumoniae*, respectively. Globally, significant progress has been made in the uptake of these vaccines; however, an estimated 44.4 million and 81.5 million children still lack access to Hib and pneumococcal vaccines, respectively.[12]

Currently, Hib vaccine is included in the national immunization programs of 96% of countries worldwide and by 2014, all 73 GAVI countries will have introduced the vaccine.[13] As of 2013, all of the countries evaluated in this report have introduced some formulation of Hib vaccine, except for China, which is known to have widespread coverage of Hib vaccine in the private market.[13] Yet only three countries (Angola, Tanzania, and Burkina Faso) achieved the 90% GAPPD coverage target for Hib vaccine in 2012. India has introduced Hib-containing pentavalent vaccine in several states and Delhi, with plans to scale up the vaccine nationally.[4] Likewise, Nigeria has been rolling out pentavalent vaccine in a phased manner. This process commenced in June 2012 and will be completed by the end of 2013,[13] although their 2012 Hib coverage rate was still low.

Compared to Hib vaccine, PCV is expected to reach low-income countries at a much faster pace.[12] In just a few years after its introduction in the developing world, more than half of the 15 profiled countries have introduced the vaccine and three countries have been approved for GAVI support to introduce.[13] The nine countries that have introduced did so in 2011 or later; therefore, their PCV coverage rates remain fairly low. The countries with the highest PCV coverage rates in 2012 were Kenya (82%) and Mali (74%), but both fell short of the 90% coverage target. India, China, and Indonesia have yet to make a decision regarding PCV introduction.

Rotavirus vaccine, which first became available in high-income countries in 2006 and developing countries in 2008, has gained much attention from the international community and country officials in recent years. Of the 15 high-burden countries, Tanzania, Burkina Faso, and Ethiopia have introduced rotavirus vaccine, five countries have formal approval for GAVI's new vaccine support, and three others are planning non-GAVI introductions.[13] Such commitment by countries to introduce this vaccine which will reduce their diarrheal disease burden is commendable. To date, however, children living in these 15 high-burden countries largely lack access to rotavirus vaccine.

There are several factors that could impact a country's political commitment and/or ability to introduce and deliver these critical vaccines. These include scarcity of available country-specific or local information on the burden of vaccine-preventable diseases and vaccine cost-effectiveness, lack of a structured process for

evidence-based decision making, insufficient advocacy and communications around the importance and effectiveness of vaccines, and weak health systems.[14] Other important considerations that could prolong or delay countries' decision-making are vaccine formulation and presentation, primary container type, optimal dosing schedules, and serotype replacement. In addition, vaccine implementation and delivery could be further complicated by issues, such as supply shortages, lack of timely training of health workers to administer the vaccines, overburdened health systems, poor monitoring and evaluation systems, transportation challenges in reaching remote hard-to-reach areas, and technical difficulties associated with vaccine cold chain management in low-resource settings.

KEY FINDINGS: PROTECTION THROUGH EXCLUSIVE BREASTFEEDING

Decades of research have produced an extensive evidence base to support the benefits of breastfeeding for child health and nutrition. Exclusive breastfeeding for the first six months of a child's life is a widely accepted best practice that is a highly effective strategy for preventing and reducing pneumonia and diarrhea mortality and morbidity.[15,16] Rates of exclusive breastfeeding in the first six months are reported for the most recent data available between 2007 and 2011 and thus do not allow us to assess rate changes from year to year. Nevertheless, they provide a rough estimate of exclusive breastfeeding levels in countries that do monitor and capture this information.

Breast milk is a vital source of nutrient that enables child health and survival. Breastfeeding during infants' early months of life is not only crucial for their growth and development, but also for building their immunity against common childhood infections, such as pneumonia and diarrhea. Despite the overwhelming evidence and the global push for exclusive breastfeeding for the first six months of a child's life, there have only been small gains in the rates, as countries continue to struggle to meet optimal breastfeeding standards, in the developing and developed world alike.[17,18] Even in industrialized countries, such as the United States (U.S.) and the United Kingdom (UK), rates of exclusive breastfeeding at six months are very low (16.3% for the U.S. and 1% for the UK).[18,19]

For the 15 countries evaluated in this report, exclusive breastfeeding rates ranged from a low of 11% in Angola to a high of 62% in Uganda. (See Fig. 2.) Only three countries (Ethiopia, Uganda, and Tanzania) met the 50% GAPPD target for exclusive breastfeeding. In countries with poor water, sanitation, and hygiene, exclusive breastfeeding is especially critical to reducing young children's

12. International Vaccine Access Center (IVAC) at Johns Hopkins Bloomberg School of Public Health. *Vaccine Information Management System (VIMS) Global Vaccine Introduction Report, October 2013*. Retrieved from http://jhsph.edu/research/centers-and-institutes/ivac/vims/

13. International Vaccine Access Center (IVAC) at Johns Hopkins Bloomberg School of Public Health. (2013, November 7). *Vaccine Information Management System (VIMS)*. Retrieved from www.vimsdata.org

14. Hajjeh, R. (2011). Accelerating introduction of new vaccines: barriers to introduction and lessons learned from the recent Haemophilus influenzae type b vaccine experience. *Philosophical Transactions of The Royal Society B, 366*, 2827-2832. doi: 10.1098/rstb.2011.0046

15. Bhutta, Z. A. et al. (2013). Interventions to address deaths from childhood pneumonia and diarrhoea equitably: what works and at what cost? *The Lancet, 381* (9875), 1417-1429. doi:10.1016/S0140-6736(13)60648-0

16. Lamberti, L. M., Fischer Walker, C. L., Noiman, A., Victora, C., & Black, R. E. (2011). Breastfeeding and the risk for diarrhea morbidity and mortality. *BMC Public Health*, 11(Suppl 3), S15. doi:10.1186/1471-2458-11-S3-S15

17. Cai, X., Wardlaw, T., & Brown, D. W. (2012). Global trends in exclusive breastfeeding. *International Breastfeeding Journal*, 7(12). doi: 10.1186/1746-4358-7-12

18. Niefert, M., & Bunik, M. (2013). Overcoming clinical barriers to exclusive breastfeeding. *Pediatric Clinics of North America*, 60(1), 115-45. doi: 10.1016/j.pcl.2012.10.001

19. UNICEF UK. *UK Breastfeeding rates*. Retrieved from The Baby Friendly Initiative: http://www.unicef.org.uk/BabyFriendly/About-Baby-Friendly/Breastfeeding-in-the-UK/UK-Breastfeeding-rates/

Exclusive Breastfeeding in the First 6 Months of Life (2007–2011)
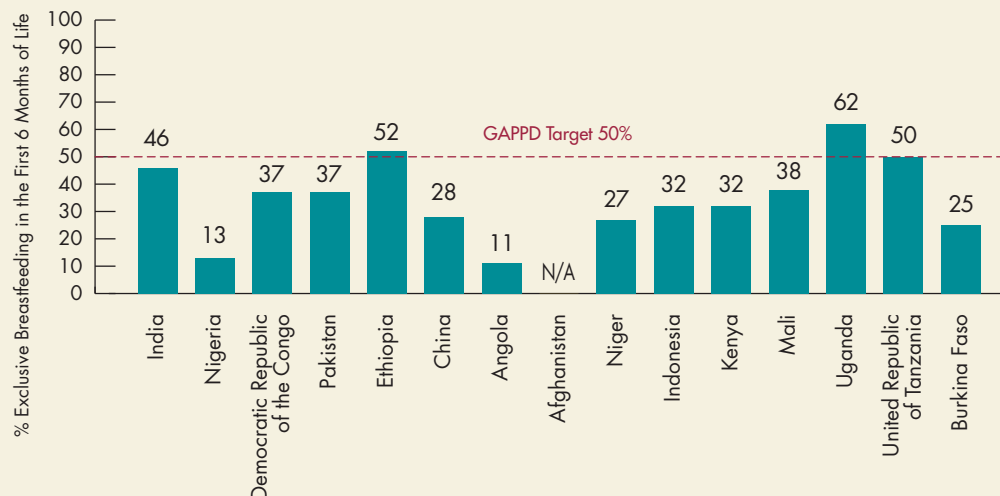
FIGURE 2: Levels of exclusive breastfeeding for infants in the first 6 months of life in the 15 countries with the highest child pneumonia mortality, 2007-2011 (based on most recent data year available). Source: UNICEF's *State of the World's Children (SOWC) 2013 Report*.

risk of exposure to contaminated foods and liquids. In studies that examined the barriers to exclusive breastfeeding in African countries, rates of exclusive breastfeeding were shown to be meager, despite mothers' recognition of its superior benefits.[20,21] Some of the perceived barriers reported by mothers were insufficient milk production, painful or difficult nursing, work-related impediments, and lack of familial support for breastfeeding.[16,17] These barriers can be addressed through national and community-based programs and policies. Particularly for countries with fast-growing economies and increasing female participation in the workforce, such as India and China, enacting "baby-friendly" policies that reduce the burden for working mothers will be essential to promoting this protective health behavior.

KEY FINDINGS: TREATMENT (ACCESS TO CARE, ANTIBIOTICS, AND ORS)

Preventive interventions are essential to reducing pneumonia and diarrhea mortality, but access to care and treatment for children who do become infected are equally as important. Without the integration of preventive and treatment measures, children will continue to die unnecessarily from these diseases.

For each of the three pneumonia and diarrhea treatment interventions, all 15 countries had coverage levels below the 90% target (Fig. 3). In general, care by an appropriate health care provider was more common than antibiotic treatment for children with suspected pneumonia. One aspect of pneumonia that possibly contributes to low

treatment rates is its difficult diagnosis. Particularly in low-resource areas, access to pneumonia care and treatment is often complicated by the challenges of diagnosing pneumonia based on clinical assessment alone, in the absence of adequate diagnostic tools and/or trained health workers.[22] In the 13 countries with available data, access to an appropriate care provider among those with suspected pneumonia ranged from 27% to 79%, while access to antibiotics did not exceed 50% in any of the nine countries with available data. For children with diarrhea, access to ORS treatment reached a high of 53% (in Afghanistan) among the 13 countries reporting such data.

This report reveals large gaps in coverage of recommended treatments for children with pneumonia and diarrhea. On the individual level, there may be a slew of factors that influence the likelihood of care-seeking behavior, such as physical access barriers (e.g., distance, inconvenient travel); cost; accessibility of financial resources by the primary caregivers, which are often women; availability of relevant health information; religious or cultural prohibitions; and preference for traditional remedies.[23,24] While barriers may vary across countries and even across regions within a country, lack of adequate funding, paucity of health care workers, insufficient capacity building in health workers, supply shortages, and poor coordination between implementing organizations may also act as institutional barriers that prevent children's access to proven treatment interventions for pneumonia and diarrhea.[25]

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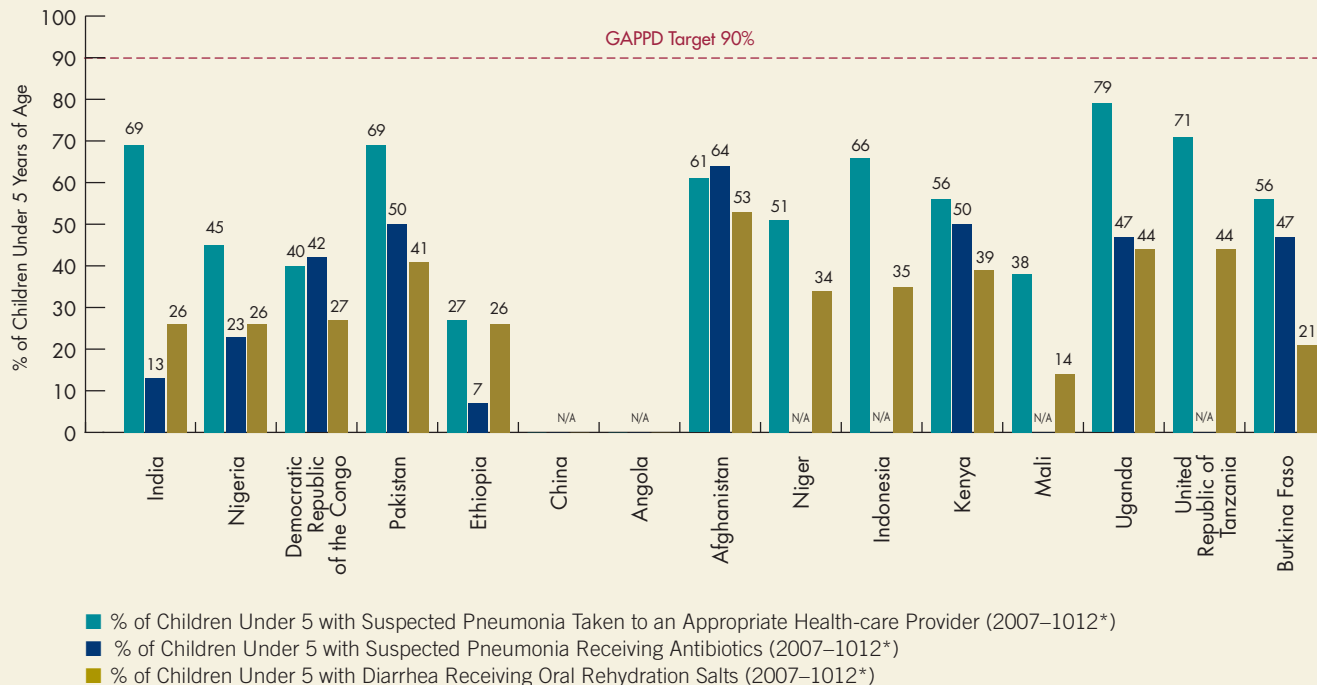
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TREATMENT — Percent of Children with Pneumonia or Diarrhea who Receive Appropriate Treatment
(Access to a Health Care Provider and Antibiotics for Children with Suspected Pneumonia and ORS for Children with Diarrhea)

■ % of Children Under 5 with Suspected Pneumonia Taken to an Appropriate Health-care Provider (2007–1012*)
■ % of Children Under 5 with Suspected Pneumonia Receiving Antibiotics (2007–1012*)
■ % of Children Under 5 with Diarrhea Receiving Oral Rehydration Salts (2007–1012*)

FIGURE 3: Levels of treatment coverage for children with suspected pneumonia and diarrhea (access to an appropriate health care provider, antibiotic treatment, and ORS), 2007-2012. Source: UNICEF's *SOWC 2013 Report*.

*Most recent year within that time period

ETHIOPIA'S LAUDABLE EFFORTS TO COMBAT CHILD MORTALITY

Ethiopia's pneumonia and diarrhea mortality rate is the 5th highest in the world. It is also one of the few countries that has reached the MDG 4 goal of 2/3rd reduction in the 1990 child mortality rate prior to the 2015 deadline reflecting that the mortality rate in 1990 was also very high.[26] Ethiopia has demonstrated a strong national commitment to child health and survival, both through programming and policy initiatives. For instance, in 2004, Ethiopia introduced its Health Extension Program (HEP), which brought on 40,000 health extension workers (HEWs) with the aim of boosting access to health care in rural parts of the country.[26,27] Then between 2009 and 2010, the Ethiopian government more than doubled its investment in routine immunization (from USD 6 to USD 17 per infant).[28] A recent study of three "woredas" (or districts) in Ethiopia with improved pentavalent vaccine coverage found that key factors that contributed to the improved coverage were the local HEWs, community engagement in health and immunization activities, collaborations between the woredas and local government, emphasis on monitoring and evaluation of performance indicators, and partner support.[27] Overall, Ethiopia has made great investments in strengthening the capacity of their health systems to deliver basic health services and has been relatively proactive with regard to new vaccine introductions. The country introduced PCV in 2011 and recently introduced rotavirus vaccine in early November of this year.[13] However, with one of the largest populations in Africa (93.9 million), health disparities still exist in vulnerable Ethiopian subgroups, including girls, rural dwelling children, and poor communities.[26] Regardless, Ethiopia's strong political will, capacity building efforts, and prioritization of funding for immunization programs are laying the foundation for successful child mortality interventions in the long term.

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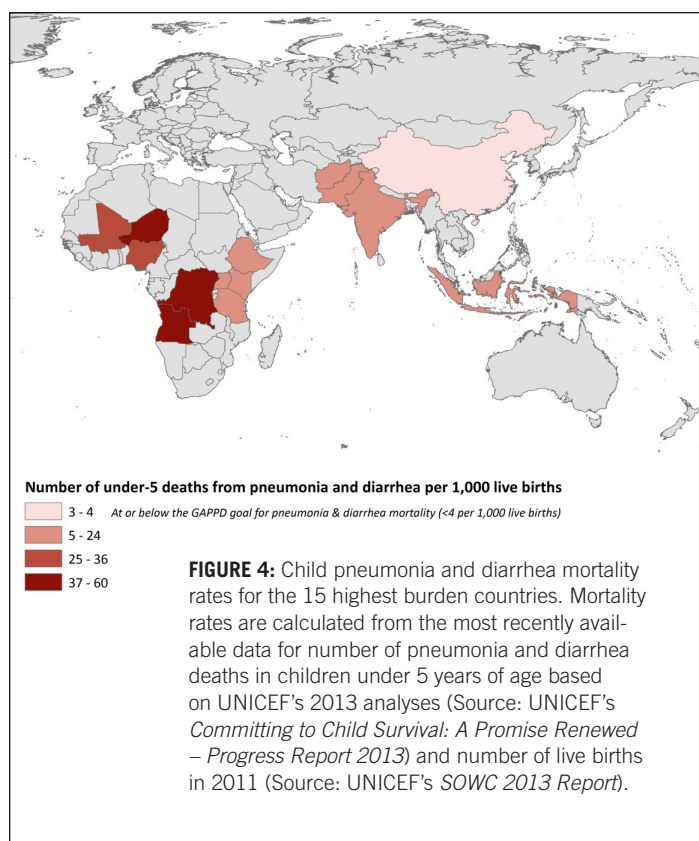28. Sabin Vaccine Institute. (n.d.). *Ethiopia – Government expenditures on routine immunization*. Retrieved from http://www.sabin.org/programs/sif-2

CURRENT LEVELS OF CHILD PNEUMONIA AND DIARRHEA MORTALITY IN THE 15 HIGHEST BURDEN COUNTRIES

In reaching the GAPPD goal of reducing pneumonia mortality in under-five children to less than 3 per 1,000 live births and diarrhea mortality to less than 1 per 1,000 live births by 2025,[3] a significant amount of work remains in these high-burden countries. In several countries, rates of child pneumonia and diarrhea mortality are 6-12 times higher than the GAPPD goal. (See Fig. 4.) China is the only country with a child pneumonia and diarrhea mortality rate below 4 per 1,000 live births. China has widespread vaccine use in the private market, but that is not captured in the GAPPD intervention scores. Indonesia and Tanzania are also close to reaching the GAPPD goal, but still need to reduce their mortality rate by 3-7 deaths per 1,000 live births. On the other hand, India, Nigeria,

and the DRC (the three countries with the highest number of child deaths from pneumonia and diarrhea) continue to have high mortality rates that are 4-10 times higher than the GAPPD goal. In order to substantially decrease the number of child pneumonia and diarrhea deaths globally, it is especially critical for these countries to accelerate their implementation of GAPPD interventions.

Besides mortality rates, other motivations for countries to scale up their disease protection, prevention, and treatment efforts are pneumonia and diarrhea morbidity rates and their associated economic costs. Not only are these economic costs a burden to families and communities, but they can also be a great hindrance to countries' economic development. Thus, whether policy makers look at this issue from a health equity or economic perspective, pneumonia and diarrhea should be top national priorities that are addressed with urgency.

Number of under-5 deaths from pneumonia and diarrhea per 1,000 live births

- 3 - 4   *At or below the GAPPD goal for pneumonia & diarrhea mortality (<4 per 1,000 live births)*
- 5 - 24
- 25 - 36
- 37 - 60

FIGURE 4: Child pneumonia and diarrhea mortality rates for the 15 highest burden countries. Mortality rates are calculated from the most recently available data for number of pneumonia and diarrhea deaths in children under 5 years of age based on UNICEF's 2013 analyses (Source: UNICEF's *Committing to Child Survival: A Promise Renewed – Progress Report 2013*) and number of live births in 2011 (Source: UNICEF's *SOWC 2013 Report*).

METHODOLOGY

There are important limitations that should be considered in the interpretation of intervention scores from this progress report. The coverage level years do not perfectly align across all interventions. While the coverage rates for the five vaccines included in the calculation of GAPPD scores are all from 2012, the coverage levels for the other non-vaccine interventions are based on the most recent data available within a multi-year time period. In addition, not all countries had data available for all nine GAPPD interventions; thus, their scores were averaged only from the intervention data that were available. As a result, scores may be inflated or deflated due to the exclusion of missing data. Because intervention data are provided on a national level, it is important to note that variations in coverage levels within a country may exist, particularly in larger countries that are heterogeneous in terms of population, level of development, and access to resources.

The sources of data used in this report were UNICEF and WHO. Vaccine coverage estimates were obtained from annual WHO/UNICEF best estimates, which are updated each year. The 2013 Pneumonia and Diarrhea Progress Report uses data from the most recent WHO/UNICEF publication on annual vaccine coverage rates, which are 2012 coverage statistics in this case. Vaccine coverage is the estimate of the number of infants who actually receive the vaccine and this is based on national data.

Additional details regarding countries' vaccine introduction statuses were acquired from the Vaccine Information Management System (VIMS), a web-based database managed by the International Vaccine Access Center at Johns Hopkins Bloomberg School of Public Health.

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