Pneumonia and Diarrhea Progress Report 2014

EXECUTIVE SUMMARY

Over the past decade and a half since 2000, significant gains have been made in the reduction of pneumonia and diarrhea mortality in children worldwide. Between 2000 and 2013, the global health community succeeded in decreasing the number of deaths due to pneumonia and diarrhea in children under the age of five years by 44% and 54%, respectively.[1] However, reductions in annual child mortality rates for pneumonia and diarrhea, the leading killers of children under five, have continued to be only modest. According to the latest child mortality estimates (published in 2014 for the year 2013), pneumonia and diarrhea caused over 1.5 million under-five child deaths, respectively accounting for 15% and 9% of the 6.3 million under-five deaths that occurred globally in 2013, compared to 1.6 million deaths in 2012.[1] This means that every 20 seconds, a mother and father lose their young child to one of these deadly, but preventable diseases.

As in previous years, the burden of child pneumonia and diarrhea mortality continues to be most heavily concentrated in just a few countries. The 15 countries with the greatest number of under-five child deaths from pneumonia and diarrhea in 2013 bore 71% of the global burden of child deaths from these two diseases in spite of accounting for only 56% of the world's under five year old population.[2] **This Pneumonia and Diarrhea Progress Report evaluates the progress of these 15 highest-burden countries in implementing high-impact interventions outlined in the Global Action Plan for the Prevention and Control of Pneumonia and Diarrhea (GAPPD) relative to GAPPD coverage targets, where data are available.** The coverage targets for indicators included in this report are 90% for vaccinations; 90% for access to pneumonia and diarrhea treatments, which include treatment by a health care provider, antibiotics, oral rehydration salts (ORS), and zinc supplements; and 50% for exclusive breastfeeding during a child's first six months of life.[3]

Despite major reductions in pneumonia and diarrhea mortality globally, progress in the highest-burden countries remains fairly stagnant. Introduction and scale-up of proven interventions that protect, prevent, and treat pneumonia and diarrhea need to be accelerated to ensure that every child, no matter what life circumstances he/she is born into, will have the chance to celebrate his/her fifth birthday.

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1. UNICEF. (2014). *Committing to Child Survival: A Promise Renewed. Progress Report 2014.* Retrieved from http://files.unicef.org/publications/files/APR_2014_web_15Sept14.pdf
2. Liu, L., Oza, S., Hogan, D., Perin, J., Rudan, I., Lawn, J. E., Cousens, S., Mathers, C., Black, R. E. (2014). Global, regional, and national causes of child mortality in 2000-13, with projections to inform post-2015 priorities: an updated systematic analysis. Lancet. Retrieved from http://www.jhsph.edu/departments/internationalhealth/centers-and-institutes/institute-for-international-programs/projects/mcee-child-cause-of-deathestimates. html
3. WHO/UNICEF. (2013). *Ending Preventable Child Deaths from Pneumonia and Diarrhoea by 2025. The Integrated Global Action Plan for Pneumonia and Diarrhea (GAPPD).* Retrieved from http://www.unicef.org/media/files/Final_GAPPD_main_Report-_EN-8_April_2013.pdf

Each year, progress of the 15 highest-burden countries are assessed through GAPPD scores, developed by the International Vaccine Access Center (IVAC) of the Johns Hopkins Bloomberg School of Public Health. GAPPD scores are derived from an average of countries' coverage levels across 10 key GAPPD indicators for which data are available. This year's GAPPD scoring includes all the indicators from 2013, with the addition of supplemental zinc coverage in under-five children with diarrhea. Based on the latest available data, very limited progress was made between 2013 and 2014 in the use of proven pneumonia and diarrhea interventions in the 15 countries with the highest-burden of child mortality from those diseases (India, Nigeria, Pakistan, the Democratic Republic of the Congo, Ethiopia, Angola, China, Afghanistan, Indonesia, Kenya, Sudan, Bangladesh, Niger, Chad, and Uganda). Because zinc coverage in the 15 countries was generally very low, the addition of this indicator to the GAPPD scoring in 2014 reduced countries' overall GAPPD scores and GAPPD-Diarrhea scores, complicating comparisons with 2013 scores. Nevertheless, overall GAPPD scores improved no more than 7% for any single country in 2014. India and Nigeria, the two countries with the greatest number of child pneumonia and diarrhea deaths, continue to have low GAPPD scores (32% and 29%, respectively), although Nigeria achieved a 7% gain from the previous year, even with the inclusion of zinc coverage in the score.

Low GAPPD scores among the 15 countries can be attributed to a combination of factors, including delayed or lack of introduction of pneumococcal conjugate vaccine (PCV) and rotavirus vaccine and poor coverage of pneumonia and diarrhea treatment interventions. Even in countries that have introduced *Haemophilus influenzae* type B (Hib) vaccine, PCV, and/or rotavirus vaccine in recent years, scale-up of these vaccination programs has been quite slow and a sizeable proportion of the under-five population living in these countries still lacks access to these lifesaving vaccines.

There are still limitations in data that potentially mask critical gaps in access to prevention and treatment or, on the contrary, underrepresent the progress that countries have truly made simply because there are no data to quantify such improvements. However, countries are beginning to take steps to measure their own progress. India, for example, has initiated plans to fill information gaps and evaluate available data at the district and block levels in high-burden states, which will guide actions that can drive forward real progress. In addition to coverage estimates of interventions, India is also looking at important process indicators to measure how well the system that delivers these interventions is performing. Nigeria, as well, is moving to implement score card measurements of system indicators at the subnational level. It will be important for other countries to follow a similar path, implementing monitoring at local levels to ensure that progress is being made. Particularly in countries with great subnational disparities, local monitoring is essential to identifying areas and populations of high risk for morbidity and mortality and matching targeted interventions to those high-risk groups. As the world nears the 2015 deadline for the Millennium Development Goal (MDG) 4 of reducing child mortality by two-thirds since 1990,[4] it is absolutely crucial that stakeholders and advocates at all levels continue the global push for equitable access to vital interventions for every child and dedicate the necessary resources to ensure that no child dies of preventable pneumonia and diarrhea.

INTRODUCTION

Between 1990 and 2013, the under-five child mortality rate has decreased by half, which translates to approximately 17,000 lives saved per day, a tremendous achievement in the global public health community.[1] During the past 13 years alone (from 2000 to 2013), child deaths from pneumonia and diarrhea have also halved.[1] Yet, pneumonia and diarrhea continue to be the leading causes of death in under-five children, together claiming the lives of more than 1.5 million children in a single year (2013).[2] Of the 1.5 million child lives lost to pneumonia and diarrhea, a disproportionate fraction (71%) occurred in just 15 countries,[2] despite the fact that only 56% of the world's under-five children live in these countries.[5]

This 2014 edition of the Pneumonia and Diarrhea Progress Report is the fifth annual progress report published by the International Vaccine Access Center (IVAC) of the Johns Hopkins Bloomberg School of Public Health for World Pneumonia Day and the second IVAC progress report to evaluate pneumonia and diarrhea interventions as an integrated approach. Expanding upon the diarrhea evaluation component, which was incorporated into the progress reports starting last year, the 2014 Pneumonia and Diarrhea Progress Report now includes data on zinc coverage in under-five children with diarrhea, another key intervention for diarrhea outlined in GAPPD.[3]

This report provides the latest updates on countries' implementation of evidence-based pneumonia and diarrhea interventions recommended for universal adoption by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) in the Global Action Plan for Prevention and Control of Pneumonia and Diarrhea (GAPPD), and reports on their coverage levels relative to the GAPPD coverage targets. GAPPD lays out an integrated strategy for ending preventable deaths due to pneumonia and diarrhea through the widespread use of existing interventions with demonstrated impact, within a broader framework of **protecting** child health, **preventing** children from becoming sick from pneumonia and diarrhea, and appropriately **treating** affected children.[3]

The specific coverage targets for the measured interventions included in this report as prescribed by GAPPD 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) and zinc supplements for children with diarrhea; and
- 50% rate of exclusive breastfeeding within the first six months of a child's life.

4. WHO. (2013). *MDG 4: Reduce child mortality.* Retrieved from http://www.who.int/topics/millennium_development_goals/child_mortality/en/
5. UN Population Division. (2013). *World Population Prospects: The 2012 Revision.* Retrieved from http://esa.un.org/unpd/wpp/Excel-Data/population.htm

INTERPRETING GAPPD INTERVENTION SCORES

Because of methodological limitations, GAPPD intervention scores should be interpreted cautiously with several key considerations in mind. First, annual data are unavailable for some interventions in some countries, and thus these parameters are not included in their score. This limits the ability to compare countries with varying degrees of available data. Second, WHO/UNICEF estimates of vaccine coverage are updated annually, based on the latest country reported figures and survey data, which may or may not reflect the true coverage levels for the most recent coverage year. Breastfeeding and treatment coverage rates are also not always updated on an annual basis. GAPPD scores are calculated from the latest available data within the last 10 years, which are not necessarily data from the past year. As a result, reference years may vary across different indicators and countries. For example, the reference year ranged from 2005 to 2013 for the exclusive breastfeeding indicator and from 2005 to 2014 for pneumonia and diarrhea treatment coverage rates, whereas vaccine coverage rates were data from 2013. From year to year, there may be updated figures for some indicators, but not all. Thus, it is possible that in the absence of updated data for some indicators, the progress made by countries may appear more stalled than it really is. When interpreting GAPPD scores, it is also important to note that scores calculated for countries with more available (and recent) data offer a more accurate assessment of countries' performance against GAPPD targets, since missing data values are excluded from the average and could potentially skew the scores if the actual value is significantly higher or lower than the other values included in the scoring. These scores should be treated as estimates to assess countries' performance, which can inform programming and motivate policy making in high-burden countries.

GAPPD INTERVENTION SCORING

To measure and demonstrate countries' progress over time, GAPPD intervention scores are calculated for each country, taking into account the coverage across key GAPPD interventions, and compared to GAPPD coverage targets. A total of ten coverage indicators are included in the overall GAPPD intervention scores, reported as a summary percent coverage, which are determined by averaging the coverage rates for all indicators where data are available. The ten indicators include coverage rates for the third dose of pertussis vaccine (as measured by DTP3), measles-containing vaccine (MCV), third dose of Hib vaccine, third dose of pneumococcal vaccine, and last dose of rotavirus vaccine (individually reported); access to an appropriate health care provider and antibiotic treatment for children with suspected pneumonia; treatment with oral rehydration salts (ORS) and zinc supplements for children with diarrhea; and exclusive breastfeeding for a child's first six months.[3] The overall GAPPD scores are a reflection of countries' progress in implementing proven interventions against pneumonia and diarrhea, including those that impact only one of the two diseases as well as those that impact both. GAPPD-Pneumonia and GAPPD-Diarrhea scores, which are respectively calculated based on pneumonia-specific and diarrhea-specific interventions only, are also provided to allow a more in-depth evaluation of countries' areas of strength and weakness in preventing and treating pneumonia and diarrhea.

GAPPD-Pneumonia scores average coverage levels for seven indicators: pertusssis, measles, Hib, and pneumococcal conjugate vaccines; care by an appropriate care provider and antibiotic treatment for children with suspected pneumonia; and exclusive breatsfeeding in the first six months. GAPPD-Diarrhea scores take into account fewer indicators (5): measles and rotavirus vaccine coverage, ORS and zinc treatment for children with diarrhea, and exclusive breastfeeding in the first six months.

In this 2014 Pneumonia and Diarrhea Progress Report, coverage of zinc treatment for children with diarrhea has been added to the calculation of GAPPD intervention scores. Treatment with zinc can lower childhood diarrhea mortality by over 20% and thus is a critical component of diarrhea treatment.[3] However, zinc treatment has often been underreported due to sparse data availability. In light of available zinc coverage data in 12 of the 15 countries highlighted in this report, this indicator is now included in the GAPPD intervention scoring. Because of this, countries' GAPPD-Diarrhea score from last year is not directly comparable to this year's score.

GAPPD scores do not take into account all possible pneumonia and diarrhea interventions that are known to be effective in reducing the burden of these childhood diseases. Rather, they focus on ten core GAPPD interventions for which measurable coverage targets were set and for which coverage data are publicly available.

KEY FINDINGS: GAPPD PACKAGE COVERAGE

Between 2013 and 2014, the countries with the greatest number of child deaths due to pneumonia and diarrhea largely remained the same, with a few exceptions. Sudan, Bangladesh, and Chad are countries that were not among the top 15 highest-burden countries

in 2013, but now are, thereby removing Tanzania, Mali, and Burkina Faso from the 15-country 2014 ranks of child pneumonia and diarrhea mortality.[6]

In the current 15 countries with the largest burden of pneumonia and diarrhea child deaths, overall GAPPD intervention scores ranged from 23% (Chad) to 63% (Sudan). (See Fig. 1a and 1b.) This indicates no major improvement in scores since 2013, as last year's scores were 22% (Nigeria) on the lower end and 57% (Kenya) on the higher end, although 2014 scores now include zinc coverage, which is low. GAPPD-Pneumonia and GAPPD-Diarrhea scores also varied widely across the 15 countries, ranging from 31%-66% and 15%-57% respectively (Fig. 1c). Whether looking at overall GAPPD, GAPPD-Pneumonia, or GAPPD-Diarrhea scores, Sudan achieved the highest and Chad achieved the lowest scores among the 15 focus countries. Notably, Sudan is also the only country of the 15 profiled in this report to have introduced both PCV and rotavirus vaccine by 2013. India and Nigeria, the two countries with the greatest absolute burden of child pneumonia and diarrhea deaths continue to score on the lower end of the scale (32% and 29%, respectively), although Nigeria achieved a 7% gain in its overall GAPPD score from 2013 to 2014. Neither India nor Nigeria has introduced PCV and rotavirus vaccine, but both have plans to introduce rotavirus vaccine within the next few years, and Nigeria is due to introduce PCV before the end of this year.

Even with the addition of zinc coverage in 2014 scores, four countries – Nigeria, Ethiopia, Angola, and Indonesia – showed slight improvements (ranging from 2%-7%) in their overall GAPPD scores, one country (China) showed no change, and seven countries (India, Pakistan, Democratic Republic of Congo, Afghanistan, Kenya, Niger, and Uganda) had 1%-7% drops in their scores. Nigeria had the largest increase in overall GAPPD scores since last year, with larger gains on the pneumonia intervention side (+12%), compared to the diarrhea side (+3%), which might be influenced by the addition of zinc coverage in the 2014 score. In some countries, mixed progress on the pneumonia and diarrhea fronts was observed. For instance, India increased its GAPPD-Pneumonia score by 3%, but its GAPPD-Diarrhea score fell by 8%, also due to the addition of zinc coverage to the GAPPD scoring. Likewise, Ethiopia made gains in its GAPPD-Pneumonia score (+10%), but those gains were largely offset by the decrease in its GAPPD-Diarrhea score (-8%). In the case of Kenya and Niger, both their GAPPD-Pneumonia and GAPPD-Diarrhea scores fell, resulting in a 7% and 4% loss in both of their overall GAPPD scores, respectively. Changes in GAPPD scores between 2013 and 2014 should be interpreted with consideration of country-specific zinc coverage rates, which were added to this year's score.

Focusing on pneumonia interventions alone, countries showing improved 2014 GAPPD-Pneumonia scores compared to 2013 are India, Nigeria, Pakistan, Ethiopia, Angola, China, Afghanistan, and Indonesia. These improvements were rather modest, with gains of as little as 1% (Angola, China, and Afghanistan) and as high as 10% (Ethiopia). On the other hand, only two countries – Nigeria (+3%) and Uganda (+5%) – had gains in their GAPPD-Diarrhea scores.

In all other countries, GAPPD-Diarrhea scores either remained the same (China) or decreased, with the greatest decrease observed in Pakistan (-12%), again likely influenced by low zinc coverage in the 2014 score. In all 15 countries, GAPPD-Pneumonia scores were higher than GAPPD-Diarrhea scores. This is in part due to delayed rotavirus vaccine introduction in 14 of the 15 countries and generally lower diarrhea treatment rates, especially the use of zinc, compared to pneumonia treatment rates.

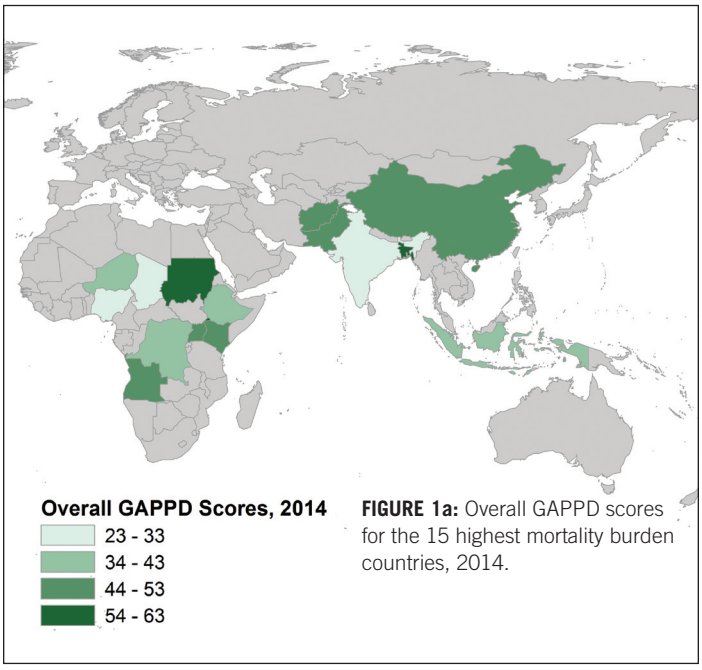

FIGURE 1a: Overall GAPPD scores for the 15 highest mortality burden countries, 2014.

If all ten minimum GAPPD coverage targets had been met, overall GAPPD intervention scores would have been at least 86%, but none of the 15 countries were even close to reaching that threshold. Similarly, no country met all of the pneumonia- and diarrhea-related coverage targets to achieve the target GAPPD-Pneumonia and GAPPD-Diarrhea intervention scores of 84% and 82%. **Only 7 of the 15 countries met at least 1 of the 10 GAPPD coverage targets, whereas the 8 other countries failed to meet even a single coverage target.** Bangladesh was the country that reached the most GAPPD coverage targets (4), including those for exclusive breast-feeding and pertussis, measles, and Hib vaccine coverage.

KEY FINDINGS: PREVENTION THROUGH VACCINATION

Child vaccinations have been long known to be one of the best public health investments because of their effectiveness in preventing the incidence of disease, reducing the severity of disease, and preventing mortality. Beyond morbidity and mortality, there has also been increasing recognition for the broader value of vaccines, which include their potential impact on social and cognitive development, educational achievement, and economic prospects.[7] Positive impacts made in these areas as a result of child vaccinations would translate to similar improvements and gains on

6. International Vaccine Access Center (IVAC) at Johns Hopkins Bloomberg School of Public Health. (2013). *Pneumonia and Diarrhea Progress Report 2013.* Retrieved from http://www.jhsph.edu/research/centers-andinstitutes/ ivac/resources/IVAC-2013-Pneumonia-Diarrhea-Progress-Report.pdf
7. Gavi. (n.d.) *Value of vaccination.* Retrieved from http://www.gavi.org/about/value/

the family, community, national, and global levels. While studies are still being done to further quantify the broader value of vaccines, it is clear that vaccines have a wide range of both personal and societal benefits that extend beyond child health and survival.

For the prevention of pneumonia, several vaccines are available and recommended for universal adoption; these include pertussis, measles, Hib, and pneumococcal vaccines. For diarrhea, rotavirus vaccine provides the best line of protection against rotavirus infection, which is the leading cause of diarrhea deaths worldwide.[8] Remarkable progress has been made in the introduction of these life-saving vaccines globally, evident in the accelerated rate of uptake in recent years, particularly in low-income countries. For Hib vaccine*, it took 20 years since its first introduction in any country to reach its introduction in 70% of low-income countries, whereas PCV and rotavirus vaccines are projected to take 15 and 11 years, respectively.[9] Despite the unprecedented pace of introduction, countries that have introduced these new vaccines have shown relatively slow progress in achieving high levels of vaccine coverage. Of the 15 countries assessed in this report, the number that met the 90% coverage target for each vaccine was four for pertussis (Angola, China, Sudan, and Bangladesh), four for measles (Angola, China, Kenya, and Bangladesh), and three for Hib (Angola, Sudan, and Bangladesh); no countries met this target for PCV or rotavirus vaccine. Moreover, countries that have lagged in vaccine introduction are often larger countries with large birth cohorts. Thus, vaccine introduction in 70% of countries does not translate to 70% of the world's children having access to the vaccine.

In some countries, such as Nigeria, Ethiopia, and Indonesia, there were modest increases in coverage rates for pertussis, measles, and Hib vaccines, whereas in other countries, such as the Democratic Republic of the Congo, China, Bangladesh, and Uganda, no change in coverage rates across the three vaccines was observed.[10] Vaccination coverage increases in Nigeria reflect a recovery from a stock-out of diphtheria-pertussis-tetanus (DTP) vaccine and the continued roll out of pentavalent vaccine, and in Indonesia, the increase reflects the introduction of Hib-containing pentavalent vaccine. In Bangladesh, coverage rates for pertussis, measles, and Hib vaccines were sustained above the 90% targets. India, the country with the greatest number of child deaths from pneumonia and diarrhea, continues to struggle with improving rates of basic childhood immunizations. No improvements were seen in India's pertussis and measles coverage, and the rollout of Hib (pentavalent) vaccine in select states, which began at the end of 2011, only achieved 20% national coverage by 2013. In 2014, additional states have introduced pentavalent vaccine, but the rollout is not expected to be complete until 2015, four years after the first state introduction. This illustrates that especially in large countries, introduction is only the first step toward universal access to vaccines; to achieve widespread coverage, phased introductions require acceleration, particularly in states with a high burden of disease.

FIGURE 1b: Overall GAPPD Intervention Scores, 2014

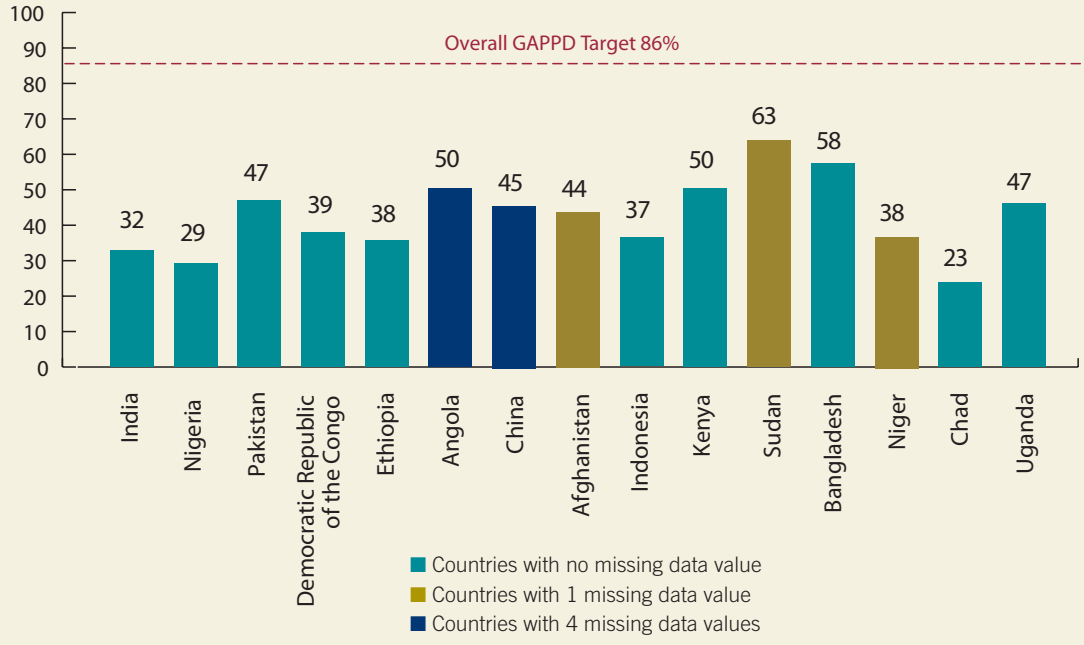

FIGURE 1b: 2014 GAPPD intervention scores for countries shown from left to right in increasing order of child pneumonia and diarrhea mortality.

Note: Not all countries have data for all nine interventions. See Table 1 for more details.

*Introduction dates for Hib vaccine presented in this report refer specifically to Hib conjugate vaccines introduced into infant programs, not to all Hib-containing vaccines targeted at any child age group.Global Vaccine Introduction Report, September 2014. Retrieved from http://www.jhsph.edu/research/centers-and-institutes/ivac/vims/

8. Munos, M. K., Fischer Walker, C. L.., & Black, R. E. (2010). The effect of rotavirus vaccine on diarrhoea mortality. *International Journal of Epidemiology*, 39, 156-162. doi: 10.1093/ije/dyq022
9. International Vaccine Access Center (IVAC) at Johns Hopkins Bloomberg School of Public Health. (2014). *Vaccine Information Management System (VIMS).* Data as of Nov 2014.
10. WHO/UNICEF. (2014, July). WHO/UNICEF Estimates of National Immunization Coverage (WUENIC) for 1980-2013, as of July 2014. Retrieved from http://www.who.int/immunization/monitoring_surveillance/data/en/

FIGURE 1c: GAPPD–Pneumonia and Diarrhea Intervention Scores, 2014

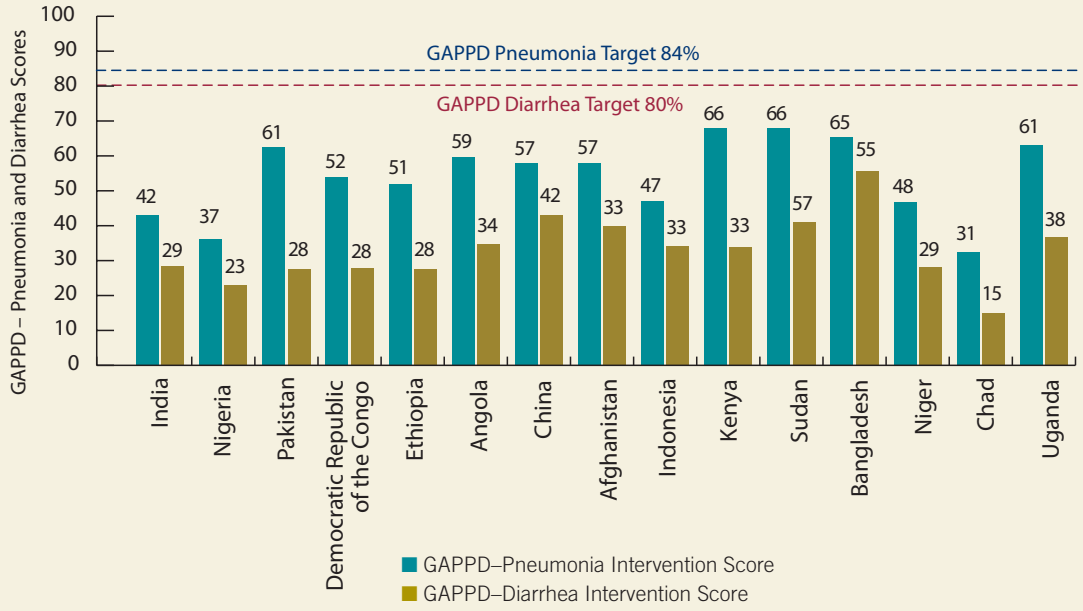

FIGURE 1c: 2014 GAPPD-Pneumonia and GAPPD-Diarrhea intervention scores for countries shown from left to right in increasing order of child pneumonia and diarrhea mortality.

INDIA'S DEVELOPMENT OF STATE- AND DISTRICT-LEVEL SCORE CARDS, ADAPTED FROM IVAC'S PNEUMONIA & DIARRHEA PROGRESS REPORT

In September 2014, India's Ministry of Health & Family Welfare, along with representatives from high pneumonia and diarrhea burden states and districts, WHO, UNICEF, and other stakeholders came together to propose and develop the Integrated Action Plan for Pneumonia and Diarrhea (IAPPD). This includes a framework for monitoring selected high-burden state- and district-level progress in achieving GAPPD targets via "score cards" and ensuring accountability in the implementation of corrective actions following regular reviews of the score cards. As a starting point, the annual IVAC Pneumonia & Diarrhea Progress Report formed the basis for a GAPPD intervention score that has been adapted to the needs of the Indian states and districts. Discussions are underway to finalize a score card responsive to the needs of Indian stakeholders and incorporates additional coverage and process indicators (e.g., measures of human resources, planning, commodities available, measures of information management, coordination, and social mobilization). To ensure meaningful assessment of progress while also maintaining the score cards' simplicity and applicability, the score cards will examine a minimal number of indicators, using existing data collection systems at the start and supplementing with rapid assessments to fill data gaps. The concept of subnational score cards was conceived as a targeted effort to address child mortality in high priority districts within Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh, four large states in India with high child mortality. However, these score cards can easily be adapted for further use in other states and districts across India.

In Pakistan and Niger, coverage rates fell across the board (for pertussis, measles, and Hib). Although Pakistan made great strides in increasing its PCV coverage (from 0% in 2012 to 66% in 2013), its coverage for three of the other vaccines (pertussis, measles, and Hib) fell, with the largest drop observed in measles coverage (-22%). Political unrest in countries can certainly disrupt access to primary health care services, but decreases in basic immunization coverage rates, especially for the third dose of DTP (DTP3), may also indicate that countries lack the public health infrastructures needed to effectively deliver vaccines. Whether improvements are needed in supply management, cold chain capacity, health worker training, outreach, or in the demand by parents for vaccines, these represent opportunities for countries to strengthen their routine immunization systems. Particularly when countries are making gains in the coverage of new vaccines (such as PCV) yet are seeing decreases in basic DTP3 coverage rates (as is the case in Pakistan), it is important to assess where strains and bottlenecks in the current system might exist and whether additional injections per visit are playing a role. With the addition of inactivated polio vaccine (IPV) to the routine immunization schedule of all countries in the coming months, the ability to manage and sustain multiple injections at a visit is critical. The ability of the immunization program to support the growing list of highly effective vaccines is a priority concern for most of the 15 countries, as evidenced by the fact that all (except Angola and China) have applied for and either received or been approved for health system strengthening support from Gavi, The Vaccine Alliance.[11]

Although Hib vaccine initially faced significant delays in introductions in the developing world, it has now reached all 73 Gavi eligible and graduating countries.[9] All countries featured in this report, except for China, have introduced the vaccine into the public sector as part of a national immunization schedule. China is believed to have widespread coverage of Hib vaccine in the private market;[12] however, the precise coverage rate through private market use is unknown. The countries with low Hib vaccine coverage in 2013 are largely those that have introduced the vaccine very recently, starting with a regional or phased introduction, including India (2011), Nigeria (2012), and Indonesia (2013).[9] Chad has persistently low Hib immunization coverage (48%), despite this vaccine being included in the country's immunization schedule since 2008.[9]

PCV, now nearly fifteen years from the initial introduction in the U.S., has only reached 9 of the 15 highest pneumonia mortality burden countries to date, albeit with two additional countries planning to introduce by the end of 2014.[9] The four remaining countries (India, China, Indonesia, and Chad) have yet to make a decision regarding PCV introduction. Even among those countries that have introduced PCV by 2013, coverage levels remain low, with no single country having coverage exceeding 75%.

The two currently licensed rotavirus vaccines were approved for use in 2006 and are now making their way onto national agendas, with more than one-third of the world's countries having access to the vaccine.[9] Five of the countries with the highest diarrhea mortality (Ethiopia, Angola, Kenya, Sudan, and Niger) have introduced the vaccine, most commonly in late 2013 and 2014. Six more countries (India, Nigeria, Pakistan, Afghanistan, Bangladesh, and Uganda) are planning to introduce within the next few years, while four countries remain undecided. Decision making on rotavirus vaccine introduction is notably lagged in Asia, where the vaccine has only been introduced in 20% of all countries in the region, compared to 47% of countries in African countries.[9] Introductions may be delayed due to a number of factors, including the perceived lack of adequate disease burden data, logistical challenges, supply shortages, barriers to vaccine acceptance, competing health priorities, and country preference for an indigenously produced vaccine. A locally produced rotavirus vaccine has now been licensed in India and inclusion of a rotavirus vaccine in the Indian Universal Immunization Programme (UIP) has recently been announced. While emerging market suppliers play an important role in shaping the vaccine market and supporting sustainability, it is critical that countries address the burden of pneumonia and diarrhea disease with the level of urgency it deserves, which includes using available vaccines until indigenous vaccines with demonstrated efficacy and safety are approved for public use.

KEY FINDINGS: PROTECTION

The benefits of breastfeeding are well established in the scientific literature. Exclusive breastfeeding is especially important in the first six months of a child's life, as it confers a wide range of health benefits both in the short and long term. Exclusive breastfeeding during this critical window in a child's life results in improved nutritional status, which protects children from becoming ill with and dying from common childhood diseases, such as pneumonia and diarrhea.[3,13] Undernutrition in children compromises their immune system's ability to fight infections, thus putting them at greater risk of adverse outcomes, including death.[1] In fact, undernutrition contributes to over 45% of the global burden of disease in children under five years of age.[14] Provided in this report are rates of exclusive breastfeeding in the first six months of a child's life for the most recent year of available data, which varies by country (from 2005 to 2013). These figures may not be representative of the current exclusive breastfeeding levels in the country, especially if the most recently available data are now many years outdated. However, they do indicate what is currently known about exclusive breastfeeding levels based on the latest surveys reporting on such practices.

11. Gavi, The Vaccine Alliance. (2014, June). *Countries approved for support.* Retrieved from http://www.gavi.org/results/countries-approved-for-support/
12. International Vaccine Access Center (IVAC), Johns Hopkins Bloomberg School of Public Health. (2014). *Vaccine Information Management System (VIMS)* Global Vaccine Introduction Report, September 2014. Retrieved from http://www.jhsph.edu/research/centers-and-institutes/ivac/vims/
13. 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
14. Black, R. E., Victora, C. G., Bhutta, Z. A., Christian, P., de Onis, M., Ezzati, M., … the Maternal and Child Nutrition Study Group. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet,* 382(9890), 427-451. doi:10.1016/S0140-6736(13)60937-X

TABLE 1: Current levels of coverage for interventions that prevent (vaccination), protect (exclusive breastfeeding), and treat (access to care, antibiotic treatment, ORS, and zinc) 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) 2013[2]	Measles 2013[2]	Hib3 2013[2] (Year Introduced) & Vaccine Use Status	PCV 2013[2] (Year Introduced) & Vaccine Use Status	Rota 2013[2] (Year Introduced) & Vaccine Use Status
1	India	318	72	74	20 (2011)	0 No Decision	0 Non-GAVI introduction planned
2	Nigeria	197	58	59	46 (2011)	0 Approved by GAVI for assistance	0 Gavi application under review
3	Pakistan	109	72	61	72	66 (2012)	0 Plan to apply for GAVI support
4	Democratic Republic of the Congo	83	72	73	72	26 (2011)	0 No Decision
5	Ethiopia	53	72	62	72	63 (2011)	0 (Nov 2013)
6	Angola	49	93	91	93	9 (Jun 2013)	0 (Apr 2014)
7	China	41	99	99	Private market coverage	0 No Decision	0 No Decision
8	Afghanistan	33	71	75	71	0 (Dec 2013)	0 Plans to apply for GAVI support
9	Indonesia	30	85	84	4 (Aug 2013)	0 No Decision	0 No Decision
10	Kenya	29	76	93	83	75 (2011)	0 (Jul 2014)
11	Sudan*	28	93	85	93	30 (Aug 2013)	80 (2011)
12	Bangladesh*	26	97	93	97	0 Approved by GAVI for assistance	0 Plans to apply for GAVI support
13	Niger	25	70	67	70	0 (Aug 2014)	0 (Aug 2014)
14	Chad*	24	48	59	48	0 No Decision	0 No decision
15	Uganda	24	78	82	78	0 (Apr 2013)	0 Plans to apply for GAVI support

*Not profiled in the 2013 Pneumonia & Diarrhea Progress Report; was not among the top 15 countries with the highest number of child pneumonia and diarrhea deaths in the previous year.

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Global Mortality Rank in Pneumonia & Diarrhea Deaths in Children Under 5[1]	Country	% of Children under 5 years with suspected pneumonia		% of Children <5 with diarrhea receiving ORS[4,5] (2005-2013)	% of Children <5 with diarrhea receiving zinc supplements[6,7] (2005-2014)	% Exclusive breastfeeding in first 6 months[8,9] (2005-2013)	2014 Overall GAPPD Intervention Score	2014 GAPPD-Pneumonia Intervention Score	2014 GAPPD-Diarrhea Intervention Score
		Taken to an appropriate health care provider[3] (2005-2012)	Receiving antibiotics[3] (2006-2012)						
1	India	69	13	26	0.3	46	32	42	29
2	Nigeria	33	45	34	2.3	17	29	37	23
3	Pakistan	69	50	41	1.5	38	47	61	28
4	Democratic Republic of the Congo	40	42	27	2.4	37	39	52	28
5	Ethiopia	27	7	26	0	53	38	51	28
6	Angola	—	—	—	—	11	50	59	34
7	China	—	—	—	—	28	45	57	42
8	Afghanistan	61	64	53	5.3	—	44	57	33
9	Indonesia	75	39	39	1.1	42	37	47	33
10	Kenya	56	50	39	0.2	32	50	66	33
11	Sudan*	56	66	22	—	41	63	66	57
12	Bangladesh*	35	71	78	40.8	64	58	65	55
13	Niger	58	—	44	10.3	23	38	48	29
14	Chad*	26	31	13	0.2	3	23	31	15
15	Uganda	79	47	44	1.9	63	47	61	38

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KEY FINDINGS: EXCLUSIVE BREASTFEEDING

Establishing good child health and nutrition through exclusive breastfeeding is an inexpensive and effective way of protecting children against pneumonia and diarrhea. Despite the mounting evidence to support exclusive breastfeeding, fewer than 4 in 10 children worldwide are exclusively breastfed during their first six months of life.[1] Least developed countries tend to have higher rates of exclusive breastfeeding (48%) compared to the global average (39%), but overall rates remain stubbornly low.

For the 15 countries profiled in this report, exclusive breastfeeding rates ranged from 3% in Chad to 64% in Bangladesh. (See Fig. 2.) Ethiopia, Bangladesh, and Uganda were the only three countries to meet the 50% GAPPD target for exclusive breastfeeding. Interestingly, in Chad, where the rate of exclusive breastfeeding is extremely low (3%), the percentage of children between 12-15 months who receive continued breastfeeding at one year is actually quite high (88%).[15] In countries with similar patterns, it is possible that even though breastfeeding is well accepted and widely practiced, physical barriers or longstanding cultural norms may prevent mothers from withholding other foods and fluids during the child's first six months of life. For example, because of the hot temperatures in Chad, mothers feed their children other fluids besides breast milk in attempts to keep them hydrated.[16] Reasons for low adherence to global recommendations for exclusive breastfeeding likely vary by country and should be examined more closely to develop tailored strategies for improving exclusive breastfeeding rates in each country.

KEY FINDINGS: TREATMENT

In addition to employing protective and preventive measures against pneumonia and diarrhea, appropriate treatment is another key aspect of the prevention and care continuum. Neglect of any of these areas will become lost opportunities to prevent child mortality, whether the opportunities were present before or after the children became ill.

PNEUMONIA TREATMENT: CARE BY APPROPRIATE HEALTH CARE PROVIDER AND ANTIBIOTICS

Access to pneumonia care and treatment is measured by the percentage of under-five children with suspected pneumonia who are taken to an appropriate health care provider and the percentage that are treated with antibiotics. These figures are provided for the latest year of available data, ranging from 2005 to 2012 for care-seeking behavior and from 2006 to 2012 for antibiotic treatment. (Niger's antibiotic coverage rate was excluded because their estimate was not within the last 10 years; its most recently available data on antibiotic coverage are actually from 1992.) When interpreting data, consideration should be given to the limitations in the data collection methodology as we have found some data to not be consistent with expected results. Nonetheless, the data can provide important information about trends, but as has been observed in many places, survey replies may not be reflective of true behavior.

For both indicators of pneumonia treatment, all 15 countries failed to meet the 90% GAPPD coverage targets (Fig. 3). The coverage rates for care by a health care provider were as low as 26% (Chad) and as high as 79% (Uganda), while the rates for antibiotic treatment ranged even more widely, from 7% (Ethiopia) to 71% (Bangladesh). In 7 of the 15 countries, rates of care by a health care provider were higher than those of antibiotic treatment and in 6 of the countries, the reverse was true. Rates of pneumonia treatment coverage may be low in countries because pneumonia may not be detected and diagnosed.[17] Communities may lack either the proper training or diagnostic tools to detect pneumonia and classify its etiology, both of

FIGURE 2: Exclusive Breastfeeding in the First 6 Months of Life (2005–2013)

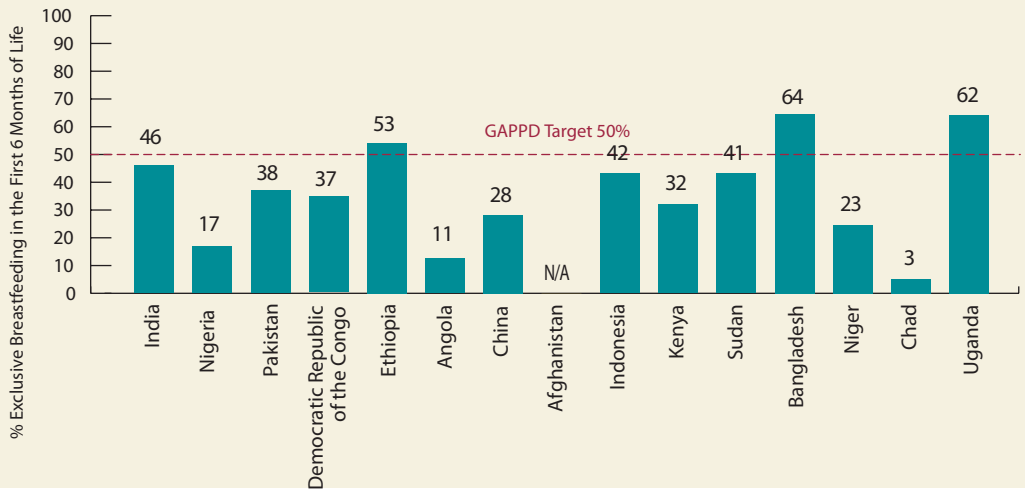

FIGURE 2: Levels of exclusive breastfeeding for infants in the first 6 months of life in the 15 countries with the highest burden of child pneumonia and diarrhea mortality, 2005-2013 (based on most recent data year available). Sources: UNICEF. Infant and Young Child Feeding (IYCF) 2014. Retrieved from http://data.unicef.org/nutrition/iycf; ICF International. The DHS Program STATcompiler. Retrieved from http://www.statcompiler.com

15. UNICEF. (2014). *Multiple Indicator Cluster Surveys / MICS5 – Chad 2010.* Retrieved from http://www.childinfo.org/mics5_surveys.html
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which are important for providers to determine the appropriate course of action. Furthermore, the field of pneumonia treatment is rapidly evolving with new scientific evidence emerging about the need, type, and course of antibiotic treatment, especially in the era of routine use of Hib and pneumococcal vaccines, which will largely prevent the two pathogens most commonly associated with pneumonia mortality. The remaining pathogens, many of which are viral, and the appropriateness of antibiotic treatment are the subject of active evaluation and guideline revisions.

DIARRHEA TREATMENT: TREATMENT WITH ORAL REHYDRATION SALTS (ORS) AND ZINC

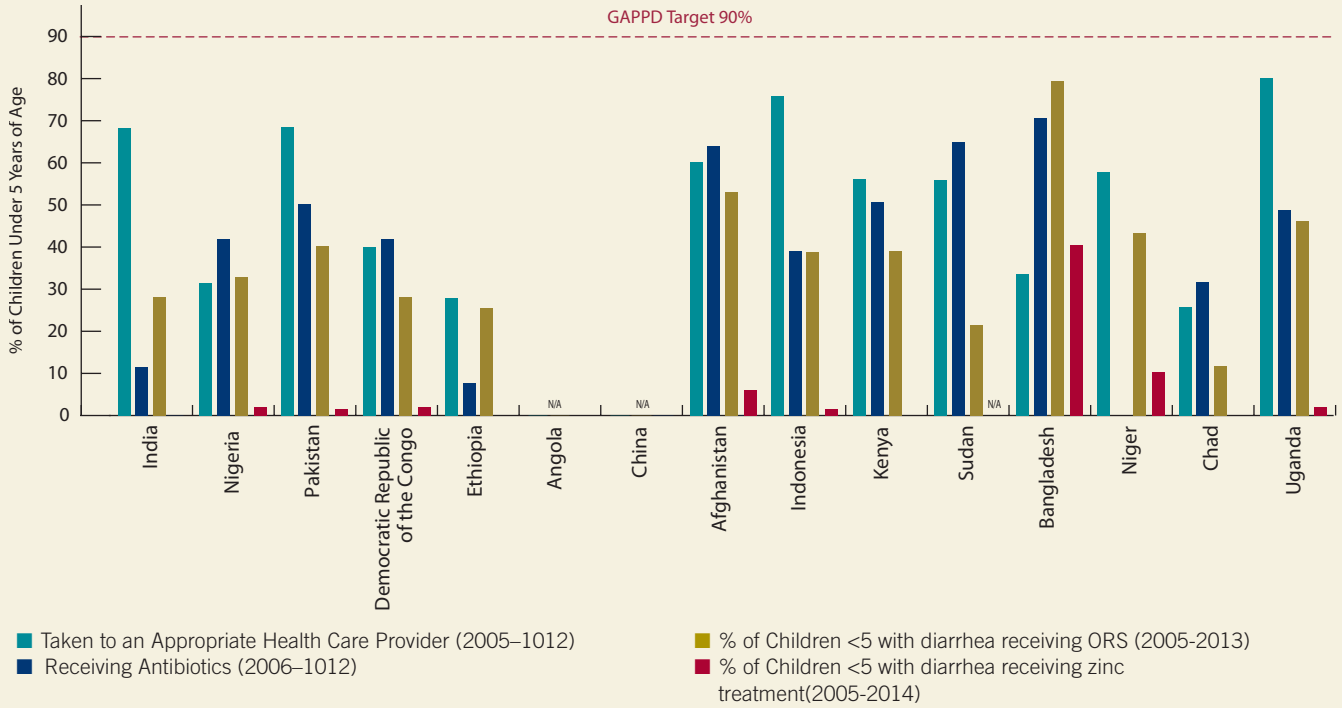
Coverage levels for diarrhea treatment, as indicated by the percentage of under-five children with diarrhea who receive ORS treatment and the percentage of under-five children who receive zinc supplements, are reported for the most recent year for which data are available. These reference years range from 2005 to 2013 for ORS coverage and from 2005 to 2014 for zinc coverage.

Data on ORS coverage were available for 13 of the 15 countries. Of these 13, the majority had ORS coverage levels below 50%, with the exception of Afghanistan (53%) and Bangladesh (78%). For zinc coverage, rates were even more depressed, with 11 of the 12 reporting countries having 10% or less of children with diarrhea receiving zinc treatment. Bangladesh achieved by a substantial degree the highest zinc coverage rate among the group of 15 countries, at 41%. This may be in part due to a practice of packaging zinc in combination with ORS to assure provision of both interventions simultaneously. **Overall, diarrhea treatment rates in the 15 highest-burden countries continue to be well below the GAPPD target (90%), with zinc coverage being drastically lower than ORS coverage.** These gaps in treatment reveal the extent of work that remains to be done, but they also represent the opportunities to move the needle in pneumonia and diarrhea prevention and control. Further research in these high-burden countries are needed to assess factors that contribute to low pneumonia and diarrhea treatment coverage rates on the national and subnational levels. With more country-specific information, decision makers will be better equipped to make evidence-informed programmatic and policy decisions to close existing gaps in coverage.

SUBNATIONAL PROGRESS IN THE TWO HIGHEST-BURDEN COUNTRIES – INDIA AND NIGERIA

This report evaluates the progress made by countries in implementing GAPPD recommended interventions. With the limitations of data that have been aggregated at the country level, we fully

FIGURE 3 — Levels of treatment coverage for children with suspected pneumonia and diarrhea (access to an appropriate health care provider, antibiotic treatment, ORS, and zinc), 2005-2014.



Sources: UNICEF. Global databases 2013 based on MICS, DHS and, other national household surveys. Retrieved from: http://data.unicef.org/child-health; The DHS Program. (n.d.). Demographic and Health Surveys (DHS) Final Reports. Retrieved from http://dhsprogram.com/publications/publicationsearch. cfm?type=5; UNICEF. (2014). Multiple Indicator Cluster Surveys / MICS5. Retrieved from http://www.childinfo.org/mics5_surveys.html *Most recent year within that time period

recognize that there may be heterogeneity in coverage levels within countries and believe that that is likely the case in large countries. To assess the potential disparities in coverage and progress that may exist sub-nationally, this report delved into coverage data for two of the highest mortality burden countries (India and Nigeria) and calculated their state-level GAPPD scores.

GAPPD SCORES FOR INDIA AT THE STATE LEVEL

Twenty-seven states in India, for which relatively recent coverage data (2012-2013) were publicly available, were included in this subnational analysis. Calculation of state GAPPD scores did not include coverage levels for antibiotic treatment for children with pneumonia due to the unavailability of such data at the state level. Additionally, the indicator used to assess zinc coverage in Indian states was the percentage of children with diarrhea receiving zinc along with ORS because coverage data on supplemental zinc by itself were not available in the survey sources. At the state level, coverage of zinc with ORS between 2012 and 2013 ranged from 26%-96%; however, the most recent zinc coverage estimates for India at the national level was from 2005-2006, which was significantly lower (0.3%). This suggests that India has likely increased its zinc coverage since 2005, but due to the lack of more recent national-level data, its GAPPD scores could not reflect the extent of its progress.

For the 27 states in India that were evaluated, GAPPD scores widely varied by state (Fig. 4), but all were above the country's overall GAPPD score (32%). This could be in part due to the exclusion of antibiotic coverage data at the state level because of the lack of data, while the national coverage rate was relatively low (13%), according to the most recent estimates. In addition, state-level zinc and ORS coverage rates (reported more recently) were much higher than the national rate reported in 2005-2006. In the top performing state (Goa), the GAPPD score (66%) was nearly double the score of Meghalaya (38%), the lowest performing state in the sample assessed. Furthermore, eight states in India showed large (>20%) coverage disparities between urban and rural populations within state borders for at least one of the GAPPD interventions. Of these, urban coverage rates were consistently greater than rural coverage rates. These disparities were seen in both the prevention and treatment type interventions.

As seen in Fig. 4, states with lower overall GAPPD scores tended to have higher rates of under-five mortality, compared to those with higher GAPPD scores, although that was not the case for all states. These deviations may be due to causes of child mortality other than pneumonia and diarrhea, which are not factored into GAPPD scoring. Furthermore, under-five mortality rates at the state level ranged from 15 to 83 per 1,000 live births, with 7 of the 20 states with available data having child mortality rates above the national average. Such disparities in child health outcomes, as well as coverage of preventive and treatment measures, underscore the importance of monitoring and evaluating subnational data to identify opportunities to close existing gaps in care.

GAPPD SCORES FOR NIGERIA AT THE STATE LEVEL

GAPPD intervention scores for Nigeria, by state, could only be calculated based on vaccine coverage rates, as state-level coverage data for the other GAPPD interventions were not available due to small sample sizes.[18] When calculated based on this limited set of data, Nigeria's state GAPPD scores ranged from 2% (Kebbi and Sokoto) to 49% (Ekiti). As many as 7 states had below 10% GAPPD scores and 15 had scores above 40%.

Geographic patterns in GAPPD scores by state are also notable, with southern states generally scoring higher and having lower child mortality rates than northern states (see Fig. 5). This pattern of states with higher GAPPD scores having lower child mortality rates, with a few exceptions, is consistent with the pattern in India. Data on coverage disparities within each state were not available for Nigeria, however, as they were for India. National data on urban-rural vaccine coverage nonetheless revealed large disparities – a 37% disparity in pentavalent (DTP-Hib-HepB) vaccine coverage and a 31% disparity in measles vaccine coverage. Urban-rural disparities were also observed in some of the treatment coverage values, although the differences were relatively smaller (10-17%). (See Fig. 6.) Beyond spatially-based disparities, wealth disparities also existed in Nigeria. Between the lowest and highest wealth quintiles in Nigeria, there were stunning levels of disparities that spanned multiple GAPPD indicators – 73% in pentavalent vaccine coverage, 65% in measles vaccine coverage, 37% in access to treatment by a health care provider for children with suspected pneumonia, and 33% in ORS treatment in children with diarrhea.

SUSTAINING MOMENTUM IN CHILD HEALTH POST-2015

As the countdown to 2015 is in the final stretches, the next set of challenges facing the global health community post-2015 will be to maintain the gains of the past two decades and accelerate the momentum as we continue to work towards the elimination of all preventable child deaths. It is time we move beyond counting introductions and partial implementations of key interventions, and strive for universal scale-up and optimization of these interventions. This will require great effort and innovation to establish quality data collection and monitoring systems that will allow those on the ground to quickly identify access gaps in vulnerable and hard-to-reach populations. In doing so, we will finally be able to work towards achieving a world where equity in access to lifesaving measures exists between countries, within countries, and between different groups of people, whether it is by gender, wealth, religion, or ethnicity.

18. ICF International. (2014, June). *Nigeria Demographic and Health Survey 2013*. Retrieved from http://www.population.gov.ng/images/ndhs_data/ndhs_2013/2013_ndhs_final_report.pdf

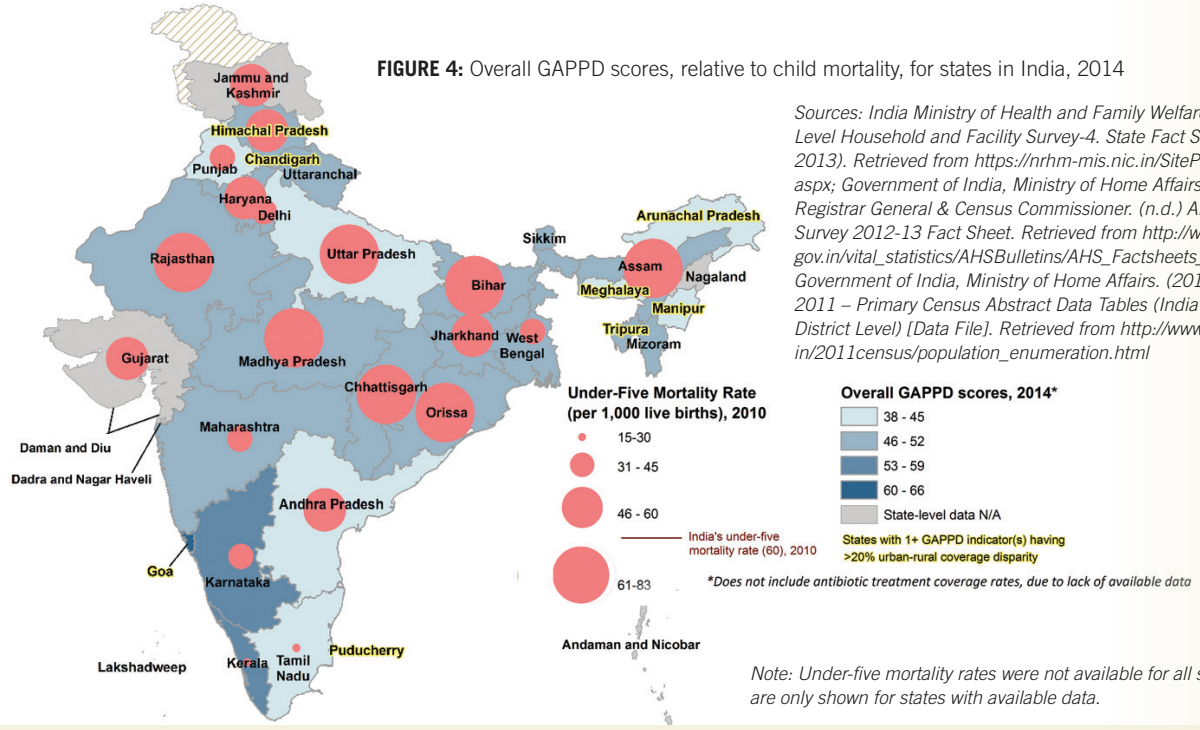


FIGURE 4: Overall GAPPD scores, relative to child mortality, for states in India, 2014

Sources: India Ministry of Health and Family Welfare. (2014). District Level Household and Facility Survey-4. State Fact Sheet. (2012-2013). Retrieved from https://nrhm-mis.nic.in/SitePages/DLHS-4.aspx; Government of India, Ministry of Home Affairs - Office of the Registrar General & Census Commissioner. (n.d.) Annual Health Survey 2012-13 Fact Sheet. Retrieved from http://www.censusindia.gov.in/vital_statistics/AHSBulletins/AHS_Factsheets_2012_13.html; Government of India, Ministry of Home Affairs. (2011). Census 2011 – Primary Census Abstract Data Tables (India & States/UT – District Level) [Data File]. Retrieved from http://www.censusindia.gov.in/2011census/population_enumeration.html

Note: Under-five mortality rates were not available for all states, and thus are only shown for states with available data.

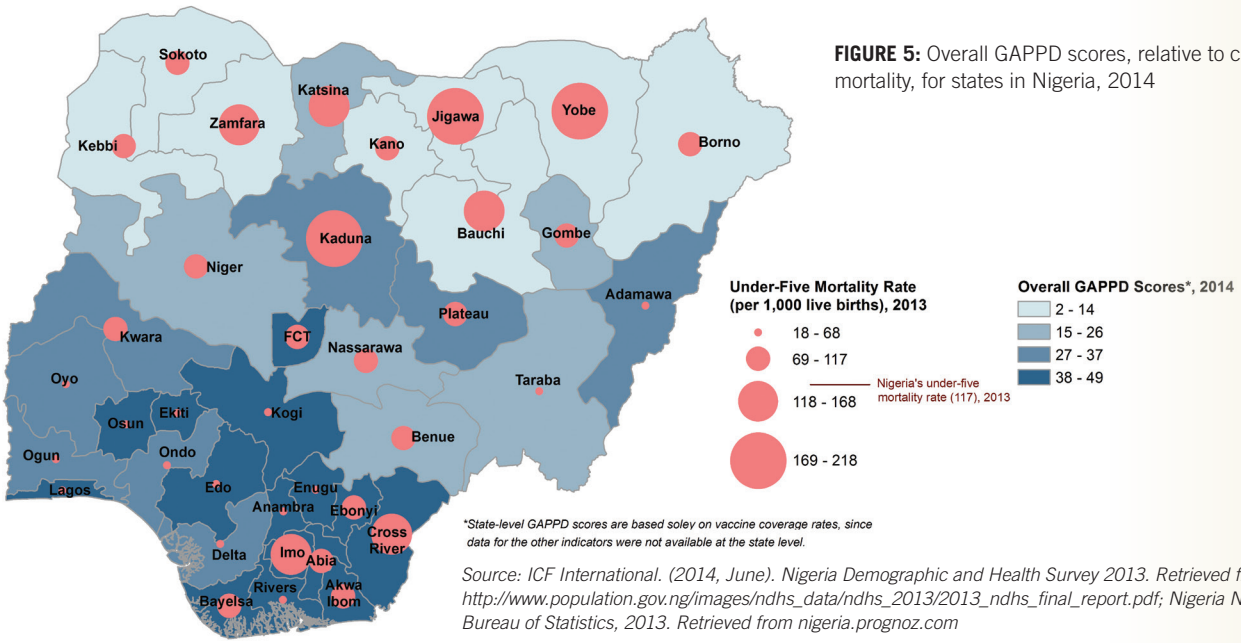


FIGURE 5: Overall GAPPD scores, relative to child mortality, for states in Nigeria, 2014

Source: ICF International. (2014, June). Nigeria Demographic and Health Survey 2013. Retrieved from http://www.population.gov.ng/images/ndhs_data/ndhs_2013/2013_ndhs_final_report.pdf; Nigeria National Bureau of Statistics, 2013. Retrieved from nigeria.prognoz.com

FIGURE 6: 2013 Levels of GAPPD Intervention Coverage by Wealth Quintile in Nigeria

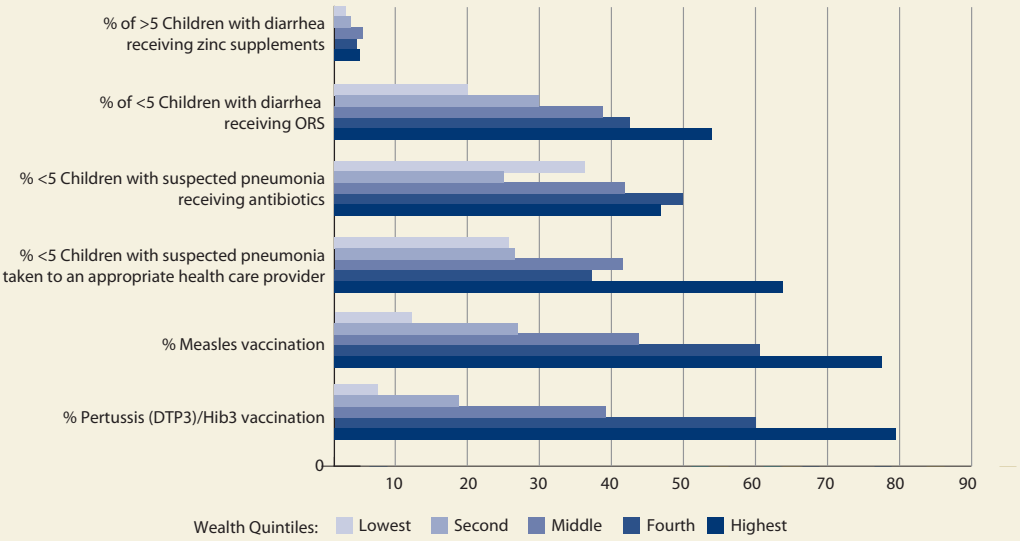


FIGURE 6: 2013 Levels of GAPPD intervention coverage, by wealth quintiles in Nigeria. Data on exclusive breast-feeding broken down by wealth quintiles were not available. PCV and rotavirus vaccine coverage rates are also not shown because Nigeria has yet to introduce these vaccines.

Source: ICF International. (2014, June). Nigeria Demographic and Health Survey 2013. Retrieved from http://www.population.gov.ng/images/ndhs_data/ndhs_2013/2013_ndhs_final_report.pdf

METHODOLOGY

There are important limitations that should be considered in the interpretation of intervention scores from this progress report. The reference years do not align across all interventions, nor across countries. While the coverage rates for the five vaccines included in the calculation of GAPPD scores are all from 2013, the coverage levels for the other non-vaccine interventions are based on the most recent data available within a multi-year time frame. In addition, not all countries had data available for all ten GAPPD interventions; thus, their scores were averaged only from the intervention data that were available. As a result, scores may be over- or under-estimated depending on the true values of the missing data. Because intervention data are provided on a national level, it is important to recognize that variations in coverage levels within a country may exist, particularly in larger countries with substantial diversity in terms of population, level of development, and access to resources. In addition, average intervention coverage data do not reflect the distribution among areas with varying risk profiles for pneumonia and diarrheal death.

The sources of coverage data used in this report were UNICEF and WHO. Vaccine coverage estimates were obtained from annual WHO/UNICEF estimates of national immunization coverage (WUENIC), which are updated each year. The 2014 Pneumonia and Diarrhea Progress Report uses the most recent WUENIC data, which are 2013 coverage statistics issued in 2014. Vaccine coverage is the percent of surviving infants (defined as children surviving past one year of age) who received vaccination. For pneumonia and diarrhea mortality estimates in children under age five, data from the Maternal & Child Epidemiology Estimations (MCEE) published in 2014 were used. Additional details regarding countries' vaccine introduction statuses were acquired from the Vaccine Information Management System (VIMS), a database managed by the International Vaccine Access Center at Johns Hopkins Bloomberg School of Public Health.

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