

# State of inequality in diphtheria-tetanus-pertussis immunisation coverage in low-income and middle-income countries: a multicountry study of household health surveys

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## Summary

**Background** Immunisation programmes have made substantial contributions to lowering the burden of disease in children, but there is a growing need to ensure that programmes are equity-oriented. We aimed to provide a detailed update about the state of between-country inequality and within-country economic-related inequality in the delivery of three doses of the combined diphtheria, tetanus toxoid, and pertussis-containing vaccine (DTP3), with a special focus on inequalities in high-priority countries.

**Methods** We used data from the latest available Demographic and Health Surveys and Multiple Indicator Cluster Surveys done in 51 low-income and middle-income countries. Data for DTP3 coverage were disaggregated by wealth quintile, and inequality was calculated as difference and ratio measures based on coverage in richest (quintile 5) and poorest (quintile 1) household wealth quintiles. Excess change was calculated for 21 countries with data available at two timepoints spanning a 10 year period. Further analyses were done for six high-priority countries—ie, those with low national immunisation coverage and/or high absolute numbers of unvaccinated children. Significance was determined using 95% CIs.

**Findings** National DTP3 immunisation coverage across the 51 study countries ranged from 32% in Central African Republic to 98% in Jordan. Within countries, the gap in DTP3 immunisation coverage suggested pro-rich inequality, with a difference of 20 percentage points or more between quintiles 1 and 5 for 20 of 51 countries. In Nigeria, Pakistan, Laos, Cameroon, and Central African Republic, the difference between quintiles 1 and 5 exceeded 40 percentage points. In 15 of 21 study countries, an increase over time in national coverage of DTP3 immunisation was realised alongside faster improvements in the poorest quintile than the richest. For example, in Burkina Faso, Cambodia, Gabon, Mali, and Nepal, the absolute increase in coverage was at least 2.0 percentage points per year, with faster improvement in the poorest quintile. Substantial economic-related inequality in DTP3 immunisation coverage was reported in five high-priority study countries (DR Congo, Ethiopia, Indonesia, Nigeria, and Pakistan), but not Uganda.

**Interpretation** Overall, within-country inequalities in DTP3 immunisation persist, but seem to have narrowed over the past 10 years. Monitoring economic-related inequalities in immunisation coverage is warranted to reveal where gaps exist and inform appropriate approaches to reach disadvantaged populations.

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## Introduction

Vaccines are a safe, effective, and cost-efficient health intervention that have substantially lowered the burden of disease in young children and averted many millions of deaths. The Expanded Programme on Immunization (EPI) was established by WHO in 1974, and since then the global health community has shown a serious commitment to realising the full potential of vaccines, with efforts dedicated to ensuring widespread vaccine distribution.<sup>1–4</sup> Gavi, the Vaccine Alliance—an organisation created in 2000—has been an important facilitator of improved access to more vaccines among children in poor countries.

Immunisation programmes have made strides in reaching populations at large.<sup>5</sup> For example, in 2014, delivery of three doses of the combined diphtheria, tetanus toxoid, and pertussis-containing vaccine (DTP3) reached 86% worldwide.<sup>6</sup> However, with about 18.7 million infants unvaccinated or undervaccinated,<sup>6</sup> there is a growing need to ensure that disadvantaged populations are not left behind. Not only are poorer children more susceptible to infectious disease but also the tendency for geographical clustering of disadvantaged subgroups might result in an absence of herd immunity.<sup>7</sup> In multicountry analyses, inequalities in child immunisation indicators have been reported, noting that richer

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See [Comment](#) page e582

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For more on Gavi, the Vaccine Alliance see <http://www.gavi.org>

### Research in context

#### Evidence before this study

We searched PubMed on July 22, 2015, to identify publications in English only addressing inequalities in immunisation coverage, with the search terms “healthcare disparities”[Mesh] AND “immunization”[Mesh]. Our search yielded 97 results, dating back to 2007 (no filters were applied). We reviewed the titles and abstracts of these papers and selected ten relevant peer-reviewed publications for full-text review. We applied a snowball searching technique, drawing on the citations within these reports and other suggested similar papers, to identify further relevant studies. We also identified major global initiatives that promote immunisation and reviewed related considerations or reporting. These initiatives comprised: the Global Vaccine Action Plan; the Millennium Development Goals; the Decade of Vaccines; Global Immunization Vision and Strategy; and the Sustainable Development Goals. In the same manner, we reviewed publications of global organisations that report data about immunisation coverage in low-income and middle-income countries, including: WHO; Gavi, the Vaccine Alliance; UNICEF; the World Bank; Countdown to 2015; and Save the Children. We consulted with experts in the area of health inequality monitoring to identify other key academic or grey literature. The Global Vaccine Action Plan—endorsed by the 194 Member States of the World Health Assembly in 2012 and supported through the work of Gavi, the Vaccine Alliance and other organisations—promotes equitable access to vaccines for all people by the year 2020. The Plan highlights the need to promote within-country equity and requests the monitoring of coverage gaps between wealth quintiles (and other appropriate indicators). Specifically, strategic objective three in the Global Vaccine Action Plan seeks to ensure that the benefits of immunisation are extended equitably to all, with a call to build a knowledge base and capacity for enabling equitable delivery.

#### Added value of this study

We used the latest available household survey data gathered in 51 low-income and middle-income countries to provide an update about the global state of inequality in DTP3 immunisation coverage. Use of disaggregated data from Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS) enabled comparisons across countries and within countries over time. We presented the level of DTP3 immunisation coverage by wealth quintile in every country, thus extending conventional reporting of between-country inequality (ie, comparisons of national averages). Furthermore, we used data from two timepoints to quantify and compare how within-country inequality has changed over time (previous 10 years). Although many study countries had a narrowing of inequality over the past 10 years, substantial inequality persists within most study countries. We also noted variability in the state of inequality across study countries.

#### Implications of all the available evidence

The Sustainable Development Goals seek to reduce inequalities and ensure health and wellbeing for all, including a movement towards universal health coverage. In general, monitoring within-country inequalities in any health topic is important to ensure that the status of disadvantaged populations is not masked behind national averages; health inequality monitoring is fundamental to promoting the progressive realisation of universal health coverage. Knowledge about health inequalities helps to inform approaches to reach at-risk populations. Where warranted, inequalities should be addressed on a priority basis through equity-oriented and context-appropriate policies, programmes, and practices. Future studies can build on our results to further investigate underlying determinants of inequalities within countries.

subgroups within countries tend to have high coverage whereas the coverage level among poorer subgroups is variable across countries.<sup>8,9</sup> In some cases, disadvantaged populations have been reached successfully through equity-oriented immunisation programmes;<sup>10,11</sup> however, without an explicit focus on equity, disadvantaged populations generally report lower immunisation coverage,<sup>7,12</sup> sometimes even alongside improving national figures.<sup>13,14</sup>

An equity-oriented approach to increasing the reach of immunisation programmes should consider inequalities between countries and within countries and tailor programmes accordingly. The Global Vaccine Action Plan (GVAP)—endorsed by the 194 Member States of the World Health Assembly in 2012—promotes equitable access to vaccines for all people by the year 2020.<sup>2</sup> GVAP specifies indicators that address within-country inequality, including a measure that compares the level of DTP3 coverage in the country’s poorest wealth quintile with the

level in the richest wealth quintile.<sup>2</sup> National-level information has been used to identify priority countries and direct resource allocation (eg, through the work of Gavi, the Vaccine Alliance). High-priority countries—identified based on low national immunisation coverage and the absolute number of children who are unvaccinated—include DR Congo, Ethiopia, Indonesia, Nigeria, Pakistan, and Uganda.

The Sustainable Development Goals (SDGs) seek to reduce inequalities (goal 10) and ensure health and wellbeing for all (goal 3).<sup>1</sup> Achieving universal coverage of immunisation programmes constitutes an important contribution to these goals and to the promotion of child survival and health at large. Measuring inequalities in DTP3 immunisation coverage between countries and within countries reveals where gaps exist in a routinely delivered vaccine and helps to inform appropriate approaches to reach at-risk populations. Assessing the extent to which gains in national coverage are driven by

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