# Health Systems Swimming Naked?
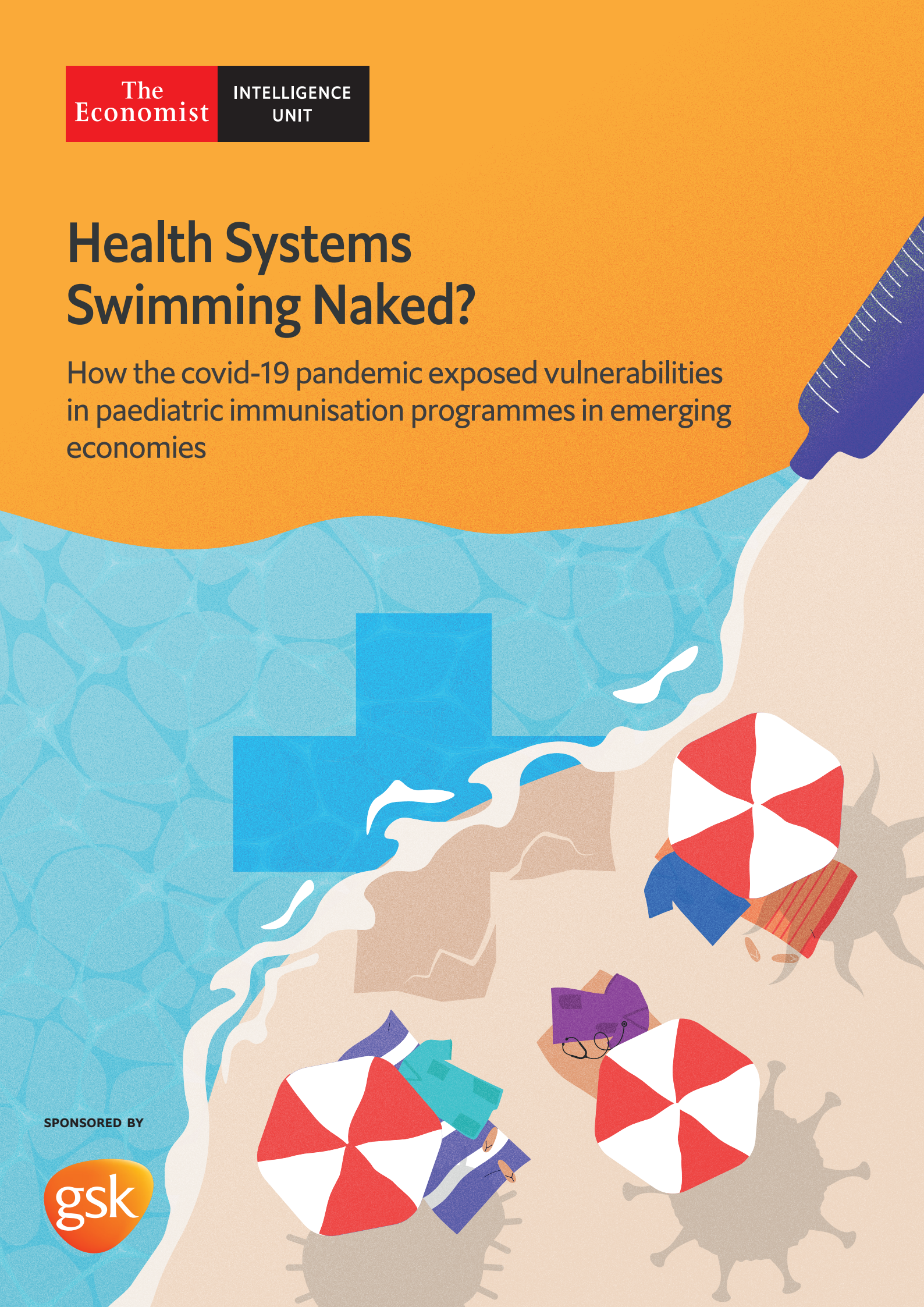
How the covid-19 pandemic exposed vulnerabilities in paediatric immunisation programmes in emerging economies

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# About this report

"Health Systems Swimming Naked? How the covid-19 pandemic exposed vulnerabilities in paediatric immunisation programmes in emerging economies" is an Economist Intelligence Unit report, sponsored by GSK. This reports examines the risk of outbreaks of vaccine-preventable diseases in emerging economies in the face of the pandemic. The emerging economies under study are three Latin American countries: Argentina, Brazil and Mexico; and two countries in Asia: India and Vietnam. This study focuses on four specific diseases which are common in many emerging economies, are dangerous on their own, and on which immunisations have great impact. These are: measles; pertussis (or whooping cough); several forms of meningitis; and paediatric diarrhoeal diseases arising from the rotavirus.

A variety of vaccines are effective against this study's conditions of interest, or at least some forms of them: for pertussis – the first and third (final) doses of DTP (DTP1 and DTP3); for measles – the first and second (final) doses of MCV (MCV1 and MCV2); for rotavirus, a common cause of paediatric diarrhoea, the completed dose of the rotavirus vaccine (RotaC); and for certain forms of meningitis – the third (final) dose of haemophilus influenzae type B vaccine, which helps prevent HiB meningitis (Hib3), the third (final) dose of PCV, an immunisation which helps prevent Spn meningitis (PCV3).

We conducted an evidence review and convened an advisory board to help design a Scorecard to assess the risk from vaccine-preventable diseases in emerging economies. For a full description of the Scorecard, see Appendix. We would like to thank the following individuals who served as our expert panellists on the topic and provided guidance on the Scorecard:

- Dr Florencia Cahn, President of the Argentine Society of Vaccination and Epidemiology (SAVE) and member of the Advisory Committee of the Ministry of Health, Argentina

- Dr Carla Domingues, independent researcher, and former co-ordinator of Brazil's National Immunisation Program, Brazil

- Dr Alejandra Gaiano, Paediatrician specialising in infectious disease, Hospital Materno Infantil de San Isidro, Argentina

- Dr Maria de Lourdes García García, Deputy Director of Prevention and Surveillance in Infectious Diseases, Center for Research in Infectious Diseases, National Institute of Public Health, Mexico

- Dr Karin Regina Luhm, Professor of the Graduate Program in Public Health, Universidade Federal do Parana, Brazil

- Dr Claudio Maierovitch Pessanha Henriques, Physician, Fiocruz Brasília, Brazil

- Dr Jaime Sepúlveda, Executive Director of Global Health Sciences, University of California, San Francisco, US

# Executive Summary

Childhood immunisation programmes are a fundamental foundation of effective health system performance. The covid-19 pandemic and its accompanying disruption impeded the delivery of all elements of healthcare. Vaccine programmes were no exception. According to joint United Nations International Children's Fund (UNICEF) and World Health Organization (WHO) figures, global coverage of doses of DTP1 and DTP3 vaccine declined by 3% in 2020 compared with 2019; for Hib3 and MCV1 the decrease was 2%; and for MCV2, it was 1%.

The declines in coverage reported in the first year of the pandemic were generally smaller than modelling studies and experts alike had predicted, as catch-up efforts valiantly recovered some ground lost during the total shutdowns experienced by numerous immunisation programmes. The results, however, are anything but perfect: the absolute number of 23 million children missing out on basic vaccinations in 2020 is alarmingly high and in need of urgent attention.

Improvement first requires seeing the true nature of the problem. The pandemic has certainly exacerbated it, but it is not the underlying cause. Declining coverage is a multifactorial issue resulting from a highly complex set of medical, political, economic and social interactions.

Although global data are important, vaccine delivery is largely a concern of national health systems. Some country programmes have been strengthened in recent years, others have been allowed to decline. When a highly disruptive event like the pandemic occurs, it places substantial stress on many of these programmes simultaneously, just as an economic downturn does on every company at once. The results for both finance and public health are revealing. To quote Warren Buffett, "only when the tide goes out, do you discover who's been swimming naked."

This Economist Intelligence Unit study, sponsored by GSK, examines the state of paediatric vaccination programmes, how they got this way, and their capacity to improve in future – as revealed by the ebbing tide created by the pandemic. It draws on substantial desk research and consultation with 17 experts which occurred either in discussions within an advisory board early in the project or through detailed interviews later. To organise and assess some of the more pertinent evidence, this project also developed, and introduces here, the Economist Intelligence Unit's *Vaccine-Preventable Disease Scorecard*. This tool can assess the strengths and weaknesses of immunisation programmes in Emerging Economies, in particular in the wake of the pandemic. The Scorecard encompasses five domains:

- **Health system resources:** assesses investment in and access to healthcare

- **Vulnerability to disease transmission:** focusing on social determinants of health

- **Programme performance:** appraising vaccine coverage, its maintenance of coverage over time and equity of coverage

- **Surveillance, preparedness and adopting recommendations:** reviewing the adoption of latest recommendations, the status of surveillance and preparedness for outbreaks

- **Supply and demand:** examining stockouts, storage monitoring, school policies and vaccine hesitancy

For this study, we have used the Scorecard to assess five countries chosen for their intrinsic importance and their diverse levels of economic and healthcare development: Argentina, Brazil, India, Mexico and Vietnam. To provide a consistent overview, we have focussed on four diseases – measles, pertussis (or whooping cough), rotavirus-induced diarrhoea, and vaccine-preventable forms of meningitis – as well as seven vaccinations which can help control these, and which the WHO recommends for every country's vaccine schedule.[1]

The point of the Scorecard is not to judge which country comes first or last: the gold medal here would be the elimination of preventable disease, not bragging rights over EIU scoring. Our hope, instead, is to start a discussion that will help every country get closer to that goal.

The key findings from our Scorecard and overall research programme include:

- **In our study countries, all vaccine programmes provided sub-optimal coverage and required improvements of various kinds, even before the pandemic.**
  In 2019, for the seven vaccination doses that this study covers, no country reached 90% coverage of the target population (the minimum goal in the WHO's Global Vaccine Action Plan). By the end of 2020, our Latin American countries did not reach this coverage level for any of our vaccines, and India for only three. Vietnam went from four to five vaccines with 90% coverage in 2020, but the country also faced much less disruption from the pandemic. The inability of all of our study countries to provide comprehensive vaccination coverage at internationally recommended rates arises from a range of issues. An overview of the Scorecard shows that strong national scores in given domains are rare. More often, the results are middling or weak in most fields.

- **Among our countries, those with greater health system resources are seeing declines in vaccination rates, but those with lower resources are placing a greater focus on achieving the benefits and value that childhood immunisations offer.**
  An attractive attribute of vaccination for health systems is the value for money which it provides. A recent analysis found that investment in childhood vaccination programmes led to a 16-fold return. These gains arose from lower overall health system costs and improved economic productivity for carers. A consequence of this low cost is that health systems in low-income states are able, if they choose, to out-perform ones in middle-income countries in this field. By any measure, our Latin American states have more highly resourced healthcare systems than our Asian study countries. In general, this also leads to better health outcomes in the better-resourced countries. In recent years, the picture for vaccinations is the reverse. Since 2015, coverage rates in Argentina, Brazil and Mexico have generally declined – albeit unevenly and at different speeds – while those in India have grown, and Vietnam's generally high figures have remained largely stable.

1 The vaccinations in question are doses one and three of diphtheria-tetanus-pertussis combined vaccine (DTP1 and DTP3); doses one and two of measles containing vaccine (MCV1 and MCV2); the rotavirus vaccine (RotaC); the third, and final, dose of haemophilus influenzae type B vaccine (Hib3), and the third and final dose of pneumococcal conjugate vaccine (PCV3). The last two also reduce incidence of certain forms of meningitis.

- **The pandemic revealed the growing size of this split.**
  The impact of covid-19 on childhood vaccination rates exacerbated existing trends. As noted above, Vietnam continued to reach most children. India, although its routine immunisation programme was greatly disrupted with the arrival of its first wave of the pandemic in early 2020, showed an impressive ability to claw back lost ground by December. This was consistent with its steady improvement in performance in recent years. The Latin American study countries, however, generally saw ongoing declines in coverage. The few exceptions involved at most modest recoveries in coverage of specific vaccines that had all seen very poor performances in 2019. In 2020, these states provided only around three-quarters of their target populations the vaccines covered in this study. Seven or eight years earlier, such coverage had been nearly universal.

- **A loss of strategic focus helps explain the decline in Latin American vaccination levels, while political commitment undergirds performance in India and Vietnam.**
  One key explanation of the varying immunisation coverage in our countries is the extent of political commitment. In India, vaccination is a key governmental priority: planning, financial and human resources follow accordingly. It is also an important issue for the Vietnamese government. Argentina, Brazil and Mexico, in contrast, have all faced general economic austerity in the last five to six years. The result has been diminished health budgets with vaccination programmes seeing more substantial cuts than other areas of care. This decline in attention has had important knock-on effects. In Brazil and Mexico, institutions which helped direct vaccine efforts have been dissolved. Gaps in governance and a lack of resources have also led to practical problems such as increased stockouts. As experts from the region report, turning the decline around requires not just more resources, but also coherent strategies on how to use them effectively.

  Although these specific problems are currently facing our Latin American countries, the lesson should apply to all, including India and Vietnam as the international funding for their vaccination programmes tapers off. Argentina, Brazil, and Mexico have shown over the years that they can deliver high levels of vaccine coverage. They have also shown how quickly that can diminish when focus is not maintained.

- **Public engagement should never simply be presumed.**
  Vaccine hesitancy, at least related to paediatric vaccination, is not currently a significant problem in any of our study countries outside of Brazil. Events there, however, show how quickly the issue can crystalise. Brazilian expert interviewees point to an inflection point around 2016, when rumours about dangers arising from certain inoculations began to spread rapidly, sparking concern in a growing proportion of the population. Even where hesitancy is low, however, eagerness by patients – or their parents and guardians – for vaccination to take place can wane, especially where the relevant diseases seem to be rare. Effective immunisation programmes need to be aware of how public opinion may

be evolving on vaccines and engage in public education efforts. The latter must respect those who raise issues as members of society with legitimate questions, rather than dismissing them as troublesome impediments to greater vaccination coverage.

- **The substantial progress seen against vaccine-preventable diseases is not irreversible.**
Progress in our five countries against the vaccine-preventable diseases on which this study focuses has been notable in recent decades. In terms of incidence, measures against the pandemic, particularly public health-driven restrictions, have further dampened case numbers for these paediatric illnesses in much of the world. This breathing space should not fool policymakers into over-confidence. As lockdowns and behavioural mandates lift around the globe, communicable diseases will come roaring back. Without better vaccination coverage to support herd immunity, such resurgent conditions will include entirely preventable diseases.

Measles's high contagiousness makes it a useful bellwether. Even prior to the pandemic, at a global level, the incidence of measles was rising rapidly – by 556% between 2015 and 2019. This jump was not even, but driven by outbreaks in specific countries where vaccination programmes were weak. The situation is not yet this ominous in Latin America, but it is worrying that measles, once eliminated from the region, has reappeared in Argentina, Brazil and Mexico. These countries have so far addressed the problem with focussed, local vaccination campaigns in affected areas. Ultimately, though, without better routine vaccination across the population as a whole, the number of outbreaks will only grow. Ad hoc strategies alone will not suffice.

- **Paediatric vaccination programmes should use the assets developed for the fight against covid-19.**
Even as covid-19 has complicated efforts to continue routine childhood immunisation, investments to deal with the pandemic can provide tools for better paediatric vaccination programmes in the years ahead. These include: harnessing the value of public education about the role of vaccination and its public health benefits; integrating the improved and expanded health workforce skills related to delivering immunisations rather than letting them atrophy once no longer needed for covid-19 vaccination efforts; and repurposing information technology (IT) tools, such as India's CoWIN, to improve capacity to monitor and deliver a range of vaccines to the entire target population.

## Key takeaways for policymakers

- Vaccines don't deliver themselves: they require ongoing political commitment, funding, and the application of a coherent strategy.

- Such strategies must take a broad overview of the diverse healthcare, social, economic and political factors which affect vaccination: every country has issues it needs to address, and these may differ from those of its neighbours.

- Existing strategies should be reviewed to consider how the investments, tools and lessons from the battle against covid-19 can bolster childhood immunisation programmes.

- Public engagement and interaction are fundamental to the ongoing effectiveness of vaccination programmes: hesitancy can develop quickly and the very success of immunisation in reducing incidence can undermine belief in the importance of the effort. Covid-19 has brought about greater awareness and understanding of vaccines, potentially providing a platform to improve awareness of routine childhood immunisations.

- Over-confidence can be deadly: without ongoing attention to vaccine programmes, diseases are likely to return and, with them, entirely preventable fatalities.

# I. Introduction: Changing focus from the pandemic to what it is revealing

## Initial omens of danger: the covid-19 pandemic's perceived threat to childhood vaccination

Covid-19 has disrupted healthcare systems worldwide, killing millions directly and by impeding essential medical activity in myriad fields. Until recently, signs showed that substantial drops in vaccination coverage were increasing the huge collateral damage.

For example, in a WHO survey in early 2021, 37% of countries worldwide reported disruption of routine immunisation programmes.[1] Moreover, as of July 2021, 44 countries had postponed a total of 57 mass vaccination campaigns for measles, polio and other diseases.[2] In July 2021, The Lancet published a detailed modelling study which estimated global declines of 7.7% and 7.9% in coverage of, respectively, the third dose of diphtheria-tetanus-pertussis combined vaccine (DTP3) and the first dose of measles-containing vaccine (MCV1). This potentially left millions of children vulnerable to vaccine-preventable diseases (VPDs).

In this context, the title of the UNICEF press release, which appeared a day after the Lancet article, was clear and alarming: "COVID-19 pandemic leads to major backsliding on childhood vaccinations, new WHO, UNICEF data shows."[2] Worldwide, it reported, 16% more children, 3.7m, missed out on basic vaccinations in 2020 compared with 2019. Much of this happened in India, where the number of children not receiving a first dose of diphtheria-tetanus-pertussis combined vaccine (DTP1) more than doubled, from 1.4m to 3.0m. The next biggest increase in missed DTP1 vaccination occurred in Pakistan, Indonesia, the Philippines, Mexico, which combined, saw an increase from 1.8m to 2.8m.

## Yet less damage than expected

A closer look at the data to which the release referred, however, suggests that – while these numbers are of concern – alarm about the direct impact of the pandemic on paediatric vaccinations may be somewhat overstated. At the global level – the one the press release uses – the language belies how moderate the change has been, as measured by the proportion of children being vaccinated. Table 1 shows the global coverage figures for seven childhood vaccines which the WHO recommends every country include in its routine schedule.

**Table 1: Percentage global coverage of seven childhood vaccination interventions**

|         | 2018 | 2019 | 2020 |
|---------|------|------|------|
| DTP1    | 90   | 90   | 87   |
| DTP3    | 86   | 86   | 83   |
| Hib3    | 72   | 72   | 70   |
| MCV1    | 86   | 86   | 84   |
| MCV2    | 70   | 71   | 70   |
| PCV3    | 46   | 49   | 49   |
| RotaC   | 34   | 39   | 46   |
| **Average** | **69.1** | **70.4** | **69.9** |

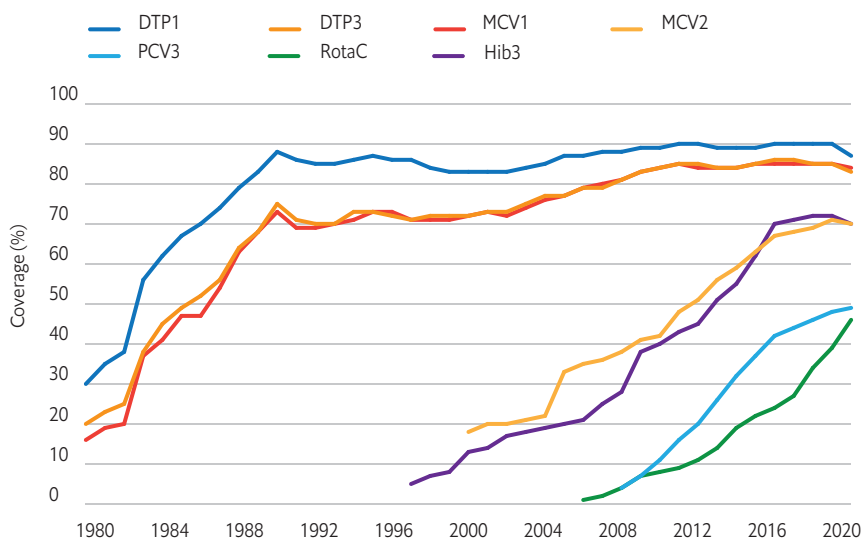Source: WHO and UNICEF Estimates of National Immunization (WUENIC), 2021

These numbers give a muddied picture. It is impossible to call them good: none of these vaccines has the minimum 90% coverage level aimed for by 2020 in the WHO's Global Vaccine Action Programme 2011-2020 (GVAP) – a goal endorsed by the World Health Assembly in 2012.[3] Also, coverage of the most widely distributed vaccines, DTP1 and DTP3, dropped noticeably.

On the other hand, the decrease in DTP3 coverage was less than half of the Lancet article's projection and, for MCV1, roughly a quarter. For the five vaccines where declines occurred, Paul Offit – Maurice R. Hilleman Professor of Vaccinology at University of Pennsylvania and Jerome Kim – Director-General of the International Vaccine Institute – agreed that the declines were smaller than had been expected. Meanwhile, growth in the coverage of complete rotavirus vaccination

(RotaC), which combats a common form of paediatric diarrhoea, actually accelerated slightly in 2020 compared to 2019 and coverage of PCV3 (pneumococcal conjugate vaccine, with coverage measured for the third and final dose) has retained its increase from the previous year.

Moreover, like the impact of covid-19, immunisation rates are not a global, but very country-specific, issue. In 2020, for the four vaccines from this list on which China reports – DTP1, DTP3, MCV1 and MCV2 – it achieved 99% coverage in 2020. India certainly did see a drop in vaccinations during its 2020 lockdown, but initial data suggest that its catch-up efforts recovered much of the lost ground.[4] Although the decline in coverage for many of these vaccines in India continues to require attention, as Kayla Laserson – Deputy Director for Infectious Diseases and Vaccine Delivery

**Figure 1: Global vaccine coverage, selected antigens, 1980-2020**



Source: WHO/UNICEF Estimates of National Immunization Coverage, 2020 Revision.

at the Bill & Melinda Gates Foundation and former Director of the US CDC's India office – notes, the system "did not implode".

## Instead, the pandemic made substantial existing problems impossible to ignore

If the data only weakly support a characterisation of "major backsliding," on a global scale, are public health officials exaggerating concerns about the state of childhood vaccination? Far from it.

While, on its own, the pandemic is neither an insurmountable nor a universal challenge, it reveals a much more dangerous problem of longer standing: a decline in focus on childhood vaccination against entirely preventable diseases in various countries.

Globally, vaccination is a story of substantial progress over recent decades mixed with worrying stasis in the last few years. Figure 1 shows estimates for worldwide coverage of various key childhood vaccinations.

Adoption of new vaccines into routine schedules follows a pattern. The positive part is a generally steady initial spread. The negative is a marked tendency for immunisation rates eventually to level off below the GVAP target of at least 90%.

Global case numbers illustrate the impact on health outcomes. Administration of multiple doses of the DTP vaccine, which inoculates against pertussis, and the first dose of MCV grew increasingly common in the 1980s and 1990s. They then rose more slowly until around 2010, when they levelled off.

**Figure 2: Cases of Measles and Pertussis reported to WHO by year**
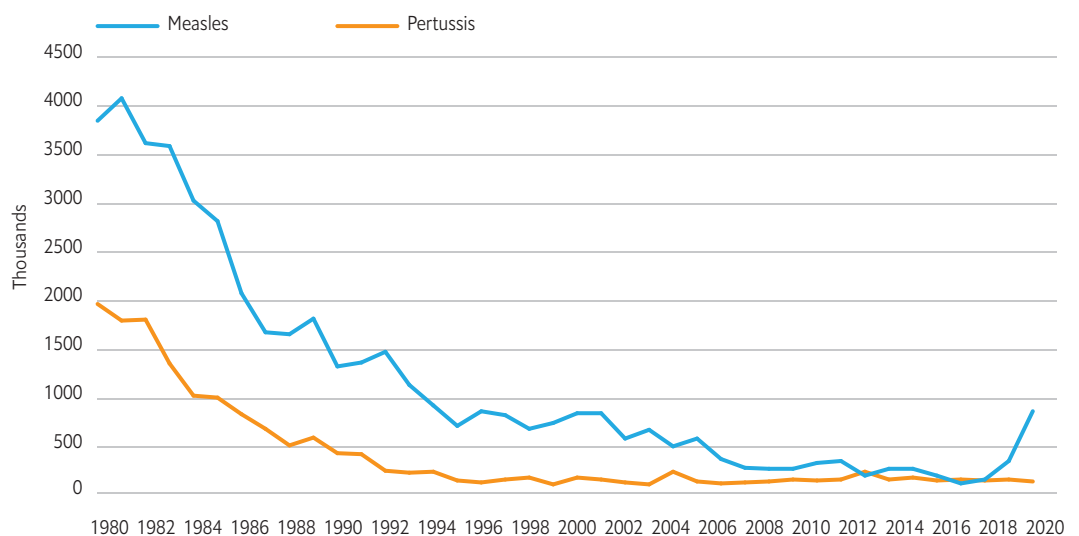


Source: WHO Surveillance for Vaccine Preventable Diseases

Meanwhile, worldwide case numbers displayed an inverse pattern to vaccine coverage, with particularly rapid drops in the 1980s and 1990s. Measles continued to decline more noticeably from 2000 to 2010, presumably because of the increasing deployment of MCV2. According to the WHO, these case reductions, along with those of other VPDs, has greatly contributed to the decline in childhood mortality since 1990.[5] After that year, deaths among the under-fives drop from 92 per thousand live births to 38 in 2019.[6]

These gains are definitely welcome but, when vaccine coverage levelled off, so did the decline in cases. Hundreds of thousands are still infected every year by these and other VPDs as vaccination lags behind the GVAP goal.

The quite visible sting in the tail of measles case numbers in Figure 2 is an important sign of the health damage that can ensue. Indeed, since 2016, global deaths from the disease have increased by 50%.[7] The concern goes beyond a single condition. Walter Orenstein, Professor at Emory University's Vaccine Centre, calls measles "a canary in a coal mine". Because of its high transmissibility, he adds, "it is often the first disease to rebound" when vaccination programmes weaken.

The nature of the 2019 global measles resurgence – to levels not seen since the turn of the century – is instructive. Nearly 70% of the 873,022 cases occurred in just three countries: Democratic Republic of Congo (DRC) (333,017), Madagascar (213,231) and Ukraine (57,282). Each has experienced weaknesses in measles vaccination. Neither

of the two African states routinely provides MCV2. As for MCV1, coverage has never been very high (DRC's peaked at 74% in 2010 and Madagascar's at 81% in 2007). Moreover, in the last decade, both have seen coverage decline: in most recent years it has been between 50% and 60%. Ukraine's problems have been different. Historically, coverage of both MCV1 and MCV2 has normally been over 90%. Between 2007 and 2016, however, there was a dramatic fall with figures usually coming in at between 30% and 70% for both.

The stability of global vaccination coverage rates obscure the shifts – sometimes marked – within countries. For every nation seeing progress, others have seen regression, occasionally to a point where significant outbreaks become possible. In other words, some countries are doing very well, while others are letting vaccination coverage – and as a result health outcomes – slide.

Covid-19 has forced countries with both weak and strong vaccination programmes to wrestle with the pandemic's many challenges. To look at the global averages, the damage has been visible but muted. However, just like an economic downturn shows which companies have not paid enough heed to the economic basics – or to quote Warren Buffett famous line, "only when the tide goes out do you discover who's been swimming naked" – the pandemic and the response in the coming years will reveal which countries have left themselves more exposed to a possible resurgence in VPDs.

# II. A closer look at the study's swimmers

## An overview of our beach: five countries, four conditions, seven vaccines

As already noted, broad generalisations about childhood vaccinations can hide as much as they reveal. This study, therefore, takes a narrower focus in order to illustrate the nuances of challenges in this field.

To begin with, it looks at five countries in, broadly speaking, two categories. Three – Argentina, Brazil and Mexico – are upper-middle income states in Latin America. Two – India and Vietnam – are lower-middle income Asian ones. The countries were chosen for their intrinsic importance and their diverse levels of healthcare development.

Rather than try to consider the entire field of VPDs, this study concentrates on four specific ones which have been common in

many emerging economies, are dangerous on their own, and on which immunisations have great impact. These are: measles; pertussis (or whooping cough); several forms of meningitis; and paediatric diarrhoeal diseases arising from rotavirus.

Progress against these conditions has been substantial in recent decades, and not just in case numbers. Among people aged under 5, for measles, the global number of deaths per 100,000 dropped from 83.7 in 2000 to 10.5 in 2019. Over the same period, the equivalent figures for pertussis were 29.3 and 16.3; for meningitis, 36.9 and 16.9; and for diarrhoeal diseases arising from rotavirus, 198.3 and 75.5.[8]

These improvements have been of different magnitude and occurred at different times across our study countries. The charts show the incidence and mortality rates, among those

**Figure 3: Mortality rate from rotavirus (per 100k people) in under-5 population**
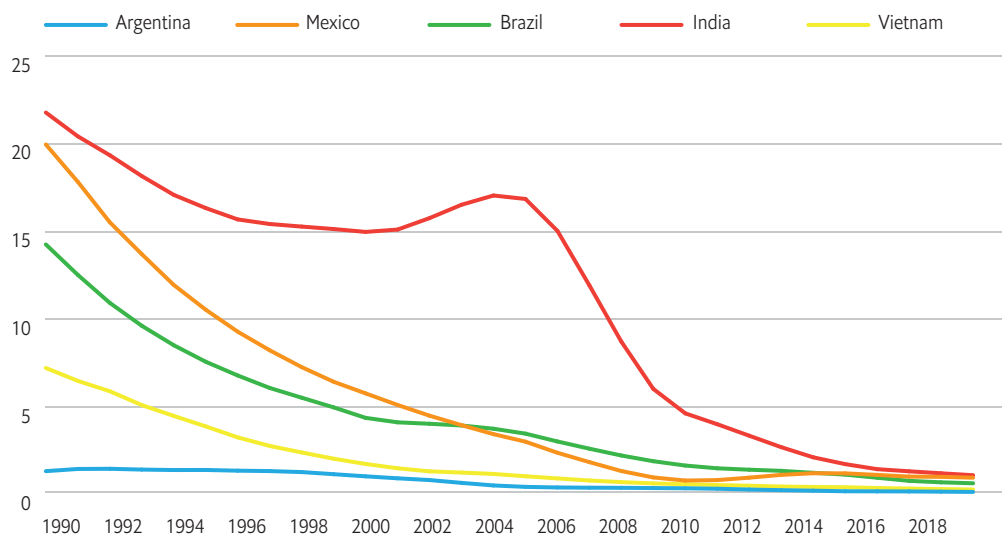


Source: Global Burden of Disease, 2019

**Figure 4: Mortality rate from measles (per 100k people) in under-5 population**

Argentina — Mexico — Brazil — India — Vietnam
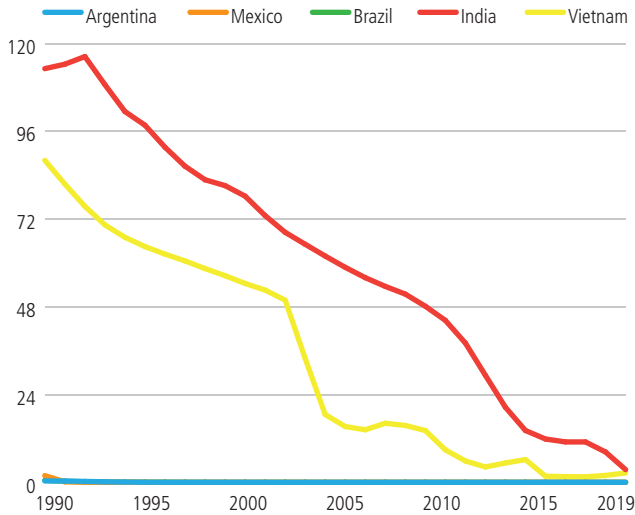


Source: Global Burden of Disease, 2019

**Figure 5: Incidence of rate from Measles (per 100k people) in under-5 population**

Argentina — Mexico — Brazil — India — Vietnam
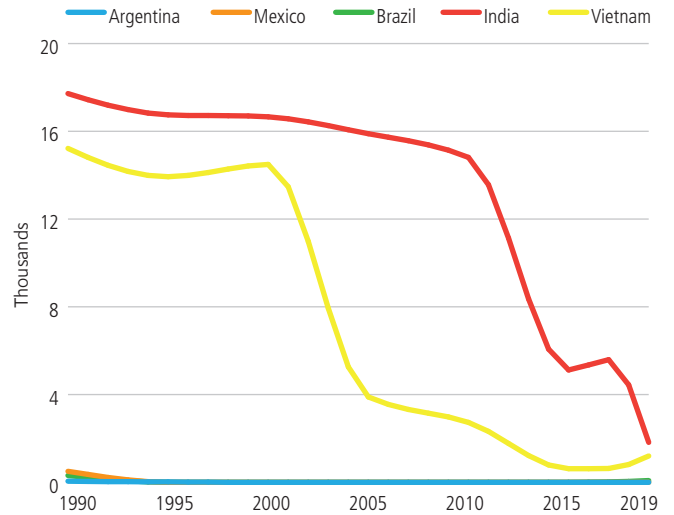


Source: Global Burden of Disease, 2019

**Figure 6: Mortality rate from pertussis (per 100k people) in under-5 population**

Argentina — Mexico — Brazil — India — Vietnam
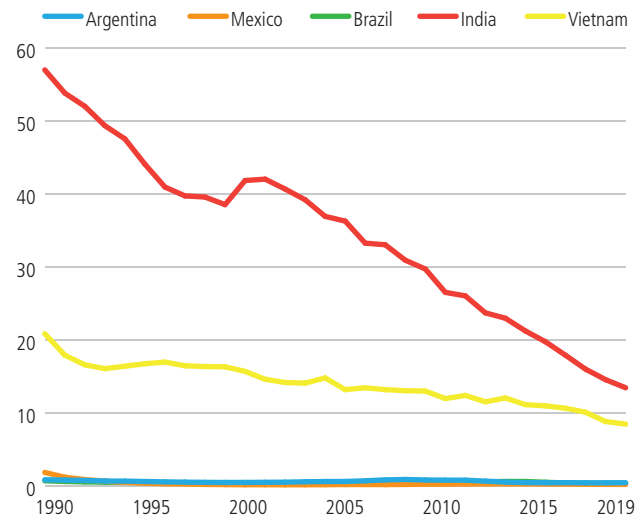


Source: Global Burden of Disease, 2019

**Figure 7: Incidence of rate from Pertussis (per 100k people) in under-5 population**

Argentina — Mexico — Brazil — India — Vietnam
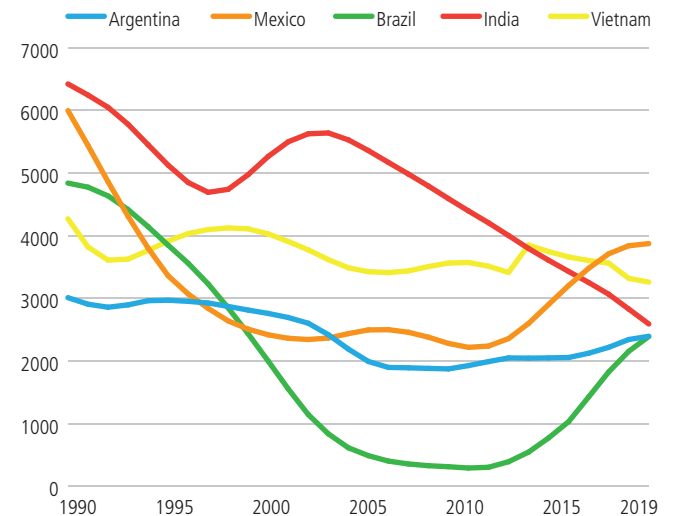


Source: Global Burden of Disease, 2019

aged under-5, from measles and pertussis in our study countries from 1990 to 2019, while only mortality data is available for rotavirus-related disease. As they show, childhood deaths from measles and pertussis were already rare in the Latin American states by the 1990s, but only recently dropped rapidly in India and Vietnam. All of the states have seen a decline in rotavirus-related mortality: India's is the most marked, but Mexico and Brazil have also made notable progress.

Immunisation has played a major role in these declines. A variety of vaccines are effective against this study's conditions of interest, or at least some forms of them, and data are widely available on coverage of different recommended stages of their application: for pertussis –DTP1 and DTP3; for measles – MCV1 and MCV2; for rotavirus – RotaC; and

for certain forms of meningitis – PCV3 as well as Hib3. This choice is not to suggest that other diseases are unimportant, or that efforts to expand coverage of other vaccines in national schedules, or even to introduce new ones, is less valuable. Instead, some restriction is needed to maintain international comparability.

## How were the countries swimming before 2020?

Although the vaccines in question have proved their worth, their deployment is far from universal. As shown in Figure 1, from 2016 to 2019, global coverage rates for DTP1, DTP3, and MCV1 were largely static, for Hib3 and MCV2 improvement was slow, and for RotaC and PCV3, slightly more pronounced. This overall slow progress

**Figure 8: Brazil: Coverage of selected vaccines, 2015-2020**
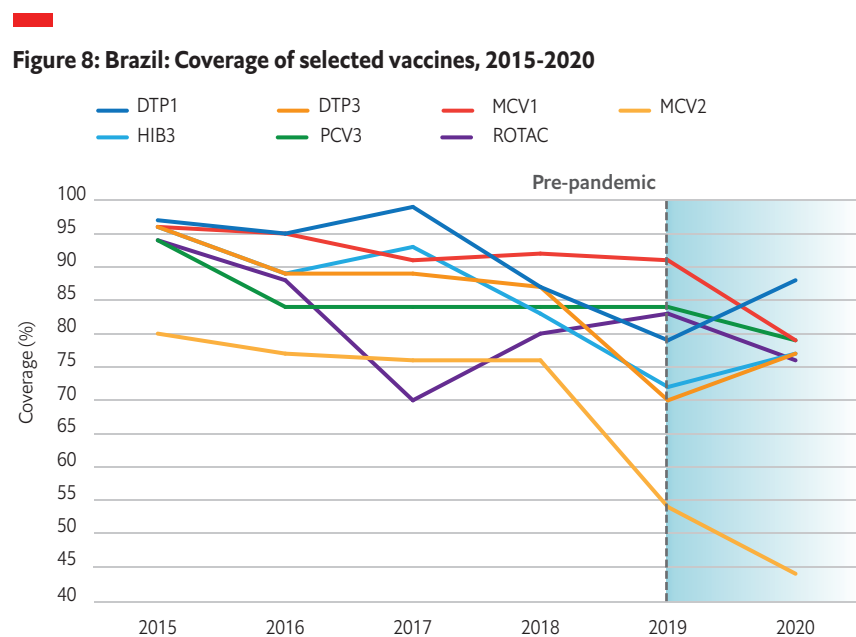


Source: WUENIC, 2021

**Figure 9: Mexico: Coverage of selected vaccines, 2015-2020**
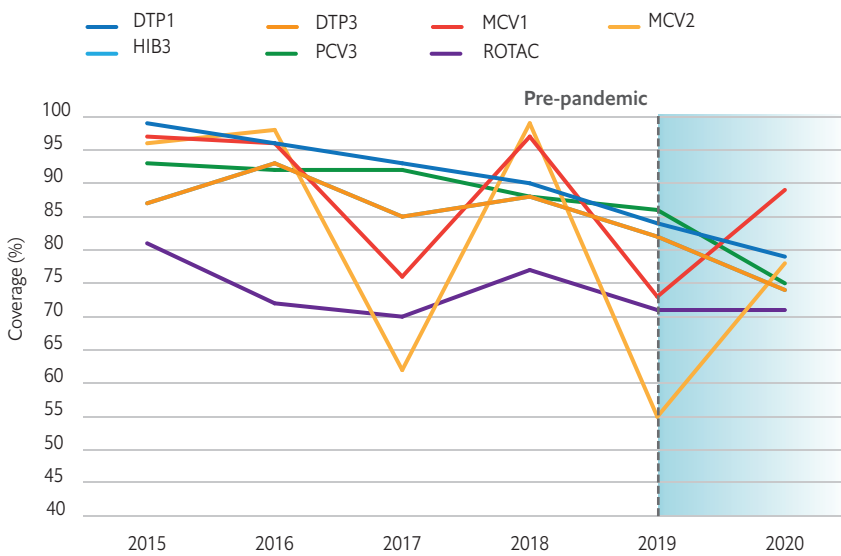


Source: WUENIC, 2021

**Figure 10: Argentina: Coverage of selected vaccines, 2015-2020**
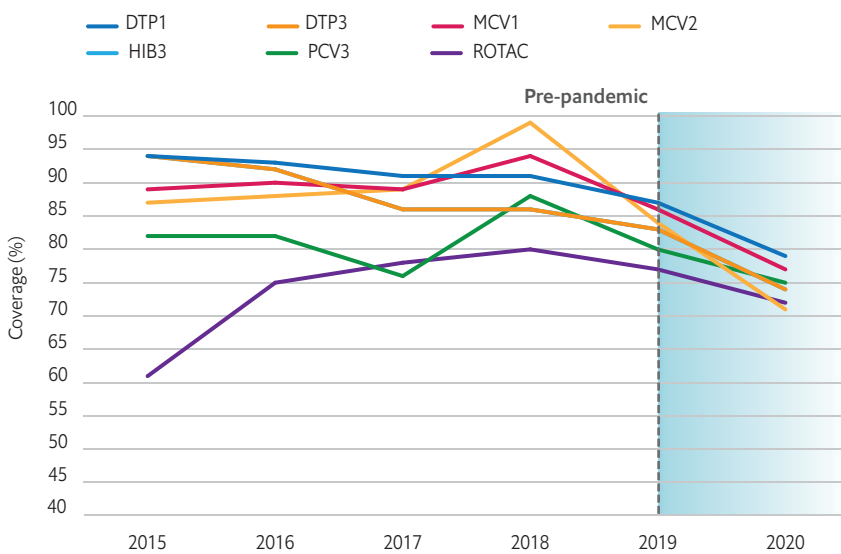


Source: WUENIC, 2021

has been frustrating for the public health community, as none of these immunological tools except perhaps DTP1 – depending on the data source[2]– have ever reached the GVAP 90% minimum goal.

In our study countries, however, distinct patterns emerge. Between 2005 and 2015, for most years the Latin American countries benefitted from over 90% coverage for DPT1, DPT3, MCV1, MCV2 and Hib3. Except for MCV2 in Brazil, the only exceptions were a few dips in coverage in individual years for specific vaccines which still reached over 80% of the target population. Rotavirus vaccine and PCV were introduced later than the others in the region, but RotaC and PCV3 achieved target coverage soon after in Brazil and Mexico.

After 2015, however, the situation deteriorated. Figures 8, 9 and 10 – using data from the WHO and UNICEF – show national coverage rates for the seven vaccines between 2015 and 2019. The unmistakable trend is downward, albeit at different speeds and with occasional brief reversals. Of these national data sets, the Mexican figures may be even worse than those presented. A 2021 study published in *The Lancet* estimated that the country's reported DTP1 and DTP3 coverage rates have likely been overestimated by around 7% in recent years.[9]

These declines bring with them growing dangers to health. That first harbinger of

trouble, measles, has broken out in each of the Latin American study states after having disappeared from the Americas in 2016.[10] Brazil went from zero cases of the disease in 2016 to over 20,000 in 2019.[11] The incidence has been limited to outbreaks of around 120-130 in Argentina and Mexico in 2019 and early 2020. Florencia Cahn, President of the Argentinian Society for Vaccination and Epidemiology, notes that the 130 cases reported in 2019 was the highest incidence in Argentina in two decades. "There are many diseases that are latent like that," she adds. "If vaccination coverage goes down and down, not only is there a risk for those not vaccinated, but also that herd immunity is lost ."

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**In Brazil, if we continue to maintain this level of coverage, we may have a recrudescence of several preventable diseases. This will be a giant step backwards.**

Dr Carla Domingues – independent researcher, and former co-ordinator of Brazil's National Immunisation Program

The situation is markedly different in our Asian countries. Vietnam does not have PCV3 or RotaC in its routine childhood vaccination schedule. For our five other vaccines, it reports that it has been above or near 90% except for a brief drop in 2018 in DTP vaccines, which arose because of national and district stockouts that year.[12]

The estimates from *The Lancet* mentioned above suggest that these figures may be

[2] WHO and UNICEF Estimates of National Immunization (WUENIC), 2021, put the DTP1 figure at 89% to 90% for much of the last decade, but the global estimates appearing in The Lancet this year stay slightly below 90% over this period (GBD 2020, Release 1, Vaccine Coverage Collaborators, "Measuring routine childhood vaccination coverage in 204 countries and territories, 1980–2019: a systematic analysis for the Global Burden of Disease Study 2020, Release 1," The Lancet, 2021.

**Figure 11: Vietnam: Coverage of selected vaccines, 2015-2020**
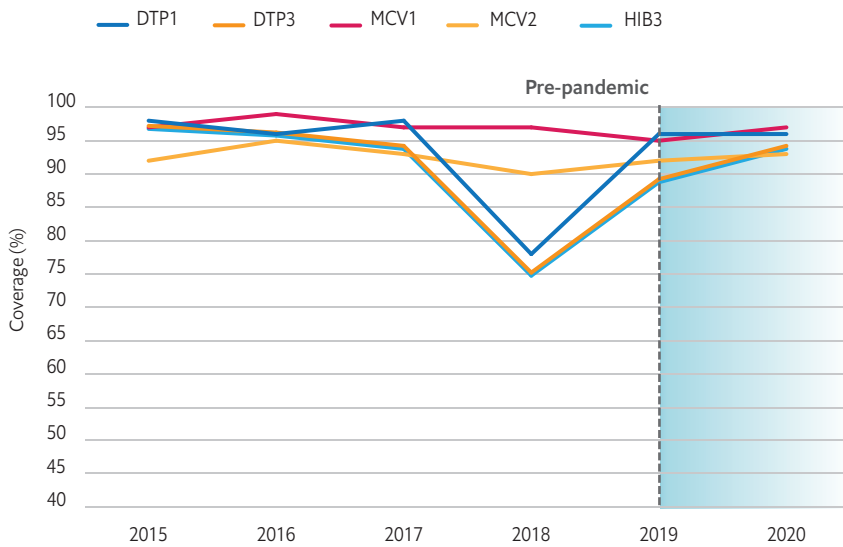


Source: WUENIC, 2021

**Figure 12: India: Coverage of selected vaccines, 2015-2020**
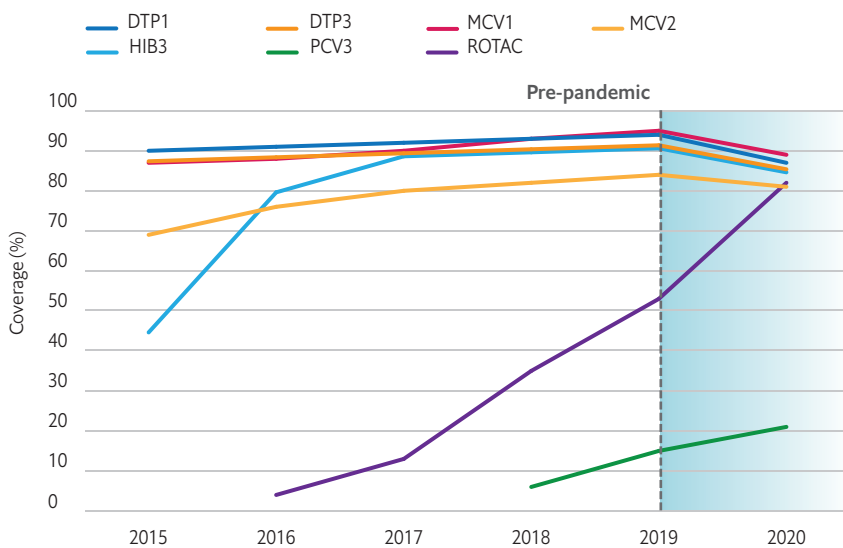


Source: WUENIC, 2021

slightly too high – putting the figures in the low- to mid-80s. Similarly, serological surveys have found that, for measles, the WUENIC estimates are poor predictors of actual levels of immunity. On the other hand, even the lower Lancet figures indicate a largely steady level of coverage in recent years.[9, 13]

India, on the other hand, saw marked, steady progress between 2015 and 2019 so that DPT1, DPT3, MCV1 and Hib3 had coverage of over 90% and MCV2 was at 84%, up from 69% in 2015. More than half of the target population also received RotaC in 2019, up from 0% in 2015. By 2019, this greatly expanded coverage already seemed to be contributing to substantial health outcome improvement. According to WHO data, the number of cases of measles in the country dropped by nearly two-thirds, from 30,168 to 10,430 between 2015 and 2019. For pertussis, the equivalent figures were 25,206 and 11,875.[6]

# III. The tide rolls out: the pandemic and childhood vaccination

## The impact on 2020 coverage

As with coverage rates before the pandemic, 2020 vaccination figures tell different stories depending on the country.

The biggest outlier in our group is Vietnam.

**Table 2: Coverage rates for selected vaccines in Vietnam, 2019-2020**

|         | 2019 | 2020 | Change |
|---------|------|------|--------|
| DTP1    | 96   | 96   | 0      |
| DTP3    | 89   | 94   | ↑5     |
| Hib3    | 89   | 94   | ↑5     |
| MCV1    | 95   | 97   | ↑2     |
| MCV2    | 92   | 93   | ↑1     |
| **Average** | **92** | **95** | **↑3** |

Source: WUENIC, 2021

For the five study vaccines on which it reports, coverage stayed the same or increased. The country may be the exception because of its limited pandemic experience in 2020. Among its 96m population, except for a brief period in March and August, Vietnam's 7-day average for daily covid-19 cases never hit double digits. Challenges were not completely absent. In early 2020, some disruption of vaccination programmes for most antigens in the country's schedule occurred.[14] Nevertheless, the very small covid-19 burden on the health system would have kept these difficulties to a minimum during the year.

In 2021, the covid-19 situation in Vietnam worsened. Dr Pham Quang Thai, Vice Head of Communicable Diseases Control and Prevention, National Institute of Hygiene and Epidemiology (NIHE), Vietnam, informs us that the increased covid-19 burden this year has led to a halt in "routine immunisation services in districts identified as high-risk". However, he explains that campaigns are in place to catch-up on any missed vaccinations, "if a child misses a vaccine due to a covid-19, two or three months later when the situation is controlled, the mother will receive an invitation by letter and by SMS to come for their vaccinations." With over 18,000 vaccination sites around the country, Dr Thai, adds that "the systems, staff and vaccine supplies are in place to catch-up on the decrease caused by the pandemic."

The situation in Latin America has been markedly different, and often worse than the global picture.

> **The systems, staff and vaccine supplies are in place to catch up on the decrease caused by the pandemic.**

Dr Pham Quang Thai, Vice Head of Communicable Diseases Control and Prevention, National Institute of Hygiene and Epidemiology (NIHE), Vietnam

As the chart indicates, Argentina's coverage has dropped for every vaccine. Although coverage of some has risen in Brazil and Mexico, this doesn't constitute progress so much as very partial recoveries from earlier sharp declines. Mexico's measles vaccination figures in 2019 dropped to their lowest this century, with MCV2's coverage falling from 99% to 55%. Seemingly dramatic rebounds in 2020 still leave coverage rates at nearly their lowest since 2000. Although the size of the swings are smaller for Brazil, the story is the same. DTP1, DTP3 and Hib3 coverage figures in 2019 were also the lowest for the country this century, and for the latter two vaccines, 2020 figures were the second-lowest.

> **The decrease in coverage – and even in the doses given – is a fact, and it is going to be a pose a significant challenge for our country [Argentina].**
>
> Dr Florencia Cahn, President of the Argentine Society of Vaccination and Epidemiology (SAVE) and member of the Advisory Committee of the Ministry of Health, Argentina

**Table 3: Coverage rates for selected vaccines in Argentina, Brazil, Mexico, 2019-2020**

|  | Argentina | | | Brazil | | | Mexico | | |
|---|---|---|---|---|---|---|---|---|---|
|  | 2019 | 2020 | Change | 2019 | 2020 | Change | 2019 | 2020 | Change |
| DTP1 | 87 | 79 | ↓8 | 79 | 88 | ↑9 | 84 | 79 | ↓5 |
| DTP3 | 83 | 74 | ↓9 | 70 | 77 | ↑7 | 82 | 74 | ↓8 |
| Hib3 | 83 | 74 | ↓9 | 72 | 77 | ↑5 | 82 | 74 | ↓8 |
| MCV1 | 86 | 77 | ↓9 | 91 | 79 | ↓12 | 73 | 89 | ↑16 |
| MCV2 | 84 | 71 | ↓13 | 54 | 44 | ↓10 | 55 | 78 | ↑23 |
| PCV3 | 80 | 75 | ↓5 | 84 | 79 | ↓5 | 86 | 75 | ↓11 |
| RotaC | 77 | 72 | ↓5 | 83 | 76 | ↓7 | 71 | 71 | 0 |
| **Average** | **83** | **75** | ↓8 | **76** | **74** | ↓2 | **76** | **77** | ↑1 |

Source: WUENIC, 2021

Experts from the region point to the size of the problem rather than any positive signs. Dr Gustavo Olaiz – General Co-ordinator of the Centre for Research, Policies, Populations and Health of the Faculty of Medicine of the National Autonomous University of Mexico – notes that, in his country, "everything in healthcare is being kept on standby. Vaccination is no different." Dr Domingues, adds of Brazil that there has been a marked decline in coverage of most vaccines: "this situation is really very serious."

India presents a slightly different picture again.

Although coverage grew for RotaC and PCV3 – both recently introduced into the country's schedule – it declined for the other vaccines in

**Table 4: Coverage rates for selected vaccines in India, 2019-2020**

|         | 2019 | 2020 | Change |
|---------|------|------|--------|
| DTP1    | 96   | 96   | ↓7     |
| DTP3    | 89   | 94   | ↓6     |
| Hib3    | 89   | 94   | ↓6     |
| MCV1    | 95   | 97   | ↓6     |
| MCV2    | 92   | 93   | ↓3     |
| PCV3    | 15   | 21   | ↑6     |
| RotaC   | 53   | 82   | ↑29    |
| **Average** | **76** | **82** | ↑6 |

Source: WUENIC, 2021

our study. That said, these drops were usually lower than those seen in Latin America. This more moderate decline, combined with higher figures in 2019, left 2020 coverage in India consistently higher than in Argentina, Brazil and Mexico for most vaccines.

Moreover, expert observers from the country add that the important vaccination story from 2020 in India is not the overall drop in coverage for some vaccines. Instead, they focus on the remarkable progress made catching up after initial dislocation when covid-19 appeared in March. Raj Shankar Ghosh – Senior Advisor, Vaccine Delivery at the Bill & Melinda Gates Foundation, India – recalls that "when India went into lockdown, we saw a rapid decline in coverage. Initial data suggested that we had seen at least a 60 to 70% fall. I had expected more. But the programme picked up and, by November, it had come back to nearly where it was a year earlier." Dr Laserson adds that "even in the first wave [of the disease in 2020], there was a quick return to essential health services and a focus on immunisation among these, including how to make it safe."

A study from Rajasthan – an Indian state with per capita GDP lower than that of the country as a whole – found that, while catch-up efforts there had not completely closed the gap with the previous year, vaccination coverage was only a few percentage points behind for children who turned one-year old in September or October 2020.[4]

Expert interviewees also report that India has been able to cope with disruption to its vaccination programmes better during the 2021 wave. Gunjan Taneja – Vaccine Delivery Program Officer at the Bill & Melinda Gates Foundation, India – notes that, although

reduced, routine vaccination has continued during this period. Dr Laserson concludes, "India is really resilient. There will be campaigns [or initiatives] to make sure things do not go off track very long."

## Vaccine-Preventable Disease: An unexpected breathing space

How quickly will VPDs grow in the wake of the most recent declines in coverage?

Measles data again give an indication, although the short-term news is positive. While Mexico saw a worrying outbreak in early 2020 of 196 cases, the annual figures for Brazil and Argentina were markedly down from 2019 (from 20,901 to 8,448, and 130 to 61, respectively).[15] Meanwhile, Indian government data report that between April and November 2020, the country had 2,826 cases among children under five, compared to 12,125 over the same period in 2019.[16]

Dr Orenstein explains that this decline is a global phenomenon. "In the US in 2020, we had 13 cases of measles [down 100-fold from 2019[17]]. We've never seen anything like that." Although the pandemic and attendant lockdowns may have impeded disease surveillance, he says, they have also had a salutary effect on most communicable diseases. "Social distancing and masking are reducing the risks of exposure," Dr Orenstein concludes.

Unsurprisingly, we cannot expect this lull to last long beyond the end of lockdowns. As Dr Offit puts it, once mandatory restrictions on behaviour are removed and inhibitions fade, communicable diseases "will come roaring back".

The risk is more than a short, sharp surge. Where children miss out on vaccinations, they continue to be susceptible to these diseases in the years ahead. As they age, the danger can increase explains Dr Orenstein. "A child in high school has far more contacts than pre-school ones. The immunity level needed is higher." The 2020 measles outbreak in Mexico affected older individuals still, beginning among adult prison inmates. Even if countries avoid immediate outbreaks, the risks of under-vaccination can last decades.

Catch-up programmes will be necessary, although in some countries these, too, are blocked by the pandemic. Too great a focus on them, however, misses the longer term challenge in any number of countries – a need to address declines in coverage that began before 2020. As Dr Olaiz says of the pre-pandemic normal in Mexico, "we have a cohort of children who are growing up without immunisations. We have to work to reach those children. The danger is real."

"The big question" in the fight against VPDs, says Dr Orenstein "is will people take this as a sign that we need to improve overall immunisation programmes?" This will be a question for health systems in which the pandemic exposed weaknesses as well as those which responded well. The following section looks at the characteristics in vaccine programmes which will shape each country's answer to that question.

# IV. The Vaccine-Preventable Disease Scorecard and the challenges it reveals

## Introducing the Economist Intelligence Unit Vaccine-Preventable Disease in Emerging Economies Scorecard

"Vaccines  don't deliver themselves," explains Dr Orenstein. "You need to have an infrastructure and ways to take corrective actions to address problems that could come up." Nor, adds Heidi Larson – Professor at the London School of Hygiene & Tropical Medicine and Founding Director of its Vaccine Confidence Project – are the problems solely practical ones like cold chain maintenance, important as those are. "Scientists in their labs are very remote from political, cultural and social realities, while public health authorities are driven almost evangelically about the good things we have to offer. How could people not want these things? But, that is not always the reality."

Ultimately, the provision of vaccines, and their uptake by the population, involves a highly complex set of medical, political, economic and social interactions. A recent Brazilian academic article lists some of the more important possible reasons for the decline in Latin American vaccine coverage: "ignorance of the importance of vaccination, vaccine hesitancy, fake news…on the purported harms of vaccines for health, partial shortages of some products, and operational problems with the execution of vaccination, ranging from inadequate data recording to difficult access to health units".[18] Nor are these interactions thoroughly understood. Dr Orenstein explains that "although it is harder to sell, we need to be ready to support implementation science research, not just vaccine development research."

> **Vaccines don't deliver themselves. You need to have an infrastructure and ways to take corrective actions to address problems that could come up.**
>
> Prof Walter A. Orenstein, Professor of Medicine, Epidemiology, Global Health, and Paediatrics, Associate Director of the Emory Vaccine Center, US

A comprehensive examination of all the possibly relevant issues would be beyond the scope of this study. As a step towards a greater understanding of the factors that have affected vaccine programmes in our study countries – and will shape their capacity for possible improvement – the Economist Intelligence Unit has developed the broadly-based *Vaccine-Preventable Disease in Emerging Economies Scorecard.*

The Scorecard is a benchmarking tool which has gathered data, where available, for 19 indicators relevant to success against VPDs. These indicators vary widely, from levels of vaccine coverage to social determinants of

health, such as poverty rates, which often correlate with infection levels for various diseases.

The indicators are combined into five domains: Health System Resources; Drivers of Vulnerability to Disease; Immunisation Programme Performance; Surveillance and Adoption of International Recommendations; Supply- and Demand-Related Factors. Of these, four are scored. Vulnerability to Disease and its four indicators are not assigned points but given as key background information.

The scoring of each indicator is specific to the data being assessed. In some cases, these results reflect whether a key policy choice has been made, for example, the inclusion of new vaccines in the routine schedule. In others, it depends on how well a country does on performance against internationally accepted measures: such as reaching 90% vaccination coverage. For further details on the Scorecard, please see Appendix.

The greatest value of these scores is as a tool for benchmarking performance on individual indicators, or at most domains. We have not produced an aggregate result, as individual indicator scores were not devised so that they could be easily weighted relative to their importance. Indeed, the point of the framework is not to judge which country comes first or last: the gold medal here would be the elimination of preventable disease, not bragging rights over the Scorecard. Our hope, instead, is to start a discussion that will help every country get closer to that real medal podium.

## Lessons from the Scorecard

Any tool such as this Scorecard inevitably paints broad strokes rather than giving specific and comprehensive details. Its results nevertheless allow for the identification of several key issues.

**Scorecard**

| Domain | Argentina | Brazil | India | Mexico | Vietnam |
|---|---|---|---|---|---|
| 1. Health systems resources | High | Med | Low | Med | Med |
| 2. Performance of immunisation programs | Low | Low | Med | Low | Med |
| 3. Adhering to latest recommendations, surveillance & preparedness for outbreaks | High | Med | Med | Med | Med |
| 4. Supply-and demand-related factors | Med | Med | High | Med | Low |

Key: Low ▮▮▮ High

Note: An additional domain 'Vulnerability to infectious disease transmission' is a quantitative un-scored background indicator. Refer to Appendix for further details.

Source: Economist Intelligence Unit

**(i) Room for improvement**

Looking at the Scorecard as a whole, the most remarkable attribute is that the pandemic's revelations may have been starker for some countries. In the accompanying chart, the domain scores have been coded as traffic lights, with low results red, high ones green, and those in between amber.

Although greens exist, they do not dominate – amber does. Just as noticeable, every country has at least one red domain. As health systems seek to recover from the pandemic's effect on childhood vaccine programmes, they will need to address a range of challenges simultaneously. In Dr Cahn's words, "the challenge is going to be great. It will be critical to think out a well-regionalised strategy not only for each country, but also [in sub-national divisions] according to local characteristics."

**(ii) Resources do not guarantee effective vaccination programmes**

One great attraction of vaccination is the return on investment. A recent analysis examining low- and middle-income countries for the period 2011-2020 found that overall, for vaccinations against 10 important childhood preventable diseases, the return in lower health system costs and lost carer productivity was 16 times greater than the expense of the immunisation programme.[19] Vaccinations are not only affordable for many countries, they are frequently money saving.

Counterintuitively, our Scorecard shows an apparent disconnect between the general strength of health system capacity and recent vaccination coverage performance.

Health facilities in our Latin American study countries are far better resourced than those in India or Vietnam. Argentina, Brazil, and Mexico, for example, have the workforce needed to provide universal health coverage if organised well. So far, India and Vietnam fall short.

A closer look at the data deepens the contrast. The Healthcare Spending indicator awards one point if the combined government and mandatory outlay on healthcare in the most recent year for which data are available – 2018 in our case – exceeds 5% of GDP. This is the WHO-recommended minimum necessary for Universal Health Coverage (UHC). Here, although Argentina comes in above the bar at 6%, its Latin American peers fall below, with 4% in Brazil and 3% in Mexico. By this metric, the latter ties Vietnam's outlay. This apparent parity, though, disappears when looking at actual figures rather than proportion of GDP. After adjusting to use Purchasing Power Parity (PPP) dollars, government and mandatory spending on the Brazil and Mexican health systems were $639 and $532, respectively. While low by global standards, these far exceeded Vietnam's $207 and India's $75.[20] It should also be noted that spending, in PPP terms, has been flat or declining in the Latin American states in recent years, while it has steadily increased in Vietnam and India. This is reflective of changes in economic growth in Vietnam and India. However, spend as a proportion of GDP stayed largely static in all five countries.

| Indicator | Notes | Scoring range | Argentina | Brazil | India | Mexico | Vietnam |
|---|---|---|---|---|---|---|---|
| **1.1 Healthcare spending** | What is the current government health expenditure as a % of GDP? | 0-1 | 1 | 0 | 0 | 0 | 0 |
| **1.2 Health workforce** | What is the general medical workforce per 1000 people? | 0-1 | 1 | 1 | 0 | 1 | 0 |
| **1.3 Access to health care** | What is the "effective UHC coverage" for the country? | 0-2 | 1 | 1 | 0 | 1 | 1 |

Notes: Government Healthcare spending*: 0=<5%, 1=≥5%
*Government schemes and compulsory contributory health care financing schemes
Health workforce: 0=under 4.45 per 1,000 population, 1=above 4.45 per 1,000 population
Access to healthcare: 0=<50%, 1=50-75%, 2=>75%

Sources: included in Appendix.

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**Table 5: Economic growth is allowing for more government healthcare spending in India and Vietnam**

Government schemes and compulsory contributory health care financing schemes, 2014-2018

| | % Gross domestic product (GDP) | | | | | Current PPP per capita | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2014 | 2015 | 2016 | 2017 | 2018 | 2014 | 2015 | 2016 | 2017 | 2018 |
| Argentina | 6 | 7 | 6 | 7 | 6 | 1,274 | 1,410 | 1,133 | 1,390 | 1,228 |
| Brazil | 4 | 4 | 4 | 4 | 4 | 607 | 603 | 607 | 622 | 639 |
| India | 1 | 1 | 1 | 1 | 1 | 47 | 57 | 63 | 70 | 75 |
| Mexico | 3 | 3 | 3 | 3 | 3 | 541 | 563 | 553 | 552 | 532 |
| Vietnam | 3 | 3 | 3 | 3 | 3 | 154 | 156 | 178 | 189 | 207 |

Source: WHO Global Health Expenditure Database

Although in a different domain in our Scorecard, surveillance capacity tells a similar story:

| Indicator | Notes | Scoring range | Argentina | Brazil | India | Mexico | Vietnam |
|---|---|---|---|---|---|---|---|
| **4.4 Surveillance** | a) Does the country use an electronic immunization registry? b) Does the government operate an electronic reporting surveillance system at both the national and the sub-national level? c) Status of surveillance for 16 current and potential future VPDs | 0-4 | 4 | 2 | 3 | 3 | 2 |

Notes: a) +1 for the existence of an electronic immunisation registry, b) +1 for the existence of an electronic reporting surveillance system at both the national and the sub-national level  c) <10=0, 10-15=+1, 16=+2

Sources: included in Appendix.

The scores indicated that well-endowed Argentina has the most comprehensive systems. India and Vietnam seem to be tied with Mexico and Brazil. This apparent equality also requires explanation. It reflects the need for our scores to rate formal capacity – which is straightforward to assess – rather than to subjectively measure quality. India's electronic system for tracking vaccinations is very good say our experts. However, disease surveillance – for which the country gets two of its three points in this indicator – remains weak. In the words of Arindam Ray – India Country Lead, New Vaccines and Immunisation Systems, at the Bill & Melinda Gates Foundation – "disease surveillance requires strengthening. Once that is fully in place, then you have the Holy Grail" of electronic information for understanding the VPD environment in the country.

Despite its strong score for this indicator, Argentina's surveillance capacity has been questioned. A recent study examining the incidence of invasive meningococcal disease (IMD) – a life-threatening disease caused by the bacterium Neisseria meningitidis – reported that IMD cases and IMD-related deaths were 3.1 and 1.9 times higher, respectively, than previously estimated.[21] The authors highlighted the need for active surveillance to better understand and manage the burden of IMD in the country. In 2017, the National Immunisation Program of Argentina introduced the meningococcal ACWY vaccination for infants, an indication that the burden was understood and requiring preventative measures. Brazil is the only other of our study countries that includes a meningococcal vaccine in their vaccination calendar.

Vietnam's National Immunisation Information System is a rare example of a national electronic immunisation registry in a middle-income country.[22] Dr Thai, discusses the application of this registry which was deployed nationally in 2017, "before, it was all paper-based which was much less reliable; with the digital registry we can track every birth, the number of vaccines each child receives in both public or private health centres, we also know when to follow up and send reminders, where to target efforts if gaps exist. The information system also tracks

the entire supply chain to ensure we have vaccines and prevent stock-outs."

Finally, target 3.2 of the UN's Sustainable Development Goals aims to end preventable deaths of newborns and children under 5 years of age by 2030, with all countries aiming to reduce under-5 mortality to at least as low as 25 deaths per 1,000 live births. Of our study countries, the Latin American states and Vietnam are on track to meet this goal, with further improvements required in India.

**Figure 13: Child mortality rates per thousand live births**
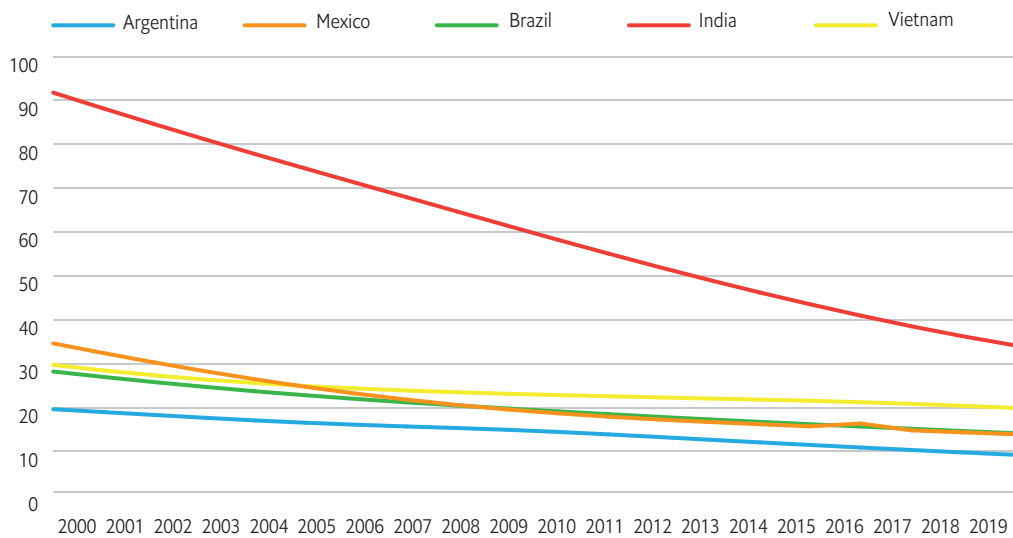


Source: UN Inter-agency Group for Child Mortality Estimation

As discussed in an earlier section, the Latin American study countries are lagging behind on the performance of vaccination programmes and have seen greater deterioration during the pandemic.

As the chart below shows, none of the three Latin American countries achieved 90% coverage for any of the seven vaccines in our study, although Brazil and Mexico gained a half mark for each having one above 80%. This contrasts with India and Vietnam. The latter two are also doing better on equity across regions and on whether coverage is expanding or contracting.

The lack of vaccine equity across districts in Brazil is an additional cause for concern. Only 47% of districts in Brazil reported DTP3 coverage ≥80%. While national-level coverage is important and informative, looking at regional and district levels can be more revealing of the risks that exist. The declining and heterogeneous coverage of MCV in the North region of Brazil is thought to have contributed to the rapid spread of measles cases in 2019, after its re-introduction, due to migration from Venezuela.[23]

**(iii) The importance of government focus**

*Variations on a Latin theme:* Explaining the disconnect between health system resources and paediatric vaccination coverage in Latin America is complex. In a piece this size, the most helpful thing would be to touch on two obvious but crucial groups of issues – one related to those providing the vaccines and one to those making decisions about receiving them.

| Indicator | Notes | Scoring range | Argentina | Brazil | India | Mexico | Vietnam |
|---|---|---|---|---|---|---|---|
| **3.1 Vaccine coverage** | Is the national coverage for vaccines for key VPDs >= 90%? | 0-7 | 0 | 0.5 | 3 | 0.5 | 5 |
| **3.2 Maintaince of coverage** | Difference in coverage of estalished vaccines (DTP1, DTP3, MCV1, MCV2, Hib3) between 2015 and 2020 | 0-5 | 0 | 0 | 3 | 0 | 2 |
| **3.3 Vaccine utilization/ follow-up** | What is the dropout rate between DTP1 and DTP3 coverage? | 0-1 | 1 | 0 | 1 | 1 | 1 |

**Key:** Low ▮▮▮ High

Notes: Vaccine coverage: 0=<80%, 0.5=80-90% and 1=>90% coverage of each of the following: MCV1, MCV2, DTP1, DTP3, Hib3, PCV3, and RotaC.
Vaccine coverage equity: 0=<70%, 1=70-80%, 2=>80%
Change of coverage 2015-2020: 0=decreased coverage, 1=increased coverage for each of the following: MCV1, MCV2, DTP1, DTP3, Hib3

Sources: included in Appendix.

Any search to explain the inconsistency between health system strength and long-term paediatric vaccination coverage needs to start by considering the role of state leadership. As Prof Larson puts it, "delivery of vaccines is highly embedded in government. They approve them; they regulate them; they often distribute them." In the Latin American countries under study, these states also fund 100% of childhood vaccination programmes.[24]

The danger is not a wholesale rejection of vaccination, but a loss of focus leading to a slow drift in effectiveness. This trajectory is understandable. As Dr Taneja explains, immunisation programmes are often deployed early in health system development. One advantage of vaccination for governments, as opposed to other public health activities, is the relative ease of quantifying resultant gains and improvements. These programmes, he adds, can "act as a fulcrum for delivery of multiple health interventions. But, as systems mature and other programmes appear, the people who deliver the services remain the same ones. Then, immunisation has to compete with other programmes and has to operate in a more complex environment." Over time, this evolution can reduce the attention paid to the requirements of effective childhood vaccination.

Although this diagnosis may be only part of what is taking place, in Latin America at least, government attention to this field has certainly been displaced in recent years. Dr Olaiz reports that already in 2016, resources for vaccinations began to decline in Mexico, and that this has continued even after the current administration launched a thorough reform of the Mexican health system. Similarly, the previous government dismissed the country's National Council on Vaccination, a co-ordinating body, which has yet to be replaced.

**"**

**Immunisation programmes act as a fulcrum for delivery of multiple health interventions. But, as systems mature and other programmes appear, the people who deliver the services remain the same ones. Then, immunisation has to compete with other programmes and has to operate in a more complex environment.**

Dr Gunjan Taneja, Program Officer, Vaccine Delivery, Bill & Melinda Gates Foundation

Policy choices can also worsen practical challenges. Mexico faced vaccine shortages for both DTP and MCV in 2018 and 2019. Dr Olaiz expects that, given the vaccination programme's current state, more will follow. Exacerbating this is a government decision, taken with the laudable aim of curbing corruption, to move authority for purchasing drugs from the Ministry of Health to the Ministry of Finance. The latter has so far not

proved adept at keeping stocks up.[25] Moreover, those currently responsible for vaccination, Dr Olaiz adds, do not take a long-term strategic view but a year-by-year one, which further complicates supply issues.

Stockouts are more than a short-term problem. As Dr Cahn notes, if somebody comes to a clinic a couple of times and the vaccine is unavailable, he or she is unlikely to appear again. Worse still, adds Prof Larson, the unavailability of a vaccine can have an impact on broader feelings of hesitancy as their confidence in the system wanes.

Dr Olaiz believes that, turning the direction of childhood vaccination in Mexico around, will require two key ingredients. "One will be money. The second is to regroup, retrain, and work with health personnel again to deliver vaccines. We have a lot of well-trained people, but we are not using them."

Although the details differ, a similar lack of attention exists in Brazil amid an environment of reduced public health spending. On the one hand, explains Karin Luhm, Professor of the Graduate Program in Public Health, Universidade Federal do Parana, "there is not enough investment" in key areas such as human resources, training, and finding those who missed being vaccinated. The necessary funds are unlikely to appear soon. Dr Domingues does not see "any effort from any level of government to try to reverse" the serious decline in vaccination coverage. Meanwhile, Dr Domingues reports, the government has disbanded the advisory committee on vaccination – an institution since 1991. "We are going to have to rethink

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**Mexico used to be an example to countries, worldwide, on how to immunise children. To return to this standing will require two key elements. One will be money. The second is to regroup, retrain, and work with health personnel again to deliver vaccines. We have a lot of well-trained people, but we are not using them.**

Dr Gustavo Olaiz, General Co-ordinator of the Center for Research, Policies, Populations and Health (CIPPS) of the Faculty of Medicine of the National Autonomous University of Mexico, Mexico

how reaching consensus to define vaccination policies is structured."

Argentina's vaccination programmes did not appear to be suffering to the same extent. Until 2019, the decline in coverage in Argentina was slower than in the other Latin American study states.

**Table 6: Average coverage of seven study vaccines in Argentina, Brazil and Mexico**

| | 2015 | 2019 | 2020 |
|---|---|---|---|
| Argentina | 85.9% | 82.9% | 74.6% |
| Brazil | 93.2% | 76.1% | 74.3% |
| Mexico | 91.4% | 76.1% | 77.1% |

However, as discussed in the previous sections, Argentina's declines in coverage during the pandemic in 2020 were more extensive than the other Latin American study countries and, by year end, little difference appeared between the three.

The decrease in coverage in 2020 likely reflects longer-term financial cuts in Argentina. From 2015 to 2019, budget reductions limited the country's national spending on healthcare overall. Even the Ministry of Health was briefly subsumed into a larger one of Health and Social Development, which created further obstacles to securing funding for public health.

Dr Alejandra Gaiano – a paediatrician specialising in infectious disease at the Hospital Materno Infantil de San Isidro in Buenos Aires –reports that the ministry's vaccination programme was one of the most affected by these cuts. Decreases in the purchase of vaccines led to shortages for many, and a resultant drop in coverage. Meanwhile, she adds, a growth in poverty accompanying the economic crisis impeded patient access to even free services by, for example, raising travel costs. Weakening human resources within immunisation programmes is another challenge that the health system has had to contend with. Dr Gaiano explains that cuts between 2016 and 2019 to the payment of health personnel "generated moonlighting with the consequent decrease in the quality of health care." This problem would have been exacerbated by the constraint faced in Argentina, as in other countries, as those with skills in vaccination have been needed to provide covid-19 inoculations.

On the positive side, the country did react to its 2019 measles outbreak rapidly, bringing it under control with a successful vaccination campaign. That said, finding funds for a wider rebuilding of the vaccination programme may prove a challenge. Dr Cahn notes "vaccination is not prioritised as a super essential activity." This is a difficult place to be as the country faces IMF pressure to reduce its deficit. Though, Dr Gaiano informs us "the public health system and immunisation programmes in Argentina were strengthened in 2020", the impact of that strengthening may take a year or two to manifest in improved coverage rates.

Until these three Latin American governments address what the ebbing tide of the pandemic has revealed and give a higher priority to vaccination, their now reduced coverage rates will likely experience stasis or further slow decline. How long before the resultant growing risks present health challenges is unclear, but the spread of measles in 2019 suggests that they will not hold off indefinitely.

*A contrast in India and questions about Vietnam:* Dr Ghosh explains that one of the key reasons for the expansion of paediatric vaccine coverage in India "is a high level of political buy-in. Immunisation is a flagship programme of both National and State governments." This includes ongoing support for routine immunisation. For example, the current administration has continued the longstanding policy of incentive payments to the nation's nearly 1m community health workers – Accredited Social Health Activists – for each child in their village who is fully vaccinated. Soon after coming into office, the government launched Mission Indradhanush, now in its fourth iteration, which seeks to immunise every child in the country, especially those previously missed. These massive campaigns, notes Dr Ghosh, are among the largest in the world.

India's sizeable pharmaceutical industry is a major advantage for its vaccination efforts. India is the only one of the five study countries not to report a shortage of key vaccines in recent years. Here, too, the government is taking a lead, having spent money to support the sector to enhance the security of its vaccine supply chains. Dr Kim highlights the importance and value of India's pharmaceutical industry, "For the rotavirus vaccine, India has two manufacturers. Having that national manufacturing capacity ensures both supply and competition for price. For the rotavirus vaccine, it's a fraction of what's charged in other markets; it's quite remarkable."

Another advantage for India over the Latin American states in this study has been that it qualified for substantial financial assistance – nearly a billion dollar's worth between 2000 and 2023 – from the Global Alliance for Vaccines and Immunisations (GAVI).[26] It appears, though, that the expected tapering of GAVI funds in the near future will not diminish the government's interest in childhood immunisation. Instead, as early as 2014, it became the first recipient country to donate to GAVI. It has since increased its commitments to $3m per year, which now exceeds the non-covid-19 related support it will receive in 2021 from the organisation.

Despite serological studies raising some question marks over coverage rates in Vietnam, the country does appear to have a stable vaccination programme.[13] However, its expected introduction of complete rotavirus vaccination in 2018, part of the Extended

Programme on Immunisation official plan for 2016-2020,[27] did not occur. As the country's economic growth means that it will also face a transition away from GAVI support, it will be interesting to see how the vaccine programme fares and what sort of prioritisation it receives.

Support from GAVI has been pivotal for lower-income countries to build up their immunisation programmes. Maintaining the momentum this support provides is a challenge that many emerging economies have struggled with. Figure 14 highlights the difficulty that immunisation programmes in middle-income countries have experienced in securing both national resources and external funding. Dr Kim notes that "the greatest burden of unvaccinated children now exists in middle-income countries; greater attention, support and strategies are needed to support populations in these countries."

Acknowledging the progress that Vietnam has made with its immunisation programmes in recent years, Dr Thai recognises where gains can be made. Between 2013 and 2017, the incidence of pertussis increased ten-fold, from 0.05 to 0.58 per 100,000 population.[28] Dr Thai highlights that much of this burden occurs among young infants before they have time to reach vaccine protection from DTP inoculations, but that strategies exist to address this. "We need to consider maternal immunisations using Tdap [Tetanus toxoid, reduced diphtheria toxoid and acellular pertussis] which would help pass protection to babies, and also use cocooning to reduce risk."

**Figure 14: PCV3 coverage, by year and income group, 2010-2020**

■ 2010 ■ 2011 ■ 2012 ■ 2013 ■ 2014 ■ 2015 ■ 2016 ■ 2017 ■ 2018 ■ 2019 ■ 2020
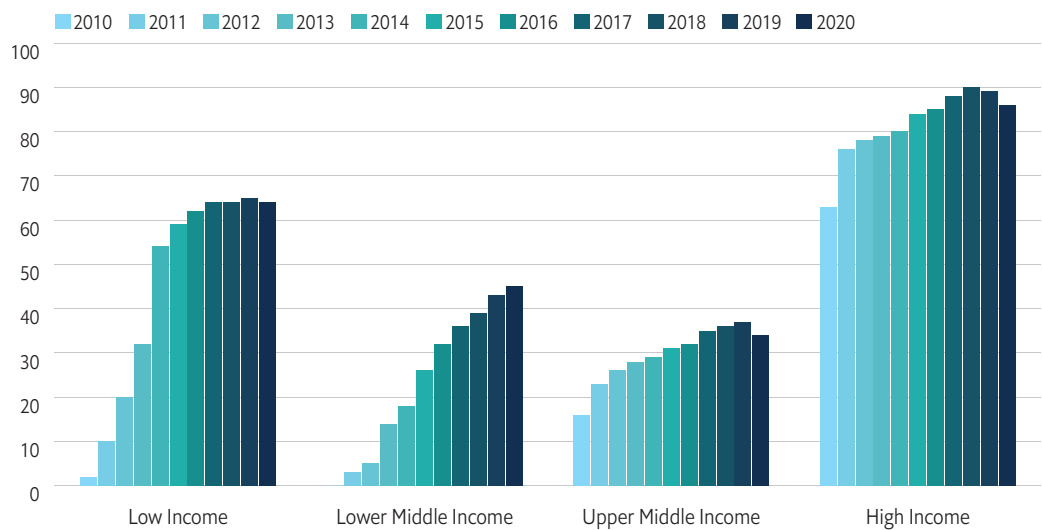


Source: WUENIC, 2021

### (iv) Maintaining public interest amid declining incidence

Besides the effective provision of vaccines, a successful programme must offer something that individuals – or, in the case of childhood vaccines, their parents or guardians – want.

With vaccinations, the most high profile issue relevant here is vaccine hesitancy. The WHO listed it among its 10 leading threats to global health in 2019. Since then, the extensive attention during the pandemic to public concerns about vaccines against covid-19 have only added to its profile.

Our research, though, suggests that currently it is a less pressing issue for paediatric immunisation in our five countries. Prof Larson explains that, in her global research into vaccine confidence, the clearest correlate

with vaccine uptake is the percentage of the population who believe vaccines are "important". By this measure, our five countries are generally in good shape. In Vietnam, 92% of people believe that vaccination is important for their children; in all the other states in our survey that figure is 97% or 98%.[29]

Moreover, with the exception of those we interviewed from Brazil, all our other experts generally say that, while hesitancy and anti-vaccine sentiment have always existed in pockets in their countries, they are not significant challenges. The experience of Brazil, unfortunately, shows how quickly this issue can escalate.

In 2016, rumours incorrectly began to blame a rise in microcephaly – related to a Zika virus outbreak – on defective, government-dispensed vaccines. Claudio Maierovitch

– a public health doctor and former head of Brazil's health regulator, ANVISA – describes the increase in hesitancy as "a brutal change". "We didn't have it here. The proportion of anti-vaccine people was negligible, until a few years ago. Then, it got mixed with a whole set of political disputes and fake news. I think there was an inflection point."

So far, although concerns about vaccine safety have spread, surveys indicate that these worries have not had a substantial impact on having children vaccinated.[30] Nevertheless, the swift rise in concern has been a wake-up call.

The potential for such rapid change puts in context the worries that hesitancy around covid-19 vaccines will spill over to childhood immunisation. Most of our experts remain hopeful that this is unlikely to occur: the specific reasons for public worries about covid-19 vaccines – their relative novelty and speed of development – do not apply to existing paediatric ones; a successful covid-19 vaccine rollout might show the benefits of vaccination; and, at the very least, people now are more aware of what a vaccine does. On the other hand, few dismiss the possibility, in Dr Offit's words, of a possible "backlash against all vaccines driven by a populist, anti-science zeitgeist". Dr Laserson was not unusual in replying, when asked about the likely interaction, "I have the same question. I don't have the answer."

In all of the study countries, even when hesitancy is not currently a significant barrier, no vaccine programme is immune. Addressing it is enormously complex. Much of the problem may have little to do with the medical intervention. As Dr Offit observes, "pushback from the anti-vaccine world is predominantly people saying they want the government off my back." Prof Larson agrees, noting a direct correlation between levels of populism and hesitancy. In such an environment, mandates – or even extensive public information campaigns – may sway some who are not fully hesitant, but could also drive others in the opposite direction.

A more common issue, and therefore one able to do more damage, is not hesitancy so much as complacency. A commonly-heard public health adage is that "vaccines are victims of their own success." As Dr Orenstein puts it, "people don't see these diseases anymore, so they think 'why should I vaccinate my child or take even a small risk?' It is difficult to overcome." Dr Kim agrees: "political support and popular support tend to drop off as diseases disappear, because they're no longer visible… Out of sight out of mind."

This is a particular challenge in the Latin American study countries. As the earlier graphs on mortality rates showed, childhood deaths from measles and pertussis in particular have long been low. In India and Vietnam, in contrast, the toll of these diseases, and the role of vaccines in reducing that burden – are of recent memory. This matters greatly. Dr Offit recalls that when, in the early 2000s, the rotavirus vaccine was introduced into Africa, "it was warmly embraced because rotavirus was a known killer."

In much of Latin America, this urgency is missing, or much less pronounced. Dr Domingues believes that, in Brazil, "the population is not clear on the risks of the current low level of vaccine coverage. The first step in mitigating it is to alert them." Similarly, explains Dr Cahn for Argentina, "there is a low perception of the risk of suffering from these diseases and that is why many times people do not get [their children] vaccinated."

These attitudes, in turn, have an effect on levels of government attention and spending. As Dr Luhm explains, "in Brazil, currently, only social pressure can guarantee investment in this area." Her country is unlikely to be unique in this regard.

Therefore, until both citizens and governments engage more, progress on vaccination coverage is unlikely.

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**The population is not clear on the risks of the current low level of vaccine coverage. The first step in mitigating it is to alert them.**

Dr Carla Domingues, independent researcher, and former co-ordinator of Brazil's National Immunisation Program

# V. The pandemic can encourage solutions as well as reveal problems

Two things are becoming clear about paediatric vaccination in the coming years. The first is the nature of the challenge. Prof Larson puts succinctly what this study has argued: "the bigger worry is not in terms of covid-19 and childhood disease but that we have already fallen behind globally [in terms of inoculation against vaccine-preventable diseases]." The pandemic has only made a difficult challenge worse.

The other important insight is that the response to the current dislocation cannot simply involve waiting while covid-19 is conquered and dispatched to medical history. "Covid-19 is not a short term anything," says Dr Olaiz, "that is something we will have to deal with." Accordingly, looking for ways for health systems to conduct routine immunisation simultaneously with preventing and treating covid-19 may grow to be more than temporary expedients.

Nor is the breathing space which the pandemic has supplied unlimited. The decline in vaccination coverage during 2020 and, where relevant, the years before, presents health dangers. Those health systems in a similar situation need to consider the weaknesses which the outgoing tide has exposed. In so doing, they may find that the pandemic has brought with it, amid its huge health burden, the chance to create an inflection point away from declining levels of paediatric immunisation. Dr Orenstein speaks for many of our experts when he says "my hope is that this could be a stimulus to get better at childhood vaccination."

## Our research has found several opportunities.

The first relates to public attitudes toward vaccination. As discussed above, concern exists that hesitancy around the covid-19 vaccine might spill over into attitudes about paediatric ones. On the other hand, the very discussion of any vaccine can be positive. At a very basic level, Dr Ray says, an important amount of public education in India has occurred: "'vaccine' is now a common word in people's vocabulary and so many difficult concepts are becoming part of popular knowledge." Dr Cahn adds of Argentina that, "vaccines are on the agenda. Everyone now talks about them, knows the importance of getting vaccinated, and how they prevent life-threatening diseases."

This, on its own, could increase the uptake of other vaccines, not only for pediatric groups but also for adult populations, of which immunization coverage is generally low. Already, Prof Larson reports of the EU, public confidence in the importance of influenza vaccine rose by 17% during the covid-19 pandemic.[31] Dr Olaiz is confident that the rollout of covid-19 vaccines will make a difference and that people "well see the benefits. It will be easier to vaccinate children. People will know that the vaccines are reliable and the information on side effects is accurate." Dr Thai, also sees a benefit in how governments and wider society perceive preventative medicine as a consequence of the pandemic, "there was very little interest in preventative medicine in the past, but because of covid-19, there's a greater understanding

about communicable disease, the value of vaccination and the role of preventive medicine, which is a very important change."

Meanwhile , efforts to make up for missed vaccinations and to roll out covid-19 ones, adds Dr Larson, present "a huge opportunity for health authorities, if they show that they care about people beyond getting them vaccinated, and how they handle that interaction can add value to that relationship. If not handled well it can undermine longer term trust," because often, she adds, vaccine uptake "is a relational issue".

Covid-19 vaccination efforts can also create important assets for paediatric, and other, routine immunisation.

Dr Cahn notes that, in Argentina, "today, a large proportion of the human resources that can give vaccines is devoted to vaccination against covid." She adds, however, that because of the size of this effort, substantial training of additional people to provide vaccinations has created "a resource which can also be used to do the catch-up in paediatrics."

At the same time, Dr Ray notes, the experience of covid-19 has "unlocked huge potential in so many aspects of vaccine distribution and innovation. It has brought a kind of urgency which is helping." A great example of this in India is the development of the CoWIN application (COVID-19 Vaccine Intelligence Network). This was built on the country's earlier eVIN (Electronic Vaccine Intelligence Network) software. CoWIN combines and integrates back- and front-end vaccine management. It provides end-to-end supply chain oversight, including tracking vaccine stocks and monitoring cold chains throughout

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**When people understand more about one disease, they can also learn about others faster. I think the greatest lesson for the whole of society is that vaccination and prevention is not only protection for themselves, but protection for the whole community.**

Dr Pham Quang Thai, Vice Head of Communicable Diseases Control and Prevention, National Institute of Hygiene and Epidemiology (NIHE), Vietnam

the country. It also can manage the distribution of covid-19 vaccines at the patient level, with individuals able to book slots online, as well as receive confirmation of immunisation which can include passport information. As Dr Taneja says, "the digital architecture has really evolved. CoWIN has shown that it is possible to do individualised tracking of vaccinations even in a country of India's size."

Dr Laserson reports that the software has created "huge excitement" in the public health community. The Indian government certainly sees it as a great success: the Prime Minister's photograph is at the top of the web page. The state is also ready to share it with the world as a public good. In early July

2021, the government made CoWIN software open-source, with the expectation that any country could adapt it to its own needs. One such potential use is routine paediatric immunisation, explains Dr Ray. "We are looking at CoWIN as a huge opportunity for children's vaccination. We understand that the government is in discussions with GAVI on it."

Looking back, much healthcare discussion will divide the world into pre- and post-covid eras. The pandemic has, in many cases, revealed weaknesses. It will also be seen as having provided ways to overcome them – if health systems are willing to use them.

# VI. Conclusion: Distilling lessons

The covid-19 pandemic and the attendant public health response have created a major challenge for paediatric VPDs – just not the one originally expected. At a global level, the reduction in vaccination coverage has been much more muted than predicted. Meanwhile, the efforts taken to contain the spread of covid-19 have also had a salutary effect on paediatric VPDs.

At the level of national vaccination programmes, however, the pandemic has played a similar role to that which economic downturns do with businesses. By putting many health systems under extensive stress, the experience of the last year has shown which vaccination programmes were well or badly prepared to deal with disruption – swimming clothed or naked as the tide receded, in our extended analogy.

The outcome for countries is accordingly diverse. Of the five in our Scorecard, Vietnam's vaccine coverage has held up the best in 2020, but the country also saw – by a large margin – the lowest level of covid-19 related disruption in general. How it does in the face of its covid-19 surge of 2021 remains to be seen. India, meanwhile, saw definite declines in overall childhood immunisation levels, but the most striking element of its experience is the extent to which it was able to catch up to minimise these decreases.

In our three Latin American countries – Argentina, Brazil and Mexico – the picture is rather different. Although they have better funded healthcare systems than those in our Asian study countries, the pressure of the pandemic exacerbated existing weaknesses, leaving them with much lower overall coverage than in India and Vietnam.

Our research points to several key considerations for health policymakers:

**Effective vaccination programmes require ongoing strategic focus from health systems**: Each of our study countries have the capacity to deliver high vaccination coverage. The currently struggling ones in Latin America delivered, for decades, the vaccines in our research to more than 90% of target populations. Their problem is more a lack of attention than one of inherent capacity, as general, austerity-related cuts to health systems have done great damage to vaccination programme budgets. Just as important, these cuts have also involved the elimination of relevant institutional bodies that have undergirded vaccination in Mexico and Brazil.

Repairing the damage requires recognition that current vaccination levels are unsustainably low in the long term. This should lead to political commitment, both to provide the necessary funding for immunisation programmes, and to create comprehensive strategies that address the specific needs of each country with the local and national human and institutional resources available. Although the case for such change is most obvious in our Latin American states, our Asian ones will also have decisions to make. Vietnam will need to maintain its commitment to vaccination as GAVI funding ends in the near future, and India must do so during the ongoing, massive expansion of its public health insurance system.

**Vaccination programme strategies must find ways to build on the experience of dealing with covid-19:** The pandemic will not end with a bang but fade slowly. Plans to deliver paediatric immunisation need to work within that context. They also must take advantage of changes which have occurred in the past year. This will involve country-specific considerations. Argentina, for example, should find ways to use those who have developed new expertise in delivering inoculations rather than letting this resource disappear after large-scale covid-19 vaccination programmes are complete. Other states which have seen extensive training of human resources, laboratory expansion, or other ad hoc investments should find ways to use these over the long term.

More generally, countries should consider ways to adapt the electronic tools created for the fight against covid-19, as well as the IT weaknesses which this has revealed. India's CoWIN software is an obvious candidate for improving vaccine management both in that country and elsewhere. On the other hand, both our Asian countries, as well as Mexico and Brazil, need improved disease surveillance in order to better understand their current VPD burdens.

**The strategies also have to consider how to maintain public engagement with childhood vaccination:** Vaccination programmes to bring covid-19 under control have drawn attention to vaccine hesitancy. Outside of Brazil, this is not a major issue for paediatric immunisation in our study countries. Brazil's recent experience, however, shows how quickly and unexpectedly the problem can arise.

A more widespread problem is a lack of urgency, with parents and guardians not always seeing the point of taking children for immunisations to protect against diseases which are presumed to be rare, or even a thing of the past.

National vaccination programmes need to monitor and understand – from the public's rather than the health system's perspective – the issues which might affect vaccine uptake. Public education is key to success, but in turn, requires interaction with those who have concerns rather than dismissing them as not being committed to the "right" beliefs.

The challenges will differ by country. The long-term low incidence of VPDs in many Latin American countries make them a less immediate concern. Contrasting media coverage of the covid-19 vaccination rollout in India, with pictures of both long lines waiting for their injections and nurses being chased out of villages by hostile residents, show that the situation is unlikely to be straightforward.

**Although great progress has occurred against VPDs, everyone still has work to do:** As the data in this study show, case and mortality figures for the diseases on which we have focussed have seen large and welcome declines in recent decades. In every case, though, preventable disease continues to infect large numbers of children. Meanwhile, our Scorecard indicates that – for each of our five countries – important weaknesses exist in their ability to provide effective vaccine programmes. To an extent, every country on our beach needs better attire to deal with VPDs, whether the tide is in or out.

# Appendix: Scorecard methodology and country scoring

| Domain | Indicator | Aim/Rationale |
|---|---|---|
| **1. Health system resources** | 1.1 Healthcare spending | To assess the government spending on health |
| | 1.2 Health workforce | To assess whether each country has the minimum density of health workforce needed to deliver the Sustainable Development Goals in health |
| | 1.3 Access to health care | To assess the status of universal health coverage |
| **2. Vulnerability to disease transmission** | 2.1 Access to potable water and sanitation | To assess vulnerability towards infectious diseases |
| | 2.2 Poverty levels | To assess vulnerability towards infectious diseases |
| | 2.3 Housing | To assess structural quality, durability and having sufficient living space |
| | 2.4 Malnourishment | To assess the prevalence of undernourishment; childhood wasting; childhood stunting; and child mortality |
| **3. Programme Performance** | 3.1 Vaccine coverage | To assess whether immunisation programmes are meeting the WHO's target coverage |
| | 3.2 Maintenance of coverage | To assess whether immunisation programmes are increasing, decreasing or stalling in their coverage |
| | 3.3 Vaccine utilisation/ follow-up | To assess whether immunisation programmes are successfully following up with subsequent doses |
| | 3.4 Vaccine coverage equity | To assess coverage risk of outbreaks based on presence of areas of low immunity |
| | 3.5 Child mortality | Serves as a proxy for the success of the programme in reducing VPD-associated mortality |
| **4. Surveillance, preparedness and adopting recommendations** | 4.1 Adhering to latest recommendations | To assess commitment to expand the national immunisation programme based on WHO recommendations/international standards |
| | 4.2 Surveillance | To assess the use of IT systems to monitor performance indicators, and to support management, accountability, and provide evidence for decision-making in the programme |
| | 4.3 Preparedness for outbreaks | To provide an indication of how well countries are prepared for/able to respond to infectious disease outbreaks |

| Domain | Indicator | Aim/Rationale |
|---|---|---|
| **5. Supply- and demand** | 5.1 Stockouts | To assess the occurrence of stockouts which may result from: i) funding delays; (ii) inaccurate forecasts; iii) orders not met in full; iv) stock management issues; v) procurement delays; and vi) global vaccine shortages |
| | 5.2 Storage monitoring | To assess whether continuous temperature monitoring occurs to mitigate the risks associated with temperature breaks in the cold chain |
| | 5.3 School enrolment | To assess whether childhood vaccinations are mandated for school attendance |
| | 5.4 Vaccine hesitancy | To assess vaccine hesitancy in the country |
| | 5.5 Public confidence | To assess confidence in public institutions |

| Domain | Question | Scoring | Argentina | Brazil | India | Mexico | Vietnam |
|---|---|---|---|---|---|---|---|
| **1. Health system resources** | What is the current government health expenditure* as a % of GDP?<br><br>*Government schemes and compulsory contributory health care financing schemes. Does not include voluntary health care payment schemes or out-of-pocket payments.<br><br>Source: World Health Organization - Global Health Expenditure Database https://apps.who.int/nha/database/Select/Indicators/en | >=5.0% = 1<br><br><5.0% = 0 | 1 | 0 | 0 | 0 | 0 |
| | What is the general medical workforce per 1000 people?<br><br>Source: World Health Organization https://apps.who.int/gho/data/node.main.HWFGRP?lang=en | Above 4.45 per 1,000 population = 1<br><br>Under 4.45 = 0 | 1 | 1 | 0 | 1 | 0 |
| | What is the "effective UHC coverage*" for the country?<br><br>*based an Index score from 23 effective coverage indicators covering five health service domains—promotion, prevention, treatment, rehabilitation, and palliation<br><br>Source: GBD 2019 Universal Health Coverage Collaborators https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30750-9/fulltext | 0 = <50<br><br>1 = 50 - 75<br><br>2 = >75 | 1 | 1 | 0 | 1 | 1 |
| **2. Vulnerability to disease transmission** | What is the proportion of the population with access to basic drinking water services?<br>Source: The World Bank https://data.worldbank.org/indicator/SH.H2O.BASW.ZS? | 0-100% | 99.1% | 98.2% | 92.8% | 99.3% | 94.7% |
| | What is the proportion of population with access to basic sanitation services?<br>Source: The World Bank https://data.worldbank.org/indicator/SH.STA.BASS.ZS | 0-100% | 94.3% | b) 88.3 | 59.5% | 91.2% | 83.5% |
| | What is the proportion of the population with access to basic handwashing facilities including soap and water?<br>Source: The World Bank https://data.worldbank.org/indicator/SH.STA.HYGN.ZS | 0-100% | Data not available | Data not available | 60.0% | 88.0% | 85.9% |

| Domain | Question | Scoring | Argentina | Brazil | India | Mexico | Vietnam |
|---|---|---|---|---|---|---|---|
| | What is the poverty headcount ratio at $1.90 a day (2011 PPP) (% of population)?<br><br>Source: The World Bank https://data.worldbank.org/indicator/SI.POV.DDAY | 0-100% | 1.50% | 4.60% | 22.50% | 1.70% | 1.80% |
| | What is the proportion of the urban population living in slums?<br><br>Source: The World Bank https://data.worldbank.org/indicator/EN.POP.SLUM.UR.ZS | 0-100% | 15% | 16% | 35% | 16% | 14% |
| | What is the score on global hunger index?<br><br>Source: Global Hunger Index https://www.globalhungerindex.org/ranking.html | 0-100 | 5.3 | <5 | 27.2 | 7.7 | 13.6 |
| **3. Programme Performance** | What is the national coverage for selected vaccines for key VPDs?<br>a) MCV1; b) MCV2; c) DTP1; d) DTP3; e) Hib3; f) PCV3; g) Rotac<br><br>Source: UNICEF / WHO https://data.unicef.org/resources/immunization-coverage-estimates-data-visualization/ | If >= 90% for a) = +1, b)= +1, c) = +1, d) = +1, e) = +1, f) = +1, g) = +1.<br><br>If 80-90% for a) = +0.5, b)= +0.5, c) = +0.5, d) = +0.5, e) = +0.5, f) = +0.5, g) = +0.5.<br><br>If <80% for a) = 0, b)= 0, c)= 0, d)= +1,e) = 0, f) = 0, g) = 0. | 0 | 0.5 | 3 | 0.5 | 5 |
| | What is the difference in coverage of established vaccines between 2015 and 2020?<br><br>a) MCV1; b) MCV2; c) DTP1; d) DTP3; e) Hib3<br><br>Source: UNICEF / WHO https://data.unicef.org/resources/immunization-coverage-estimates-data-visualization/ | If increased in 2020 vs 2015 for a) = +1, b)= +1, c) = +1, d) = +1, e) = +1<br><br>If decreased in 2020 vs 2015 for a)= 0, b)= 0, c)= 0, d)= +1, e) = 0. | 0 | 0 | 3 | 0 | 2 |

| Domain | Question | Scoring | Argentina | Brazil | India | Mexico | Vietnam |
|---|---|---|---|---|---|---|---|
| | What is the dropout rate between DTP1 and DTP3 coverage?<br><br>Source: World Health Organization https://apps.who.int/immunization_monitoring/globalsummary | <10% = 1<br><br>>=10% = 0 | 1 | 0 | 1 | 1 | 1 |
| | Do all districts have a DTP3 coverage >=80%?<br><br>Source: World Health Organization https://apps.who.int/immunization_monitoring/globalsummary | >= 80% = +2; 70-80% = +1; <70% = 0 | 1 | 0 | 1 | 0 | 2 |
| | What is the under-5 mortality rate per 1000 live births? (The proposed UN SDG target for child mortality aims to end, by 2030, with all countries aiming to reduce under-5 mortality to at least as low as 25 deaths per 1,000 live births)<br><br>Source: UN Inter-agency Group for Child Mortality Estimation https://childmortality.org/data | <25 deaths per 1000 live births = 1<br><br>>= 25 deaths per 1000 live births = 0 | 1 | 1 | 0 | 1 | 1 |
| **4. Surveillance, preparedness and adopting recommenda-tions** | Are new and underutilized vaccines integrated in national routine immunisation programmes?<br><br>a) MCV2; b) Hib3; c) PCV3; d) Rotac<br><br>Source: World Health Organization https://apps.who.int/immunization_monitoring/globalsummary | If yes for a) = +1, b)= +1, c) = +1, d) = +1,<br><br>If no a/b/c = 0 | 4 | 4 | 3 | 4 | 2 |
| | a) Does the country use an electronic immunisation registry?<br><br>b) Does the government operate an electronic reporting surveillance system at both the national and the sub-national level?<br><br>c) Status of surveillance for 16 current and potential future VPDs<br><br>Source: The Global Health Security Index https://www.ghsindex.org/wp-content/uploads/2019/10/2019-Global-Health-Security-Index.pdf | If yes for a) =+1<br><br>If yes for b) =+1<br><br>If surveillance exists for 16 current and potential future VPDs=+2, if surveillance exists for 10-15 =+1, if<br><br>surveillance exists for <10=0 | 4 | 2 | 3 | 3 | 2 |

| Domain | Question | Scoring | Argentina | Brazil | India | Mexico | Vietnam |
|---|---|---|---|---|---|---|---|
| | Cumulative number of confirmed deaths from Covid-19 per million people by June 30th 2021<br><br>Source: Johns Hopkins University https://github.com/CSSEGISandData/COVID-19 | <50=2<br>50-250=1<br>>250=2 | 0 | 0 | 0 | 0 | 2 |
| **5. Supply- and demand-related factors** | Is there evidence for a stock-out at national (a) and district levels (b) for routine vaccines for at least one of the key VPDs?<br>Source: World Health Organization | If no for a/b= 2<br>If yes a/b = 0 | 0 | 0 | 2 | 0 | 0 |
| | What % age of cold chain equipment has an electronic continuous temperature monitoring system?<br>Source: World Health Organization https://apps.who.int/immunization_monitoring/globalsummary | >=50% = 1<br>< 50% = 0 | Data not available | 1 | 1 | Data not available | 1 |
| | Is there a policy or law that requires proof of vaccination to enrol in childcare or school (a), and is it implemented (b)?<br>Source: World Health Organization https://apps.who.int/immunization_monitoring/globalsummary | If yes for a) = +1, b)= +1<br>If no a/b = 0 | 2 | 1 | 0 | 1 | 0 |
| | Do people in the country strongly agree that vaccines are important for their children (a), safe (b), and effective(c)?<br>Source: The Wellcome Trust https://wellcome.org/reports/wellcome-global-monitor/2018 | If >=90% agree for (a) = +1, (b) = +1, (c) = +1.<br>No <90% for a/b/c = 0 | 1 | 1 | 3 | 2 | 1 |
| | The level of confidence in public institutions<br>Source: The Global Health Security Index https://www.ghsindex.org/wp-content/uploads/2019/10/2019-Global-Health-Security-Index.pdf | High = 1<br>Medium = 0.5<br>Low = 0 | 0.5 | 0 | 1 | 0 | 0.5 |

## Scorecard domain weighting

| Domain | Scoring range | | | |
|---|---|---|---|---|
| **1. Health system resources** | 0-4 | 0 | 1-2 | 3-4 |
| **2. Vulnerability to infectious disease transmission** | - | - | - | - |
| **3. Performance of immunization programs** | 0-16 | 0-5 | 6-10 | 11-16 |
| **4. Adhering to latest recommendations, surveillance & preparedness for outbreaks** | 0-10 | 0-3 | 4-7 | 8-10 |
| **5. Supply- and demand-related factors** | 0-9 | 0-2 | 3-6 | 7-9 |

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