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Fairer financing of vaccines in a world living with COVID-19

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The COVID-19 pandemic underscores that infectious disease is a global challenge. For many infectious diseases, vaccines are the best tools available for control and elimination. Vaccines helped eliminate smallpox and reduce annual measles deaths from 2.6 million before widespread vaccination to 140 000 in 2018.[1] Vaccines avert two to three million deaths annually, and they are often touted as one of the most cost-effective health interventions.[1] Since infectious diseases do not recognise borders, vaccine deployment requires global cooperation to achieve the best outcomes.

Presently, many countries have halted vaccination programmes and campaigns, including for measles and polio, where vaccination has had transformative impact on the burden of disease. Gavi estimates that at least 13.5 million people are missing vaccinations, and that will rise as the pandemic continues.[2] Hence, the burden of vaccine-preventable diseases will increase as a consequence of COVID-19: this is especially true in low-income and middle-income countries (LMICs), which already suffer from a greater infectious disease burden than high-income countries and where the pandemic could, as elsewhere, overwhelm health systems that have a lower capacity. Sustaining routine vaccination programmes in Africa, for example, is estimated to prevent 140 deaths for every excess COVID-19 death attributable to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections acquired during the routine vaccination visits.[3]

Uncertainties loom over future vaccine financing, as the postpandemic outlook for development assistance for health (DAH) is unclear. LMICs and global funders must trade off between increasing vaccination coverage, continuing disease elimination campaigns and introducing new, more expensive vaccines. A vaccine for SARS-CoV-2 has huge potential to alleviate death and suffering, but without increased DAH, its deployment could also exacerbate financial pressures on health systems. Further, though we have not seen COVID-19 cases overwhelm health system capacity across LMICs at the time of writing, we have seen global fiscal contraction, and this could negatively affect DAH and funding of health systems and vaccination programmes in LMICs. Global cooperation and wise prioritisation are important for the sustainability of vaccination programmes and to avoid resurgence of diseases already controlled in many places.

The science is clear that high-income country funding for vaccines in LMICs is both indispensable and in the interest of high-income countries themselves. Klepac *et al*[4] explore local and global vaccination strategies in an integrated susceptible–infected–recovered game-theoretic model. They show in a model with identical countries that a global optimum is reached when countries cooperate and do not impose travel restrictions: countries achieve higher vaccination coverage (and hence lower disease

Summary box

- The COVID-19 pandemic has disrupted routine and campaign-based vaccination, potentially increasing the future vaccine-preventable disease burden and threatening to overwhelm health systems.
- Vaccine-preventable diseases are transboundary problems that require global cooperation to achieve the best outcomes.
- Investments, predominantly by rich countries—in effect transfers to poor countries—are required as part of the financing solution. Theoretical advances show how such funds can be operationally prioritised and disbursed equitably. Such transfers are also in the interest of high-income countries, and cooperation achieves better outcomes than strategies such as travel restrictions for vaccine-preventable diseases.
- Similar cooperation and financing issues will arise if and when it is time to distribute a COVID-19 vaccine.

prevalence) at a lower cost working together than on their own. Further, when countries are economically or epidemiologically different, countries that are better off benefit from investing in vaccination in connected countries with a higher burden by reducing imported cases from other countries.[4] In both of these cases, by acting together, countries achieve better outcomes (lower prevalence and higher vaccination coverage) at a lower cost than by acting alone.

Even if the global community rises to the challenge of cooperation, and even if funds for vaccine deployment are raised, how should money be prioritised and disbursed? Prioritisation must be principled and demonstrably equitable while maintaining immunisation programmes' sustainability in light of other financial pressures. The donor–country (DC) model proposed by Morton *et al*[5] is relevant.[5] Conventional health economics practice for a single decision-maker allocating funds in a single country suggests we invest in the most cost-effective interventions.[6] However, in a multiactor environment, Morton *et al*[5] demonstrate that to achieve the greatest benefits from donors' funds, cost-effective interventions—ones below a cost-effectiveness threshold—should be financed domestically. Donors should avoid crowding out domestic financing by prioritising cofinancing interventions that are only just cost-ineffective, reducing these interventions' costs to the point of cost-effectiveness from the country perspective.

Gavi is the main distributor of vaccine-specific donor funding, contributing US$1.52 billion in 2018 (54% of donor vaccine-funding),[7] and Gavi's aid has helped increase vaccination coverage.[8] Gavi's aim is for partner countries to achieve financial and programmatic independence that sustains high immunisation coverage.[9] To achieve this goal, Gavi also supports health system strengthening, which is particularly important because vaccine costs purport only a small proportion of the funds required for vaccine delivery. Sustainable country vaccination programmes require strong institutions and delivery systems. Gavi's innovative cofinancing policy, which embodies the idea that countries should transition towards self-sufficiency as their wealth increases, is a core part of its approach to sustainability. However, the policy is based on rules that, though transparent, seem ad hoc, have no theoretical underpinnings and do not clearly lead to an equitable allocation. Further, financial and institutional sustainability remain challenges for many graduating countries[10]—an issue the pandemic may exacerbate.

Our recent study, Analysis of Interventions in Development Aid (AIDA) reviewed information on cofinancing of vaccines in Ghana and comparator countries.[11] Figure 1 shows suggested diphtheria, tetanus, pertussis and hepatitis B vaccine cofinancing in Ghana according to the DC model using costing evidence from a cost-effectiveness study (figure 1A)[12] and cofinancing in practice according to Gavi country progress reports (figure 1B).[9] Two immediate observations stand out. First, the DC model suggests the transition to self-sufficiency should be gradual, though, in practice, it seems sporadic. This inconsistency in cofinancing is evident for comparator countries across time, when comparing the per cent of the vaccine financed by Gavi to gross national income per capita (figure 1C). Second, the costs derived from the cost-effectiveness study are higher than the vaccine progress report since the study accounts for costs such as training and social mobilisation that are not included in the reports. The discrepancy further emphasises the importance of Gavi's health system strengthening initiative, which is not accounted for in vaccine-specific financing reports, and further research on how this funding is distributed is needed.

Based on our findings, we argue that Gavi cofinancing policy should be underpinned by an explicit normative model—such as the DC model in Morton *et al*[5]—to ensure equity between member countries and accountability to funders. The model should be flexible to adjust for unexpected events such as the COVID-19 pandemic. Countries would transition towards self-sufficiency as their wealth (and thus their cost-effectiveness threshold) increases. Implementing such a model requires transparent cost-effectiveness studies that provide complete descriptions and presentation of costs, allowing reproducibility from different stakeholder perspectives, a point highlighted by AIDA stakeholders. The DC model, in particular, also requires cost-effectiveness threshold data, which are increasingly estimated in recent years.[13–15] AIDA stakeholders also provided valuable insights on how such theoretic models can be adapted for use in a real development setting. For example, they highlighted that disease burden, and thus population health and budget impact, are important for vaccine financing decisions and so should be explicitly included in the country decision problem in the likes of the Morton *et al* model.[11] These aspects are important from the donors' perspectives if donors aim to include sustainability and equity, and, before transitioning countries out of aid, donors should be more aligned with local processes that promote sustainability. More research is needed on how to incorporate factors that define which countries have the greatest need (eg, financial and institutional capacity) in or alongside a normative model. Defining these factors will require further stakeholder engagement.

Many of the same arguments are true for developing and distributing a COVID-19 vaccine, though the models we discuss here do not explicitly consider vaccine development. A cooperative multiactor approach is also salient for vaccine development, distributing the risks and costs to accelerate the process in outbreak situations. A coordinated, international and intergovernmental plan is especially important for new epidemics such as the COVID-19 pandemic. In 2017, the Coalition for Epidemic Preparedness Innovation was launched precisely to fill this gap—as a public, private and philanthropic partnership—and so we have seen encouraging cooperation in this space. Nonetheless, if and once we have a vaccine available, we

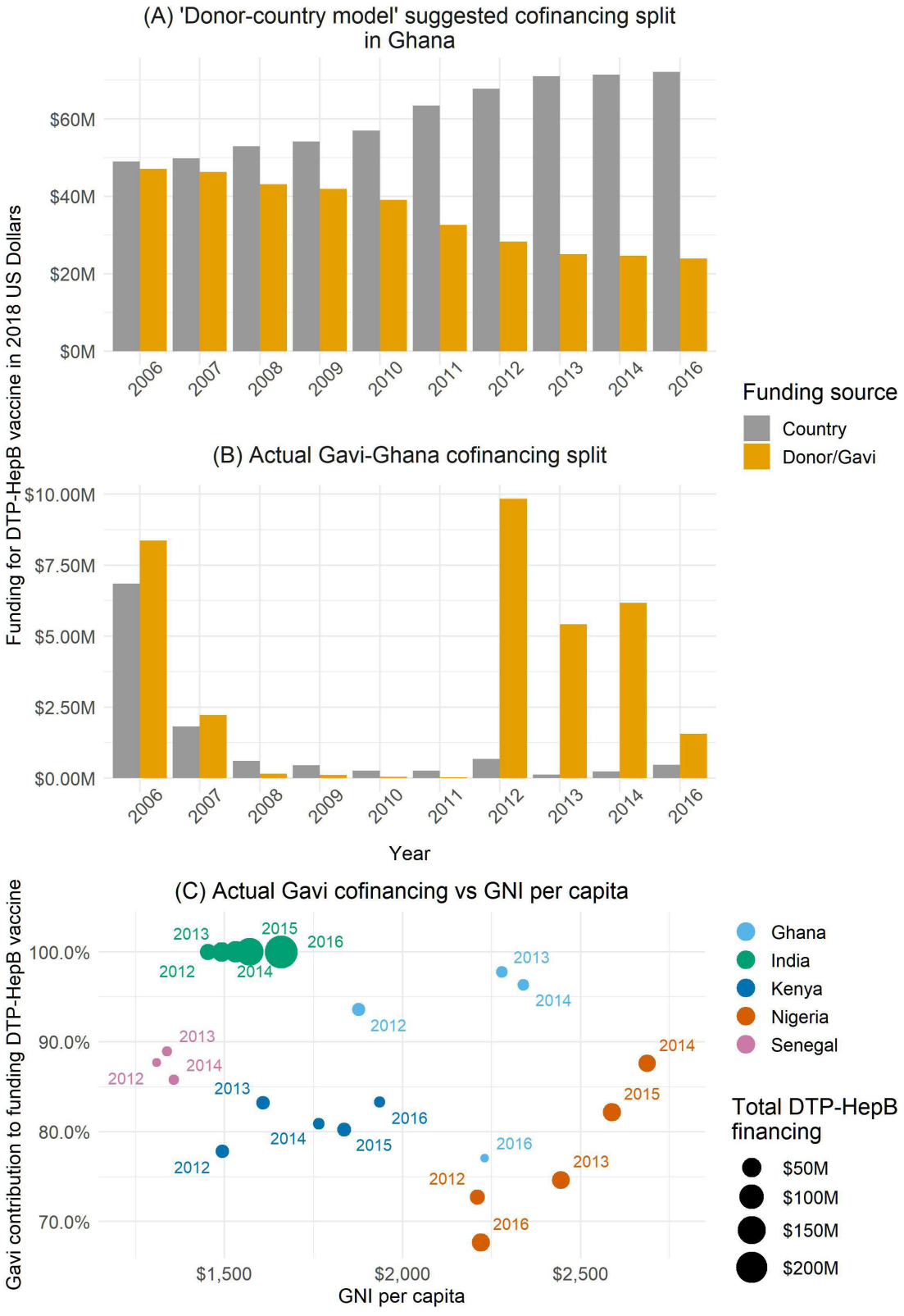

Figure 1 DTP-HepB vaccination cofinancing in Ghana and comparator countries. (A) Donor–country model suggested cofinancing split of domestic country and donor cofinancing of the DTP-HepB vaccine (diphtheria, tetanus, pertussis and hepatitis B) in Ghana using costing evidence from Levin *et al.*[5 11 12]; (B) Actual split of domestic country and Gavi financing based on Gavi country progress reports between 2006 and 2016 (no data were available for 2015).[16] (C) Per cent of Gavi contribution towards cofinancing compared with GNI per capita for comparator countries between 2012 and 2016,[16] for different year and country observations and the size representing total funds for the vaccine. DTP-HepB, diphtheria, tetanus, pertussis and hepatitis B; GNI, gross national income.

will need to distribute it in a manner that effectively and efficiently alleviates the burden of COVID-19 globally while doing so in an equitable manner and using the health systems we have available at the time.

Defeating the world's vaccine-preventable diseases requires cooperation, but without fairness, cooperation cannot be sustained. Recent theoretic advances show why rich–poor financial transfers will be required as part of any financing solution, and also how such funds can be operationally prioritised and disbursed equitably. Contextualising studies such as AIDA are an important next-stage priority to show how these ideas can be implemented in practice for specific vaccine programmes and in specific country settings.

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REFERENCES

1 World Health Organization. World Health organization fact sheets, 2019. Available: https://www.who.int/news-room/fact-sheets/detail [Accessed 25 Jun 2020].
2 Gavi, the Vaccine Alliance. COVID-19: massive impact on lower-income countries threatens more disease outbreaks, 2020. Available: https://www.gavi.org/news/media-room/covid-19-massive-impact-lower-income-countries-threatens-more-disease-outbreaks [Accessed 9 Apr 2020].
3 Abbas KM, Procter SR, van Zandvoort K, *et al*. Benefit-Risk analysis of health benefits of routine childhood immunisation against the excess risk of SARS-CoV-2 infections during the Covid-19 pandemic in Africa. centre for mathematical modelling of infectious diseases: London school of hygiene and tropical medicine, 2020. Available: https://cmmid.github.io/topics/covid19/EPI-suspension.html [Accessed 5 May 2020].
4 Klepac P, Megiddo I, Grenfell BT, *et al*. Self-enforcing regional vaccination agreements. *J R Soc Interface* 2016;13:20150907.
5 Morton A, Arulselvan A, Thomas R. Allocation rules for global donors. *J Health Econ* 2018;58:67–75.
6 Teerawattananon Y, McQueston K, Glassman A, *et al*. Health technology assessments as a mechanism for increased value for money: recommendations to the global fund. *Global Health* 2013;9:35.
7 Dieleman JL, Sadat N, Chang AY, *et al*. Trends in future health financing and coverage: future health spending and universal health coverage in 188 countries, 2016–40. *The Lancet* 2018;391:1783–98.
8 Ikilezi G, Augusto OJ, Dieleman JL, *et al*. Effect of donor funding for immunization from Gavi and other development assistance channels on vaccine coverage: evidence from 120 low and middle income recipient countries. *Vaccine* 2020;38:588–96.
9 Gavi, the Vaccine Alliance. Gavi, the vaccine alliance, 2020. Available: https://www.gavi.org/ [Accessed 25 Jun 2020].
10 Kallenberg J, Mok W, Newman R, *et al*. Gavi's Transition Policy: Moving From Development Assistance To Domestic Financing Of Immunization Programs. *Health Aff* 2016;35:250–8.
11 Megiddo I, Nonvignon J, Owusu R, *et al*. *Analysis of interventions in development aid (AIDA) study*. London, UK: International Decision Support Initiative (iDSI), 2020. https://idsihealth.org
12 Levin A, Levin C, Kristensen D, *et al*. An economic evaluation of thermostable vaccines in Cambodia, Ghana and Bangladesh. *Vaccine* 2007;25:6945–57.
13 Woods B, Revill P, Sculpher M, *et al*. Country-Level cost-effectiveness thresholds: initial estimates and the need for further research. *Value in Health* 2016;19:929–35.
14 Ochalek J, Lomas J, Claxton K. Estimating health opportunity costs in low-income and middle-income countries: a novel approach and evidence from cross-country data. *BMJ Glob Health* 2018;3:e000964.
15 Edoka IP, Stacey NK. Estimating a cost-effectiveness threshold for health care decision-making in South Africa. *Health Policy Plan* 2020;35:546–55.
16 Gavi, the Vaccine Alliance. Ghana country documents, 2020. Available: https://www.gavi.org/country-documents/ghana [Accessed 26 Mar 2020].