Integrated vaccine economics for countries transitioning from Gavi support

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Rotavirus is a leading cause of childhood deaths from diarrhoea and one for which vaccines are fortunately available. In *The Lancet Global Health,* Frédéric Debellut and colleagues[1] evaluate the cost-effectiveness of rotavirus vaccines in 73 countries that now or recently had received financial support from Gavi, the Vaccine Alliance, for their childhood vaccine programmes. The evaluation is timely for at least two important reasons. First, two new rotavirus vaccines are now available at less than half the cost of the original two. Second, paediatric diarrhoeal mortality burden has declined dramatically in low-income countries worldwide in the past decade. This last point is important to emphasise as this reduction is partly due to factors other than rotavirus vaccines. Such factors include the effects of improving sanitation, medical care, maternal education, and other factors linked to an improving economy.[2–5] This effect has also been shown in other areas, like the profound decline in respiratory paediatric mortality in the decades before pneumococcal vaccines were in use.[6]

In terms of cost-effectiveness, these two factors pull in opposite directions: on the one hand, an expensive vaccine becomes cheaper, while on the other hand, the potential health effect declines. Debellut and colleagues' study is therefore a much needed update on this issue, and the key message is that, despite these changes, rotavirus vaccine remains highly cost-effective in most Gavi-supported countries.

Debellut and colleagues address the changing and varying landscape of rotavirus cost-effectiveness by accounting for the different vaccine choices made in each country and the background decline in childhood mortality that is expected even in the absence of a vaccine. Still, rotavirus vaccine was projected to be strongly cost-effective for the decade 2018–27 in all but four of the 73 Gavi-supported countries, and might avert about 80 million outpatient visits, around 8 million hospitalisations, and over half a million deaths. From a government perspective with Gavi support, the vaccine was highly cost-effective at an overall US$264 per disability-adjusted life year (DALY) averted, corresponding to one sixth of the per-capita gross-domestic product (GDP). WHO considered interventions up to 1 times GDP per capita per DALY to be highly cost-effective, but nowadays have shifted to recommend country specific thresholds.[7–9]

A key question that still needs addressing is the economics of rotavirus vaccination programmes for countries that have already or will soon graduate from Gavi support because their national economy has improved and passed the Gavi threshold of $1580 GDP. For such countries, the case was less compelling as these must pay an increasing part of vaccine price and typically have a lower disease burden; cost-effectiveness estimates ranged from $108 per DALY averted in the African region to $1081 in the European region. Indeed, as countries transition away from Gavi support, the relative costs of rotavirus vaccines might increase several-fold (figure). Four countries (Armenia, Honduras, Moldova, and Ukraine) who have graduated from Gavi support had less than 50% probability of vaccine cost effectiveness at the 1 times GDP per capita threshold.[1] Therefore, Debellut and colleagues rightfully recommend that Gavi-graduating countries should look at the newer, less expensive rotavirus vaccines to offset the loss of Gavi support.

This issue ties into another key one that needs more attention; namely, that of affordability. A national vaccine programme might have a considerable effect on a country's health-care budget such that other

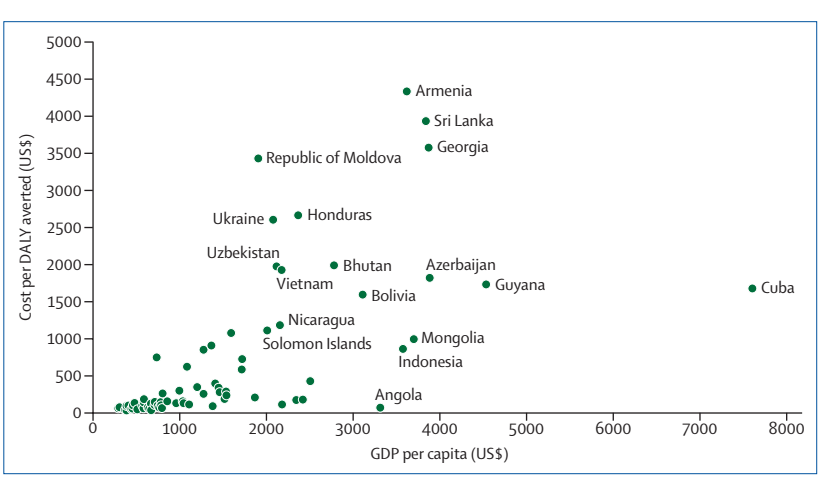

Figure: **GDP and average cost of the rotavirus vaccine per DALY averted in US$ (2015)**
Data taken from the base case scenario, as presented in table 4 in Debellut and colleagues.[1] As GDP per capita increases, the cost of vaccination increases substantially. DALY=disability-adjusted life-year. GDP=gross domestic product.

options for spending are foregone. Thus, even in the case of a cost-effective rotavirus vaccine programme, the question must be asked as to the opportunity costs in terms of alternative health investments. This query is particularly pertinent for countries transitioning out of Gavi support and looking at a new large investment in rotavirus, and probably several other expensive paediatric vaccines, such as the pneumococcal, meningococcal, and human papillomavirus vaccines. Will the health-care budget allow for the new expense for all of these vaccines at market prices? Will the costs disallow other investments in paediatric health? How do we define such opportunity costs, and what time horizon should be included in assessments? Can investments in other areas perhaps be more worthwhile in the long term, such as structurally improving access to health care, improvements in hygiene and maternal education, and so on? A first step would be to consider multiple vaccines in economic analyses and relate this to a nation's health-care budget spending. This would provide a more complete picture of the impact of transitioning from Gavi relevant for policy makers. Such an analysis should also consider what will happen if a country, after years of Gavi support, decides to discontinue rotavirus, and other relatively expensive, vaccines. Will hospitalisation and mortality rates soar, and if so, on what time scale? These questions are still open and need to be addressed in order to allow truly informed policy decisions.

Updates of the cost-effectiveness of vaccines, such as those elegantly presented in this issue by Debellut and colleagues, are an important tool for policy makers. Their value can be increased further by considering more than one vaccine at the time. We look forward to studies that provide a broader understanding of the effect of transitioning through Gavi and increasing economic self-reliance, its effect on regional health-care budget, and the opportunity costs incurred.

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