Challenges in tracking global malaria spending

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In *The Lancet Infectious Diseases*, Joseph Dieleman and colleagues describe how global malaria spending has changed between 2000 and 2016, using data from 106 malaria-endemic countries. They analyse the proportions of government spending, out-of-pocket spending, and prepaid private contributions to total malaria spending, including the costs for treatment seeking, care, and drugs. Although total annual malaria spending has increased in this period to US$4·3 billion, they conclude that we are still off meeting target annual funding by 2020 by $2·3 billion.

If we take these results at face value, we can see development assistance for malaria increased by 30·2% from 2000 to 2010. Since then, it has decreased annually by 1·9%, but by 2016, development assistance was nonetheless contributing to 56·5% of total malaria spending.[1] Although out-of-pocket spending appears to have decreased from 26% (2000) to 13% (2016) of total malaria spending, it has actually seen an absolute increase of $249 million.[1] Whereas absolute government expenditure has increased between 2000 and 2016, its percentage contributions have decreased from 55% (2000) to 28% (2016).[1]

However, these findings should be read with attention to the limitations of the underlying data and analysis. We highlight two in particular. First, in two of the study's main sources, data availability for aggregate government spending did not include spending on malaria inpatient and outpatient care. These figures had to be calculated separately, by means of estimates on volume of care and prices for treatments. Although relying on estimates is widely used in global health, there is concern that we have become too reliant on them and should instead be investing in strengthening the capacity to produce quality data where it is absent.[2,8] We welcome the creation of credible estimates of total malaria spending, as well the authors' initial steps towards identifying areas to improve data quality, but providing specific recommendations on what these improvements should consist of and how to achieve them should be an important point in all discussion sections for papers relying on such estimates.

Second, volumes of care were calculated on the basis of public treatment seeking and specifically treatment seeking for fever, and this method was also used for out-of-pocket spending calculations. However, use of fever as part of the methodology for estimating malaria cases has been widely criticised for contributing to the overdiagnosis and mistreatment of malaria;[2] in particular, in malaria-endemic countries, most individuals presenting with fever are prescribed antimalarials.[3-6] These overestimations are likely to inflate the amount of out-of-pocket spending because they capture visits for fever, rather than visits for malaria alone.

Estimations of total malaria spending are valuable, as they fill a major gap in our knowledge of how malaria prevention and treatment is financed. Although it is useful to know that there is a difference in spending patterns related to a country's malaria status, these estimations do not always translate into directly relevant information at the country and district levels.[7]

For example, one policy implication that Dieleman and colleagues stress is the need for an increase in government contributions to total malaria spending. Although we can all agree that more money would be beneficial, there are no clear suggestions on how this can be achieved, particularly in low-income countries. Rather they highlight some of the constraints such as poor tax collection, low population income, and corruption.[9]

The other important finding from this study is the absolute increase in out-of-pocket contributions to total malaria spending. Dieleman and colleagues highlight the increased affordability of malaria drugs and applaud the global effort to reduce costs. However, the burden of out-of-pocket payments is still high for the 500 million people living below the poverty line in malaria-endemic countries.[1] One action that a health minister could take to address out-of-pocket spending would be to expand prepayment mechanisms to cover costs, such as health insurance or fee exemption schemes. This strategy must be approached with care, as certain approaches to extending prepayment mechanisms can undermine national progress toward universal health coverage. In the case of private prepayment systems for health, financial protection is shaped by demand, which depends on one's willingness to purchase the item and ability to pay for it.[10] Individuals might understand the need for insurance; however, a large proportion of the population affected by malaria will not be able to afford

the premium (ie, membership fee), exacerbating health inequity within the country, a defining principle of universal health coverage.

To conclude, although we welcome the creation of estimates for spending, more work needs to be done translating the findings of these types of financing studies into actionable and concrete strategies for governments and donors. Ultimately, some reflection is needed on how tracking financing data can help shift funding patterns to suit specific country's needs, and thus produce tangible results towards malaria control and eradication.

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Rotavirus vaccine protection in low-income and middle-income countries

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Global under-5 mortality decreased by 50% between 1990 and 2016. The UN Sustainable Development Goals (SDGs) call for under-5 mortality to be no greater than 25 deaths per 1000 livebirths. Since 1990, there has been tremendous progress towards this goal, with a reduction from 142 deaths per 1000 livebirths to 65 deaths per 1000 livebirths for the poorest quintile in low-income and middle-income countries (LMICs).[1–2] Diarrhoeal diseases are estimated to result in 424 000 deaths in children younger than 5 years in 2017, making them the fourth leading cause of death after prematurity, birth trauma, and pneumonia.[3] Control of diarrhoeal diseases is complicated by the fact that there are ten different pathogens that together are responsible for the vast majority of cases.[4] Of these ten causes of diarrhoea, for only one, rotavirus, is there a vaccine.

A further problem with control of diarrhoeal diseases is that the oral rotavirus vaccine is less effective in LMICs.[5,6] In our work,[6] we found protection efficacy against severe rotavirus diarrhoea in Bangladesh was 74%, and that rotavirus vaccine failure was associated with a chronic inflammatory intestinal disease called environmental enteric dysfunction (EED). EED was present in 80% of infants aged 12 weeks in an urban slum of Dhaka, Bangladesh, as measured by faecal biomarkers of inflammation.[7] EED was associated with oral vaccine failure but not failure of systemically administered vaccines, such as the diphtheria, tetanus, and pertussis vaccine. We measured rotavirus vaccine failure as the occurrence of rotavirus-caused diarrhoea in a vaccinated child. Biomarkers of EED and maternal health accounted for 24% of rotavirus vaccine failures.[7]

One cause of EED is enterovirus infection. We found that enterovirus in stool on the day of vaccination was associated with diminished rotavirus IgA vaccine response.[8] It is probable that rotavirus vaccine failure is in part due to a failure of vaccine virus replication resulting from an active gut antiviral immune response.[8]

Despite the issue of a less effective response in LMICs, the WHO Strategic Advisory Group of Experts on Immunization has recommended rotavirus vaccination as part of the Expanded Program on Immunization