Vaccinating Zambia: the race to protect infants from preventable diseases

**MOST PEOPLE ARE** aware that developing countries are affected by a vast number of life-threatening diseases – pneumonia, malaria, diarrhoea and measles, among others – but the real tragedy of such conditions is that they are not only treatable, but also preventable. Historically, these conditions have not been unique to tropical areas; they existed in Europe and elsewhere, but were eradicated using effective preventive strategies and treatments. While they may not have previously been obtainable in less economically developed areas, they are now increasingly available.

Of note, rotavirus infection kills 500,000 children worldwide every year – but almost half of these fatalities occur in sub-Saharan Africa. In Zambia, diarrhoea is the third-leading cause of mortality for those under five years old; significantly, in up to a third of cases, the culprit is the vaccine-preventable rotavirus.

Rotavirus is distinct from many other neglected diseases. While it is preventable through the use of live oral vaccines in places like the US – where vaccination programmes have reduced severe infections by as much as 86 per cent since 2006 – efforts to repeat these results in developing countries have met with extremely mixed results. It has been shown that the efficacy of the vaccination varies wildly between different countries; a recent trial of a rotavirus vaccine evaluated in South Africa and Malawi had a disease-preventive efficacy rate of around 77 per cent in the former, and less than 50 per cent in the latter.

Like many other developing countries, Zambia recently introduced Rotarix™ – a live oral vaccine for immunising infants against rotavirus. Dr Roma Chilengi is a vaccinologist at the Centre for Infectious Disease Research (CIDRZ) in Zambia, where he and his colleagues are pursuing ambitious research on rotavirus and other enteric pathogens affecting the country’s populace.

**THE THREEOFOLD HYPOTHESIS**

What environmental factors could be influencing the efficacy of live oral vaccination? Rotavirus vaccination works by presenting neutralised viruses to the immune system in the hopes of affecting seroconversion – the process whereby the body develops antibodies specific to the rotavirus and builds up their population to noticeable levels.

Chilengi and fellow researchers have developed a threefold hypothesis as to what may be impeding the successful completion of this process: firstly, they believe that maternal antibodies in breast milk and transplacental serum are major contributors to failed seroconversion. Secondly, they posit that malnutrition negatively impacts immunity and makes infants more likely to suffer from rotavirus and other gastroenteritis after the vaccination. Finally, they suggest that introducing the rotavirus vaccines at population level will alter circulating rotavirus strains that cause severe diarrhoea.

The first aim of Chilengi’s work, therefore, is to investigate how maternal immune factors contribute to the failure of seroconversion in infants and, subsequently, the breakthrough rotavirus infections, which could result in severe gastroenteritis. Considerations such as rotavirus-specific immunoglobulin A in breast milk, immunoglobulin G in the maternal and infant serum and the mother’s HIV serostatus and immunostatus could all be playing a role in the failure of seroconversion and the vaccine overall. In addition, the group will test its suppositions about infant malnutrition by measuring the impact of weight-for-age score, linear growth, abnormal anthropometrics and micronutrient levels on the incidence of severe rotavirus gastroenteritis. A second and more complex aim of this research programme is to examine the contributions made by different strains of virus to overall disease burden.

**WATCH THIS SPACE**

The programme of research being pursued by Chilengi and his colleagues is not only vitally important, it is also timely. The team at CIDRZ is determined to undertake innovative research that is relevant to Zambia. It is important that scientific evidence also originates from regions where the disease is endemic, as results from the developed...
Rotavirus infection kills 500,000 children worldwide every year

world are not always replicable. More specifically, understanding the effect of applied water, sanitation and hygiene (WASH) practices, environmental enteropathy, gut function and micronutrient deficiencies are difficult scientific questions the team is poised to address and, in turn, contribute to global knowledge.

As well as serving the rotavirus research community at large by providing further data and helping to draw attention back to the unpredictable performance of live oral vaccines in developing countries, the Zambian scientists are providing critical evidence on vaccine failure with direct relevance to the national programme. Its outcomes, some of which have recently been released in science and medicine journal *Plos One*, will be well-placed to inform medical practice and even government policy on this issue.

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