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Defeating dengue starts at home, but will hinge on scientific research

The writer says that it is widely accepted among scientists that we need to take a multi-pronged and multidisciplinary approach, both to control mosquitos and their habitats, as well as to treat and prevent human disease. ST PHOTO: GIN TAY

There are many promising drugs and vaccines for dengue in the pipeline, and it is worth investing in clinical trials.

Ashley St John

Even as Singapore is a leader in the fight against dengue on both the public health policy and research fronts, those of us living here find ourselves continuously challenged by the seasonal cycles of dengue surges.

From a broader perspective, Singapore is truly an island within the flood of dengue that inundates South-east Asia. Many Asian countries get hit far harder than we do. Bangladesh comes to mind, having met the tragic milestone in early September of reporting its highest number of deaths in a year, with more than 800 casualties.

In Singapore, cases have ticked upwards in the opening weeks of September, although the figure is still lower than we saw in recent years. According to the European Centre for Disease Control and Prevention, more than three million dengue infections and at least 2,000 deaths were reported globally in the first half of 2023, illustrating the great human cost associated with the disease and its outbreaks. In spite of these sobering statistics, as a scientist and researcher, I'm optimistic that we can solve some of the remaining questions about dengue and find creative solutions to reduce its local and global impact.

One of the mysteries of dengue is the broad spectrum of disease it causes in humans. Some individuals experience asymptomatic or mild infections and are not even aware they have been exposed to the virus, while others develop a painful febrile illness that was originally aptly named "breakbone fever". I, personally, fall into the first category. Not having had a documented dengue infection, I donated my blood to a research study here in Singapore a few years ago as a "negative control" or someone who has never had dengue. They quickly got back to me that I was not a good "negative control" at all and had, at some point in time living in Singapore or travelling in the region, had a dengue virus infection.

Maybe I had been one of the true asymptomatic cases or, perhaps, one of the times I had felt a little under the weather, I had unknowingly contracted dengue. Either way, it was sobering insight, knowing how dengue often silently transmits in the community. Others are not so lucky to have asymptomatic infections and may develop severe disease, which often occurs as their fever is subsiding and they appear to be recovering.

As scientists have zoomed in, over decades of research, to understand the disease processes arising during severe dengue, we have built a growing understanding of what is happening at the level of our cells, the building blocks of our bodies.

Initially, infected cells raise the alarm for the immune system to begin clearing the infection. However, as they do this, they produce signals that amplify inflammation and enzymes that work like scissors to cut apart the connections holding cells together. When this occurs between the cellular blocks that form our blood vessels, during the time in the disease course when dengue virus is circulating at high levels in the blood, it can allow the blood plasma to seep into tissues. This can then lead to tissue and organ damage, pooling of fluid in the lungs and insufficient blood pressure for the heart to pump. In research done at Duke-NUS Medical School in collaboration with hospitals in Singapore, we noted that even patients with mild dengue experience this leakage to a certain degree.

My colleagues, who are clinicians treating dengue patients, always emphasise to me how difficult this condition is for them to manage, since providing more fluid is needed to restore blood pressure, while providing too much can even augment the organ damage resulting from the excess fluid leakage and pressure on the organs.

In some cases, this breakdown of blood vessels also results in haemorrhaging – for which the most severe form of disease, dengue haemorrhagic fever, was named. To put it simply, dengue is bad news and, knowing the facts about dengue, we should not be complacent and disregard the spread of dengue in our community or allow for possible treatments and countermeasures to go untested.

There is no easy solution to dengue. Because of the complex way that dengue virus spreads and is amplified in the environment, involving both mosquito and human hosts, it is widely accepted among scientists that we need to take a multi-pronged and multidisciplinary approach, both to control mosquitos and their habitats, as well as to treat and prevent human disease. This involves considering the problem from the perspectives of multiple fields of research, including virology, immunology, medicine, environmental science, health policy and others.

In practice, this involves our personal efforts, from eliminating mosquito habitats in our environment and wearing insect repellent when appropriate, to getting tested when we have symptoms of febrile illness, tracking the clusters on the National Environment Agency website and heeding signs at our housing blocks to know when we are at highest risk. It also involves broader policies such as investing in educating and reminding the public of the measures they can take to protect themselves and the community. Importantly, we want to not only manage dengue with the existing tools we have, but also work towards a time when dengue is a reduced health and economic burden to Singapore and the region.

Achieving this will likely involve not only the mitigation efforts that we currently undertake, but also investment in research to develop and test improved dengue treatments and vaccines. There are many promising drugs for dengue in development that have shown efficacy in early pre-clinical testing, as well as new vaccines in the pipeline that are informed by decades of research. Although it is difficult and costly to push these drugs into trials, more clinical trials for dengue would allow us to identify the drugs that have strong scientific rationales for working and can actually give patients a degree of relief.

In Singapore, these trials are more costly than they would be in neighbouring countries, and they might require funding over several dengue seasons to recruit enough patients for analysis, but there would be payoffs from better understanding how the therapeutics and vaccines would work in the local population where the age of patients is higher than in many neighbouring countries, and where pre-existing conditions, such as metabolic diseases, often contribute to complications during dengue.

The challenge of dengue sometimes seems insurmountable, and we can be discouraged in the face of recent record-breaking dengue years. However, the years of investments in research and technology are likely to continue to yield advances in how we prevent and treat dengue disease as we stay the course with our dengue control measures.

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