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Zika Virus and Health Systems in Brazil: From Unknown to a Menace

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In 1947, Zika virus was first identified in Uganda;\textsuperscript{1} on February 1, 2016, a World Health Organization (WHO) emergency committee declared clusters of birth defects suspected of being linked to an epidemic of Zika virus in the Americas as a Public Health Emergency of International Concern (PHEIC).\textsuperscript{2} The 69-year period between these two events was, for the most part, uneventful with regard to research and international awareness. When the virus made its way to the Americas, however, history changed its course. An association between Zika infections during pregnancy and the birth of babies with microcephaly was first suggested by Brazilian physicians in August 2015, and in November microcephaly cases potentially associated with Zika started to be recorded; three months later WHO made its announcement. In Brazil, the country hit hardest by the epidemic so far, there have been 6,906 suspected cases of microcephaly as of April 2, 2016; 1,046 have been confirmed for microcephaly, 1,814 have been discarded, and 4,046 remain under investigation.\textsuperscript{3} The exact number of Zika infections in Brazil is not known, but autochthonous transmission of the virus has been confirmed in all 27 states in Brazil. In addition, as of April 7 autochthonous transmission of Zika virus has been confirmed in 34 countries/territories of the Americas (http://ais.paho.org/phip/viz/ed_zika_countrymap.asp).

The unfolding story of Zika virus in the Americas is much more than a mosquito-borne disease that may affect fetal development. It is the story of a disease that exposed problems and raised challenges that the affected health systems and governments cannot ignore. Next, based largely on lessons provided by Brazil’s Zika epidemic, we discuss five critical problems and challenges and reflect on opportunities to remedy them.

\textbf{SCREENING CRITERIA}
When the surge of reported cases of microcephaly started in Brazil, the national screening
criterion recommended by the Ministry of Health was a measurement of head circumference of
less than or equal to 33 cm for term newborn babies (both sexes and all gestational ages), and for
preterm babies the cutoff was the 3rd centile of the Fenton\textsuperscript{4} curves by gestational age and sex. On
December 8, 2015, the Ministry of Health reduced the cutoff to 32 cm, but made no distinction
between boys and girls.\textsuperscript{2} That criterion was still likely to detect many false positives, as detailed
by Victora et al (2016),\textsuperscript{2} which combined with a long period until confirmation, ended up
generating stress and anxiety among parents who were left for several weeks without knowing
for sure if their child does indeed have microcephaly. Understanding this burden on mothers, on
March 15, 2016, Brazil’s Ministry of Health released a plan to expedite screening of suspected
cases.\textsuperscript{5} In addition, on March 9, 2016, Brazil followed recommendations from the WHO and
reduced the cutoff to 31.9 cm for boys, and 31.5 cm for girls; and for preterm babies the cutoff
was \(-2\) standard deviations of the sex-specific and gestational-age specific InterGrowth
standards.\textsuperscript{6} Combined, these measures are expected to reduce the current large number of
suspected cases yet to be confirmed, reduce the future number of suspected cases that are in fact
false positives, and reduce the unnecessary emotional stress on parents of healthy children who
would have been considered as suspected for microcephaly under the previous screening criteria.

**Medical Care for Children with Microcephaly**

The health system in Brazil is facing an urgent demand: the provision of regular care for children
born with microcephaly, who need to receive early stimulation and special family support,
particularly in the first three years of life. Although the basic health care units were not prepared
for this demand, the Ministry of Health issued guidelines for early stimulation of children born
with microcephaly;\textsuperscript{7} is preparing specialized training for physical therapists, psychologists,
physicians, phono audiologists, among other professionals; and is certifying rehabilitation centers for the proper delivery of care. Brazil also passed legislation to provide a special monthly payment to poor families that have a microcephalic child. Thus, although overstretched with the many extra demands triggered by the Zika virus epidemic, the national health system is making provisions to be able to deliver proper care.

One pressing question is whether children born without microcephaly, but whose mothers had a Zika virus infection during pregnancy, will have normal development or will present with problems later in childhood. Thus, it is of utmost importance to have cohort studies that closely monitor the cognitive and motor development of children, considering a careful design that would include all children born with microcephaly in a certain area, but also a sample of those born without. This would enable the health system to prospectively document and understand the range of potential developmental problems that may arise, enabling the delivery of proper comprehensive care.

**REPRODUCTIVE HEALTH AND ABORTION**

The association between Zika virus and microcephaly spurred some government leaders of countries affected by the virus to suggest that women should postpone having babies for a few years (for example, the Deputy Health Minister of El Salvador suggested that women should delay pregnancy until 2018). This statement ignores the fact that about 58% of pregnancies in Latin America and the Caribbean are not intended; rates of sexual violence are high in the region; and despite being illegal, more than four million abortions were performed in Latin America in 2008, about 95% under unsafe conditions (https://data.guttmacher.org/regions). As a result, Zika virus has stimulated discussion throughout the region about women’s rights to
contraception access and abortion. A review of abortion laws in Latin America and the Caribbean shows that only Cuba, Guyana, French Guiana, Uruguay, and Mexico City allow abortion without restriction; Chile, Haiti, Dominican Republic, El Salvador, Nicaragua, and Honduras prohibit abortion altogether; and other countries make exceptions to save a woman’s life (http://worldabortionlaws.com).

It is important to reflect if and how the current Zika epidemic will prompt health systems of affected countries to introduce changes in antenatal care protocols. In the absence of a treatment that prevents the Zika virus from crossing the placenta, women have no legal framework to exercise the choice of having a child following an infection during pregnancy. Also, in the hypothetical scenario that a pregnant woman tests positive for Zika virus and has an abnormal ultrasound showing problems in fetal development, what should be the protocol? In the absence of legal abortion, a woman would have to carry on the pregnancy and deliver a microcephalic child, or put her own health at risk by inducing an abortion or by seeking an illegal abortion. Neglecting to face these issues can have serious consequences for women’s health. However, whether affected governments will actually consider significant changes to current legislation is yet to be seen.

UNDERSTANDING AND COMMUNICATING THE RISK OF MICROCEPHALY

The production of knowledge about Zika virus has been increasing exponentially. Many cases have been reported indicating the presence of the virus in the placenta, in the amniotic fluid, in the blood of newborns, and in the brain and several organs of microcephalic fetus. There are reported cases indicating that asymptomatic Zika virus infections during pregnancy were also associated with fetal malformations, and that Zika virus can cross the placental barrier at any
time during the gestational period. Experiments using neural stem cells exposed to Zika virus showed the effects on cell growth and division. Yet, many questions remain unanswered, such as: If a pregnant woman gets Zika virus and the baby is not born with microcephaly, will the child present with developmental problems later in childhood? Does the answer vary if the infection is asymptomatic? What is the risk of having a baby with microcephaly, after a Zika virus infection, considering when during the gestational period the infection took place? Does the risk vary if the infection is asymptomatic? Are there individual- or contextual-level factors that modify these risks? Does a previous infection with another pathogen (e.g., dengue), or a co-infection, increase the virulence of Zika?

Answers to these (and other) questions are of utmost importance to support health systems in tailoring messages at the primary health care level, during antenatal care, and in overall public campaigns about the disease. Most importantly, better message would minimize the panic and misinformation to which women are exposed. Brazil has been at the forefront of knowledge production during the Zika epidemic: Brazilian physicians were the first to suggest a link between Zika virus and microcephaly, and much of the evidence produced so far has come from Brazilian researchers or with their direct involvement. Solid research capacity and infrastructure in Brazil is a major advantage, but the availability of more funds for Zika virus research (currently still modest) would speed up the production of additional knowledge.

**VECTOR CONTROL**

Vector control strategies used today rely on spraying houses (inside and in the peridomicile), destruction of larval habitats, use of larvicides, and education campaigns. Spraying is often part of a surveillance strategy that treats all houses within a certain distance from a house where a
case was detected; spraying kills all adult forms of the mosquito in the treated area, but has no residual effect. The destruction of habitats is often done during home visits made by vector control agents, but unless it has 100% coverage, it is unlikely to be effective. Larvicides are also applied during home visits, but they have a limited lasting effect, requiring routine and exhaustive applications. Education campaigns are important to sensitise the population, but unless they promote a change in behavior that leads to fewer breeding habitats, they will have minimum, if any, effect on vector control. As an extreme measure, on February 15-18, 2016, the Brazilian government recruited 55,000 military personnel to support the work of vector control teams: almost one million houses were inspected in 290 cities. Yet, this effort is not sustainable over time, and some critical areas in slums were not targeted. New approaches, such as genetic engineering of mosquitoes and infecting mosquitoes with Wolbachia are currently being tested, but they are unlikely to have any immediate effective outcomes at a large scale.

In the past few decades, vector control programs have not prevented the spread and introduction of diseases transmitted by Aedes aegypti, even in areas with well-organized public health systems. The current failure of vector control efforts contrasts with historical examples of mosquito elimination. As part of a yellow fever eradication program, Ae. aegypti was eliminated from almost all the countries in the Western Hemisphere from the 1950s to the 1970s. Yet, lessened surveillance, reduction of vector control personnel, and rapid and unplanned urbanization, often lacking proper sanitation, reliable access to piped water, and regular waste collection, have created cities with extraordinarily well suited conditions to Ae. aegypti, and thus to the transmission of dengue, chikungunya, and Zika virus.

In such a scenario, it is inconceivable that current vector control efforts will ever be successful without the provision of sanitation, access to piped water, and regular waste collection; without
collaboration among different government sectors—e.g., health, urban planning, and education; without the use of environmental management—a necessary strategy in all historical examples of successful vector control; without partnerships between the public and the private sector—the burden of diseases transmitted by *Ae. aegypti* may affect their revenue, so that collaborating with the government is not an extra expenditure but an investment; and without community engagement. Fred Soper, who successfully organized eradication campaigns (largely based on vector control) against yellow fever (also transmitted by *Ae. aegypti*) and malaria in the 1940s and 1950s, used to say that eradication would not be possible in a democracy.\(^{17}\) Here we argue that, in a democracy, success will only be achieved through community participation and through governmental intersectoral collaboration for the provision and maintenance of infrastructure.

In summary, the challenges currently faced by the Brazilian health system from the Zika virus epidemic, as well as the solutions being implemented to overcome some of these challenges, highlight actions that other countries in Latin America and the Caribbean, with active transmission of Zika virus, should be considering. With a universal health care system,\(^ {18}\) and a successful primary health care strategy,\(^ {19}\) Brazil is in a better position than its neighboring countries to handle the chaotic situation that has emerged with the Zika virus epidemic. The struggle in Brazil shows that the fight against the Zika virus, and against other diseases transmitted by *Ae. aegypti* (dengue and chikungunya), cannot be won if the only fighter is the health sector, if the weapons are limited and/or inappropriate, and if the battle plan does not address the basic needs and rights of the population. Otherwise, besides losing this fight against Zika, it is just a matter of time until the next menace arrives.


