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Synopsis

ZIKA AND OTHER MOSQUITO-BORNE DISEASES: ARE WE PREPARED?

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More than 275,000 people across the globe die each year due to diseases transmitted by mosquitoes. This does not include the almost half a million deaths caused by malaria, nor other serious repercussions that may arise. The latest big health threat is the Zika virus, already present in more than 80 countries and capable of causing microcephaly (a serious brain anomaly) in children born of infected mothers.

Globalization and climate change are facilitating the spread of these types of diseases beyond the areas where they typically occur, including the Mediterranean region. In these countries we cannot rule out the arrival of new infections caused by the Zika virus.

Are we ready to prevent them or fight them? To discuss this, and to propose the necessary improvements, some of the top international experts will participate in the debate '[Zika virus and other mosquito-borne viruses. Science for preparedness and response in the Mediterranean region](#)', organized by B-Debate –an initiative by Biocat and "La Caixa" Foundation to promote scientific debate– together with the [Barcelona Institute for Global Health \(ISGlobal\)](#).

CONCLUSIONS

- Mosquito-borne diseases are an **extremely serious problem on a global level**. Moreover, due to globalization and climate change more areas are being exposed to them.
- **Surveillance campaigns**, together with **mosquito-control methods**, are **fundamental for preventing or containing infection**. However, there are still some gaps and shortfalls.
- The Zika virus is the latest infection to gain notoriety. Although the only cases Catalonia have been imported from other countries, there is a risk that the virus may be transmitted by the tiger mosquito.
- **Risk communication campaigns are crucial** and should include both generic and specific messages for each community.

1. MOSQUITO-BORNE DISEASES: A GLOBAL PROBLEM

Excluding malaria, there are five main diseases transmitted by mosquitoes: dengue, yellow fever, chikungunya, West Nile virus, and Zika virus. They differ in terms of their severity and geographical extension, but all are spread by the *Aedes* mosquito. There are two types of *Aedes* mosquito: *Aedes aegypti* and *Aedes albopictus*, the latter also known as the “tiger mosquito” (already present in European regions such as Italy, the French Riviera, and the Spanish Mediterranean coast). These are the so-called ‘necessary vectors’.

As stated by Collen Acosta, epidemiologist at the World Health Organization (WHO), “**dengue affects between 70 and 500 million people each year**, around two million of whom will develop a serious illness.” And up to 4,000 million people are exposed to contracting the disease.

Chikungunya fever was for a long time considered a mild disease, but doubts started to arise and it is now believed to be serious in some cases. Yellow fever is more dangerous, and is the only one of these diseases for which there is an effective vaccine. Despite this, “there have been three major outbreaks between 2015 and 2017 in Angola, the Democratic Republic of the Congo, and Brazil”, says Acosta.

Western Nile virus. Despite its name, this virus has a wide, global distribution. “Its impact is unknown”, admits Acosta, but in 2006 in the United States alone “more than 4,000 cases were reported, of which 3 and 15% resulted in death.”

The latest of these infections to gain notoriety is the **Zika virus**. Although its existence has been known since 1947, it was not until 2014 that it began to spread, reaching the American continent. **Today, evidence has been found of its transmission in more than 80 countries**, with over 200,000 confirmed patients and at least 3,000 cases of babies with microcephaly born of mothers infected with the virus during pregnancy.

The virus has not reached Europe, or has at least not reached the mosquitoes that could carry and transmit it (the virus has only been found in infected people returning from areas where it is already endemic). However, it cannot be ruled out that it will not arrive in the future. **Globalization and climate change “are changing the frequency and distribution of many infectious diseases”**, says Acosta. Although the Zika virus has not been transmitted in Europe, there have been “recent outbreaks of dengue,

chikungunya, yellow fever and Western Nile virus in regions that were previously free of these diseases, including the European Union.”

In fact, as mentioned by [Laurence Marrama](#), an expert in vector-transmitted diseases at the European Centre for Disease Prevention and Control in Stockholm, what we are seeing now may just be the tip of the iceberg, as these diseases are often not properly diagnosed or pass as asymptomatic infections. **Therefore, we need to be prepared**, especially in countries where some of these mosquitoes are present. This involves research into how to control the disease and its vectors, in addition to surveillance and effective communication strategies.

According to [Pablo Martínez de Salazar](#), leader of this B-Debate and coordinator of arbovirus research and the response to the Zika virus at the ISGlobal Institute, this meeting serves to “identify the challenges, capacities and existing gaps, and to explore new ways in which to collaborate”.

2. ARE WE READY TO DEAL WITH FUTURE OUTBREAKS?

[Xavier de Lamballerie](#), professor at Aix-Marseille University of France, outlined **several areas to work on to be better prepared on a global level:**

- Diagnostic tools need to be improved, especially in the poorer countries, to make them faster, safer and more readily available. “This should be an absolute priority in the research”, says de Lamballerie.
- We need to create a risk map, with coordinated, global medical surveillance.
- The natural history of the infection should be studied; although this may seem “simple and obvious, a lot of the time it is not done.”
- We need to study some social science aspects - “the perception of risk, attitudes, and behaviors”.
- Data from clinical studies should be harmonized, standardized and shared.

And, of course, advances must be made in the prevention and treatment of disease, as well as in the **methods used to control the vectors**. [Paul Reiter](#), consultant at the Pasteur Institute in Paris, spoke about the latter. There are four main methods to work with: **irradiate mosquitoes** to sterilize and then release them, infect them with the [Wolbachia](#) bacteria –which makes reproduction difficult and prevents the

development of the virus–, use **transgenic mosquitoes** ('friendly' mosquitoes) which displace the wild mosquitoes and need an antibiotic to survive, or use **gene drive technology**: taking advantage of the new cut-and-paste gene editing tool CRISPR to introduce sterility genes that will propagate quickly.

All these strategies carry **risk** and are still not as effective as we would wish. "We still need greater knowledge", says Reiter. "But in the meantime, we must continue to do what we can, with our fingers crossed hoping that the new methods will work". **Carla A. Souza**, professor at the Institute of Hygiene and Tropical Medicine in Lisbon, went a step further by asking: "**Could something like that be applied in Europe?**"

3. ZIKA: THE ENEMY AT THE DOOR

"We have many gaps when it comes to understanding the Zika virus. We don't have antiviral drugs or a vaccine, and information about the risk factors of transmission from mother to fetus is limited", says **Antoni Soriano**, a pediatrician specialized in infectious diseases at Vall d'Hebron Hospital in Barcelona. "**For pediatricians, it was a kind of déjà vu, reminding us of the beginnings of the rubella virus or even the AIDS virus.**"

Soriano is currently monitoring around 60 children, the eldest of whom is only 13 months old (all are imported cases, where the infection occurred abroad). In addition to the risk of microcephaly, "we know hardly anything about the possible long-term effects", he says. The pediatrician forms part of the **ZIKAction** consortium, a multidisciplinary European project which aims to establish a network to improve research on the virus and the response capacity in the event of an outbreak.

Another European project to fight the virus is **ZIKAVAX, which focuses on developing a vaccine**. "The objective is to achieve 80% effectiveness", says **Odile Leroy**, executive director at the European Vaccine Institute, and project coordinator. In total "there are 50 projects from 27 different institutions across the world", she says, 10 of which are already in the clinical trial stage.

Meanwhile, there is the threat of outbreaks of the virus replicating and spreading. The regions at risk of being 'colonized' by the virus are those where mosquitoes capable of transmitting it are present. Some of these are areas on the Mediterranean coast, where a few years ago the *Aedes albopictus*, the 'tiger mosquito', settled.

“The first time we detected the mosquito in Catalonia was in 2004, in Sant Cugat”, said [Mireia Jané](#), subdirector of the Department of Surveillance and Response to Public Health Emergencies of the Public Health Agency of Catalonia. Since then, concern has led to new initiatives such as [Mosquito Alert](#), a collaborative citizen science platform which, according to the project director [Frederic Bartumeus](#), “aims to close the circle between science and public health.” The warning by citizens of the presence of the mosquito allows “control and surveillance measures to be increased and is, in itself, a research platform.”

On an official level, **a surveillance plan has been in place since 2014** to fight diseases transmitted by these mosquitoes. The plan initially included dengue, chikungunya and the Western Nile virus, with the Zika virus being added later. Since then, 237 cases of dengue, 203 of chikungunya and up to 156 cases of Zika have been confirmed, all of them imported from other countries. That is, **no transmission has occurred in Catalonia, nor has the virus been found present in mosquitoes.**

But there is a risk that this could happen. Therefore, the surveillance plan involves numerous actors and measures - political, health, scientific and communication.

4. ZIKA AND RISK COMMUNICATION

Communication during a public health emergency plays a fundamental role and its main aim is to **“empower people to protect themselves from infection”**, says [Jonh Kinsman](#), professor at the Epidemiology and Global Health Unit of Umeå University, Sweden. According to Kinsman there are two types of messages to communicate: one, **generic**, which can be applied anywhere and which are based on **universal** biological principles; and the other, context-specific messages, aimed at specific aspects in each community.

The latter are usually more complicated to establish, and “require systematic social research to identify what is happening in a Community.” In fact, **“the authorities don’t always understand the issues at local level**, and without this understanding these messages may not be understood or accepted.”

Kinsman participates in the [ZikaPLAN project](#), one of the aims of which is to assess how the Brazilian population perceives the information campaigns they receive about Zika. One observation made is that the campaigns are often unbalanced: they are either

overpacked with information or they appeal too much to emotion, without informing people properly.

The journalist [Mônica Manir](#) studied how news about Zika was treated in the four main Brazilian newspapers. She differentiated three types of discourse. One is the **discourse of power**: how the government updated figures on the disease while at the same time emphasized in the media the important role of the population in the fight against the virus. Another, the **discourse of science**: how the reference research centers came to have an unusual role in other times. And, lastly, the **discourse of sufferers**: that of the mothers (the WHO asked women to consider delaying pregnancy, but in these regions many women live to be mothers”) or that of the affected children, who “in the beginning don’t appear in the newspapers and then later just their backs are shown, until, finally, their faces are shown. That’s when we really assimilate the problem”, said Manir.

Another important aspect is that of media coverage, the number of news stories devoted to the virus. This was at its height during the outbreak, but fell quickly as winter arrived and the mosquito population declined, and hence infection rates.

[Laurence Marramahad](#) previously commented that: “**we go from one extreme to another. They are either ignored by the media or are totally swamped by them.**”