

## Zika and *Aedes aegypti*: new and old challenges

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#### Abstract

Infection with the zika virus had a great impact not only on pregnant women and newborns, but also on public health, on popular ideas about *Aedes aegypti* and with respect to women's social rights. The objective of this paper is to identify this impact and the historical, social and health changes of the disease and the legacy of the zika virus. Interventions by researchers from different specialties foster conditions for more comprehensive investigations into future epidemic threats in Brazil and Latin America. This dialogue took place after the seminar "*Aedes aegypti*: past and future health emergencies," organized by the Casa de Oswaldo Cruz, when we talked with some speakers and other leading researchers about the history and challenges of *Aedes aegypti* and zika.

Keywords: zika; *Aedes aegypti*; Latin America; global health; yellow fever.

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This discussion took place on the occasion of the seminar “*Aedes aegypti*: past and new health emergencies” held on December 2, 2016, by Casa de Oswaldo Cruz in partnership with the World Health Organization, the Pan American Health Organization, and the Centre for Global Health Histories (University of York, UK). After the seminar, Marcos Cueto (scientific editor) and Roberta Cerqueira (executive editor) talked to the speakers José Moya and Mónica García and the researchers Jaime Benchimol, Ilana Löwy, and Flávia Bueno about the history and challenges of *Aedes aegypti* and zika.



Marcos Cueto: The subjects we’re going to address here have to do with the following questions: What was the legacy of the fight against yellow fever in Latin America? How can the zika and chikungunya epidemics be situated within the historical context of the fight against mosquitos and vectors, especially *Aedes aegypti*? What can this crisis of epidemics tell us about scientific medical practice and its interface with the so-called lay public? How do you see the zika epidemic impacting on the debate about contraception and maternal and infant health? How has the zika epidemic contributed to discussions about abortion in Brazil and Latin America? And a more general question: How can the social sciences and history help shed light on and orient public policies for the fight against zika and dengue fever epidemics? I suggest we begin by discussing the legacy of the fight against yellow fever in Latin America and how the zika and chikungunya epidemics fit into this tradition of vector control, especially the control of the mosquito *Aedes aegypti*.

Jaime Benchimol: I’d like to begin by referring to the particular case of Brazil. One obvious legacy is the very institution we’re now in. Fiocruz could well not exist if there hadn’t been a campaign against yellow fever and the whole process triggered by the disease. Yellow fever was a major public health issue – a priority throughout the nineteenth century and into the early twentieth century. So the discussion about yellow fever, and specifically about the vector *Aedes aegypti*, stems from our tradition of tropical medicine and sanitarianism – a robust medical tradition built from the discussions and challenges spawned by the fight against yellow fever and, from a certain point in time on, by campaigns against the vector. Brazilian medicine and public health have a sturdy tradition of combatting these vectors, with high points and low points, periods of more sustained success, periods of defeat and retreat. The period right now is paradoxical. On the one hand, zika has revealed considerable capacity for response on the part of scientific institutions, and this is largely due to these medical traditions, whose roots lie in yellow fever.

As far as public health actions are concerned, we’re going through a very complicated time with a great many difficulties. The model for addressing the problem in harmony with SUS [the Brazilian public health system], with primary healthcare, hasn’t yielded consistent results, maybe for political reasons, which have conspired against the success and progress of SUS. On the other hand, some old structures that could be of assistance today have been dismantled.

For the Olympics, a flustered attempt was made to revive the campaign model. In fact, it's very hard to get a grip on the fight against these diseases. There are new alternatives appearing on the horizon, like biological control. The government is putting a lot of faith in that; I hope it works. There's the prospect of vaccines for dengue and perhaps Zika. But we're at a stalemate at the moment.

Another important legacy is that no matter how hard it is to get the population to take preventive measures, the fact is that urban populations are already very familiar with the issue of mosquito-borne diseases. It's no coincidence that in this moment of crisis, in the most disastrous way possible, the authorities have been capable of reactivating old mechanisms that were in use for a long time, while also reactivating a number of concepts that are rooted in people's minds when it comes to fighting vector-borne diseases.

Mónica García: The impression I have is that a lot of these vector-control agendas, like in Colombia, are agendas that originate more from international organisms than from local demands. International agendas in the sense that Latin American states transitioning to modern capitalism had to be responsive to the demands made by the emerging international public health organizations, at least the ones from the USA for the regions of Latin America, which ended up influencing all the anti-mosquito and research policies in the first half of the twentieth century. There was clearly a strong international agenda that drove the creation of permanent institutions, which, in the case of Colombia, were for the areas of yellow fever epidemiology, entomology, and so forth.

I think the way new institutions and professional training in tropical medicine were planned is a subject worth researching. We must analyze the meaning of this institutionalization for the political ruling classes and, as far as possible, for the local populations, too. In the case of the campaigns against hookworm disease, for instance, which opened the door to the Rockefeller Foundation in many places, there was already a tradition in Colombia whereby the local coffee producers who knew about the campaigns in the USA actually sought out the foundation's support for the fight against this tropical disease.

In some particular cases there was also a national agenda in the fight against *Aedes aegypti*, like in Brazil. But in others, like Colombia, whatever the mortality rates, the international agency of the Rockefeller Foundation was crucial for the fight against yellow fever. The foundation evaluated the epidemic, quantified it, and essentially constituted the disease as a public health issue. As such, one great legacy of the fight against yellow fever led by the foundation in Colombia was the creation of laboratories for researching and measuring the extent of yellow fever, as well as the modernization of part of the country's sanitation infrastructure.

Marcos Cueto: Would you like to add any comments about this historical aspect? You, José, mentioned that in the 1960s several Latin American countries were free of *Aedes aegypti* and that they even received certificates from PAHO attesting to the eradication of the mosquito. What happened to vector control?

José Moya: Good question. Unless I'm mistaken, the 1947 resolution by the Directing Council is precisely about the eradication of *Aedes aegypti* for the control of urban yellow fever. The resolution is marked by great optimism, which is typical of that time. I think there was initial optimism because of the success of the *Aedes aegypti* eradication strategy in the first two decades, because governments were taking part, there was political will, financial resources, and training for battalions of health workers. Even today, the memory of those battalions is etched on people's memories. I believe some of us here had a chance to see those men in their uniforms, which weren't military, but which identified them as vector control professionals.

It's also worth considering that this optimism was related to the size of the populations. Compared to today, the populations were very small. In 1950, Peru had a population of around ten million people, mostly living in rural areas. The same can be applied to other countries in Latin America. They were scattered rural populations with a lower risk of being affected by malaria, and who could be controlled by that military-like strategy of yellow fever campaigns, or should I say, *Aedes aegypti* control campaigns.

By 1950, 18 countries had eradicated the mosquito, but when they were unable to keep up the political and financial commitments and the training and capacity building of the vector control brigades, they were gradually reinfested by the mosquitos. The US border, for instance, was never completely free of the disease, and Mexico was infested as a result. Reinfestation was progressive and came together with the social crises in our continent: wars, population migrations, and displacements.

As the populations grew and started to be more concentrated in urban areas, when they were exposed to the presence of the mosquito, outbreaks of dengue started to crop up. It wasn't yellow fever any more, but dengue fever that started to manifest more severely: classic dengue, hemorrhagic dengue, deaths... There are two separate periods: first, the positive impact of the elimination of *Aedes* (which was achieved in ignorance of the negative environmental impacts of DDT) and later, reinfestation. All these factors mean that cases of dengue fever have been on the rise in practically every country in the region for the last 30 years.

In the middle of this all, zika and chikungunya have appeared, which are also a consequence of global population shifts. The region has been exposed to diseases that were restricted to certain parts of Africa. It was there in the 1950s that the zika and chikungunya viruses were discovered, and soon afterwards major outbreaks occurred in other parts of the globe, first reaching the Americas in 2013 and 2015, respectively. Here, they encountered all the right conditions: a susceptible population and a corresponding vector. They are two diseases that we didn't know and which, when they've manifested as epidemics in our populations, have proved to have far more serious public health consequences than we expected.

Ilana Löwy: I agree with Jaime that we must explain this problem of difference. Today, everyone's looking for a high-tech solution. The 1930s and 1940s answer was the low-tech solution of eliminating the mosquito. It wasn't a social solution, but a technical one. Now we're expecting some "molecularization," some "geneticization" of the solution. You can't control populations using low-tech solutions anymore because populations today are often uncontrollable.

Jaime Benchimol: A couple of comments. One has to do with what Mónica said about yellow fever, that the international agenda was a major influence, as compared to hookworm, for instance, which emerged from a local agenda and went international. I think that in Brazil, yellow fever had such a role. The disease had been a major sanitation concern since the mid-nineteenth century and it's clear that the solutions devised locally stemmed from resignifications and international networks – the time the British spent in Havana, for instance, and the American presence in Cuba. Yet one way or another, I still think there's an overwhelmingly local agenda in this case.

Many of us Latin American historians are working to revert the Eurocentric vision and show that Latin American medicine and science were co-participants in knowledge building processes. In Brazil, when it came to yellow fever and other rural endemic diseases, the local agenda was very important. As for the question of the campaign battalions, José, I have some doubts on the following level: from the perspective of SUS [Brazilian public health system], sanitation reforms, and primary health actions, the utopia implied by this project – combining the forces of different areas of government, health, education, sanitation, housing, as well as the general public and raising public awareness – was not attained. None of that actually happened. So the complicating factors you raise are valid for both cases. What I mean is: How can you galvanize the general public in a situation where state services are privatized by a clientelistic policy, large urban areas are overrun by violence, and people, despite wealth redistribution programs, are still largely concerned with the basic issues of survival, which are not so different from the ones faced during the military regime, before SUS was founded?

On the other hand, thinking in terms of structure, I'm impressed by the model that was started by Gorgas and Oswaldo Cruz, and perfected and internationalized by the Rockefeller Foundation, which has lasted so long. Take the case of leishmaniasis, which I'm studying now. In the Amazon, people I've interviewed say that the personnel from Sucam – the public health entity in the 1970s – would go to even the most remote of places. Today, the population is certainly bigger and the questions are more complex, but resources also evolve. Today we have the internet, we have means of getting from A to B, a far larger research infrastructure. It seems to me that an epistemological issue runs through this whole problem and hinders its resolution. When the sanitarians and different social movements took action through projects that resulted in SUS, very strong arguments were put forward against any form of vertical action. And I think that in emergency and crisis situations like the one we're going through now, where there are weaknesses on the horizontal and vertical planes, all resources must be brought into play, improving resources while taking account of the new, current-day challenges and also successful aspects of past experiences.

The experience of Rosângela – the health professional I married – working with Hansen's disease in the Amazon was similar to what I came across with leishmaniasis in Recife, and I think the same also applies to yellow fever. One of the basic principles of Primary Health Care is decentralization. People train community health agents, build structures, educate health workers, and then a new municipal authority comes in, everything changes, it's a case of musical chairs, and everything starts again from scratch. The work that's been done is destroyed. There's no transparency or continuity.

We're on the brink of a new summer epidemic with the prospect of many more deaths from chikungunya. How can we cope with this on an emergency footing? Today I'm in favor of armies of workers with a direct line of command, who will never have the autonomy of Sucam or the Rockefeller Foundation and shouldn't be manned with insecticides, but could take out education. There's a lot of talk about DDT. Paradoxically, recent campaigns have reintroduced the idea of insecticide for the adult form and the larva, because for a long time the larvae were targeted and that's still an effective way of fighting the mosquito. Popular education messages are geared towards the procreation of the mosquito, the larval form. So why not bring back this tradition, this know-how that still exists, and combine it with established forms of primary healthcare?

Ilana Löwy: I don't think so. But you're right, the Sucam experience is very interesting, because back then the public were really mobilized. There was a really positive perception of the sanitation agents as people who were there to help them. And speaking of the role of the social sciences, I absolutely agree with Jaime about this issue of urban violence. The problem of the campaigns against epidemics cannot be dissociated from the value of human lives. And there are studies, like João Biehl's, about how hard it is to do campaigns to galvanize the public when people's lives are already derailed. In a favela, where the risk of dying of a gunshot is far more serious than the risk of dying of dengue, how do you get people on board?

Marcos Cueto: How does this interface between medical scientific practices – in the plural – and the public work? I put it in the plural because I'm thinking of a study by Mónica in which she observes that in the nineteenth century the hegemonic vision was the one that today we would anachronistically call "clinical" or "geographic," while a more bacteriological vision gained precedence later on. Yet with both of them there was some tension with the public, the people on the receiving end of public healthcare. This question of public uncertainty during an epidemic, the relationship between medical practices, scientific ideas, and the public, is an interesting one, I think.

Flávia Bueno: As for the zika epidemic, I think it has one peculiarity that sets it apart from other epidemics when it comes to this interface between science and the lay public. When the epidemic broke out in Brazil in 2015, laypersons and scientists were similarly lacking in knowledge about what this mosquito could cause, and the WHO public health emergency was declared precisely because of this lack of knowledge, because of the link between zika and neurological disorders in children, which was what the authorities were actually worried about. Zika was thought to be like dengue fever, which has never alarmed many people, has never had any major international repercussions, and has never galvanized the scientific community in the way zika is now.

There's another issue, which is responsible communication. I work directly with communication. When an epidemic like this breaks out, there's pressure to get quick answers. People want to know what to do and what's causing it. In the zika epidemic there was a lot of pressure on the Brazilian authorities to get answers, and the whole context could have caused a sense of panic. Epidemics are like that: they frighten people precisely because of what

they don't know. And the fact that the public don't know exactly what's going on – how the disease is transmitted or if it's in fact the mosquito – can also result in the stigmatization of people who are infected.

As for science, just as laws are made to regulate what already happens in practice, science also reveals what the population and doctors working on the front line have already realized is going on. There's a book about Zika by Debora Diniz<sup>1</sup> that talks about the way the doctors reported on the strange things that were going on, the fact that so many children were being born with brain damage. And she reports that the public themselves and the doctors working in the field started this movement of getting the word out that something was going on that wasn't quite right. Perhaps that's what the role of the social sciences is: to think about what scientific evidence is and who can produce it and be considered a scientist in fact.

Mónica García: Flavia also mentioned this debate between the doctors, who were discussing whether they should or shouldn't announce the potential connection between Zika and microcephaly, and the biologists, who said there wasn't enough evidence at the time to confirm it. Medical, epidemiological, and biological evidence is produced using their own specific criteria for scientificity. What's interesting in this case is that political decisions are often taken in the midst of such divergences, before a consensus about the scientific evidence has been reached.

We often think that health policy decisions are made after scientific evidence has been gathered, but in practice it's often the other way round. I think that arguably the challenge for health research is not just to produce the best scientific evidence possible, but also to successfully interface with political decision-making entities, where these problems are converted into priority issues. Health workers can disclose evidence on causal relationships between phenomena, like obesity and sedentariness, but that could be a subject that's absolutely marginal in a country's public health policies and so result in absolutely nothing being done. So the problem is not just one of doing more research, but of having access to policymakers – state and international entities – and convincing them to prioritize it in their agendas.

Ilana Löwy: This morning [December 2, 2016] a good article came out in *Science* about the uncertainties of Zika that sums up the problem well. First, the main problem was causality; now, there's little question about causality and the big problem is epidemiology. Why are there so many cases of brain malformation in a small part of northeastern Brazil but not elsewhere? That's the big problem. Laura Rodrigues, an epidemiologist from the London School of Hygiene and Tropical Medicine, defends the thesis that only poverty can explain it. The impacts of dengue and yellow fever can only be explained by poverty.

The biggest uncertainty today is in the field of epidemiology, because it seems that the same virus can have very different effects. Another uncertainty has to do with the consequences of infection on the fetus, which are completely unknown. So far we've only seen the tip of the iceberg, just a small part. What can you do in a situation of such uncertainty? I really like

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<sup>1</sup> DINIZ, Debora. *Zika: do sertão nordestino à ameaça global*. Rio de Janeiro: Civilização Brasileira, 2016.

a book by Michel Callon, a leading figure in science studies, and Pierre Lascoumes, an Aids active, called *Agir dans un monde incertain* [Acting in an Uncertain World]. It's about what to do in an epidemic with a high level of uncertainty. I think it's a good book for students. The answer is to open up and democratize.

Jaime Benchimol: I'd like to bring up a historical fact here. Mónica talked about the lack of scientific evidence and the calls in society for urgent action. Historically, the situation surrounding yellow fever was similar. When the Americans demonstrated Finlay's theory in Havana, no clear consensus had been reached. There was no solid scientific evidence that other mosquitos weren't vectors, that bacteria didn't transmit it. There was a sea of uncertainty. And if there's anything that can explain the turbulence of the whole Oswaldo Cruz situation it's precisely the fact that his group decided to put the so-called Havana theory into practice while scientific evidence was still being produced by the French mission from the Pasteur Institute and by the German mission.

Zika has a similar anomaly. I'm intrigued by this story of poverty, because there's poverty in other parts of the country. It's not enough of itself to explain the singularity of zika. Even so, if there's one thing that can lead the public health authorities to take measures even in the face of uncertainty, it's the legacy of yellow fever, the tradition of fighting *Aedes aegypti*.

I'm just beginning to study leishmaniasis. Until recently, laboratory-based research as was done for yellow fever – whether by entomologists, virologists, or epidemiologists – was very closely tied up with public health actions. I find leishmaniasis surprising because it seems to be the area with the largest number of research groups in the country and the field with the most scientific publications. The volume of studies published in the area is astounding. And yet when it comes to practical actions, very little is done. It's partly due to the fact that there is still uncertainty about the vectors, reservoirs, and treatments. There's a lot of uncertainty and there are also the geographical singularities associated with the disease. In this sense, yellow fever and dengue fever were different: there were equations that were quickly solved, allowing immediate action to be taken. Zika raises a good deal of uncertainty, too. Traditions cement certain paradigms and people act accordingly.

There's another source of uncertainty, although Fiocruz has strongly denied it. I recently went to the Aggeu Magalhães Research Center, and the researchers there said there's evidence that the southern house mosquito, *Culex quinquefasciatus*, is a potential vector. They've found infected *Culex*. Actually, that's a factor that may have influenced the outcome of the recent election for the presidency of Fiocruz. Some people were upset because when the researchers spoke out about this, they didn't authorize the communication of the information because they were concerned about reaching a consensus quickly so that public health actions could be taken. I don't know if things transpired in quite as straightforward a way as I'm describing. What I want to stress is the influence of uncertainty, which is so important for science and so complicated for public health authorities when public health crises break out. And then the yellow fever and dengue tradition weighs in, the tradition of *Aedes*, and the reductionism implicit in this tradition.



Ilana Löwy: I absolutely agree that these traditions are really important in public health. One subject that really interests me is the problem of sexual transmission. I'm not an epidemiologist, but I read an article published about two months ago in the *International Journal of Infectious Diseases* by researchers from Rio de Janeiro, from Fiocruz, who argued that the sexual transmission of zika in the city was very high. They explained that there's a very big difference in notifications by men and women, with far more women. So you think, "well, that makes sense: women are afraid, men aren't." But the article compared the dengue and zika notifications. In the case of dengue fever, the difference is small, but when it comes to zika there's huge disparity between male and female cases. The most obvious explanation is sexual transmission. If a woman has a temperature and a rash, she has no way of knowing whether it's zika or dengue, so she goes to the doctor to make sure it's not zika. Now, here in Rio, I asked epidemiologists why they don't discuss sexual transmission. There's no certainty, it's not for sure, but it's a possibility. They explained exactly what Jaime said, that there's a tradition of attacking *Aedes* for yellow fever and dengue. And that's why they think there's no need to consider anything else.

Marcos Cueto: José, I think sexual transmission has been reported in the Dominican Republic. Rumors were very important there. Could you tell us about that?

José Moya: Before I answer, I'd just like to make a comment. As for the sexual transmission of zika, it was identified when cases were confirmed in the absence of the mosquito and when one of the partners had been on a trip somewhere where transmission had been confirmed. There have been cases in Córdoba (Argentina), Lima (Peru), and Santiago (Chile), where there are no mosquitos. So the question was: How did these people get infected with zika? When investigating this, it was found that one of the partners had been somewhere where the disease was transmitted. So the subject that's emerging, and is now coming into evidence, is the role of sexual transmission in relation to zika.

In an area like Rio de Janeiro or even Brazil as a whole, where *Aedes aegypti* is so prevalent, it's hard to estimate this magnitude except for the factors that Ilana mentioned – the very unequal distribution between men and women. How can we determine when it's sexual transmission and when it's transmission via a mosquito?

Rumors were first heard in all the countries affected by chikungunya, not just the Dominican Republic. When we trace how chikungunya reached Saint Martin (French Caribbean), which was the first place in the Americas to be affected by the virus, we can see that rumors already started to be spread. They're documented. There's a list of ten rumors that circulated in the general public about chikungunya. The most serious was that the disease wasn't transmitted by a mosquito because of the high number of cases in a short period of time and the clinical manifestations of the disease, which causes intense, incapacitating joint pain. Chikungunya causes extreme pain and very high fever, but because of the magnitude of the disease (number of cases), it wasn't associated with the mosquito. So conspiracy theories started to come out, like that the origin had been a foreign boat, a Chinese boat, which had released something into the air that was transmitted by respiration. There's a certain logic to that, because, for instance, 80% of the residents of a given district were infected in a period

of three or four weeks. It couldn't have been an outbreak of dengue, because the population had coexisted with dengue for 20 years.

Some quite prestigious public figures spoke out in public, saying that the disease had nothing to do with the mosquito. So then it was no longer just a piece of local gossip, but much bigger and snowballed out of control. That obviously caused other challenges, but from an intervention and health education perspective. Ten years ago, when there was an epidemic of chikungunya in Réunion (a French territory in the Indian Ocean), knowledge about the disease changed completely. That chikungunya epidemic was the subject of a great deal of research based on several research protocols, and vertical transmission, the chronicity of the disease, and the severe and atypical cases that can cause dysfunctions were all confirmed. One of the lessons learnt from that chikungunya epidemic was the importance of effective risk communication as soon as the first cases are confirmed. The best way a government, a health ministry, can protect themselves is by keeping the general public adequately informed. The problem should be owned up to at the beginning in a press conference, as was the case in the Dominican Republic.

By doing this, little by little the rumors died down and the people started to cooperate more in combatting the mosquito's breeding grounds. If you go on YouTube and search for chikungunya songs, you'll find lots. I've done that. I found chikungunya to *cumbia*, *merengue*, *bachata*, Jamaican reggae beats – I've found it to all sorts of different rhythms, which just goes to show how the people also see it positively, look on the bright side. With suffering, but with humor and music, which is also part of the impact this kind of problem has on the public.

Mónica García: It's worth asking ourselves about the role of the media and the public in all this. One of the pioneering studies by Steven Shapin shows the literary technologies that seventeenth century scientists used to convince the public they were doing science. In the absence of an audience to legitimize what scientists do, there is no science. The well-known text written by Ludwik Fleck in 1935 on syphilis is still a valuable reference even today. Fleck and Shapin argue that when someone thinks about science, works with science, they must by definition be thinking about the public, because defining anything as scientific knowledge implies setting a boundary between those who have such knowledge and non-specialist members of the public, between experts and laypersons.

I think José's words have to do with this: the relationship between the uncertainties of scientists and the uncertainties of the lay public, who are assumed not to have knowledge. The latter group are fundamental in knowledge creation processes because it's often they who are sought out by scientists for their legitimization. I'm not keen on that word, but I can't think of another one.

What's interesting about the case José has commented on is that the public may support or reject what the doctors say and what's divulged in the media. The public can react negatively when what's divulged doesn't ring true with their own experience, and in cases like this health agencies must intervene strongly. But if people are the first ones to confirm the information of experts and agencies, as in the case mentioned by José, then that public becomes a reliable informant. How can the public, the layperson, be transformed into a

reliable informant? What is the communication strategy of the international bodies whose role in managing diseases is so important?

José Moya: That's so important. At all the Pan American Health Organization bureaus and also at the organization's headquarters, there's a group that works with communication. Risk communication, which is linked to health emergencies, is an increasingly consolidated group not just in the organization I represent, but also in health ministries. It's related to the WHO's International Health Regulations, which say that events that endanger international public health must be notified.

Mexico's experience with influenza A(H1N1) in 2008 is a case in point. The press conferences given every day by the health minister gradually clarified the situation. In the beginning there was a good deal of uncertainty and the eyes of the world were turned towards Mexico, as is the case now with Brazil and zika. Unlike what happened in the Dominican Republic with chikungunya, there was not such pressure in the country because it was already known what would happen. Even so, considering the potential impact of an H1N1 epidemic confirmed in Mexico, with the potential to turn into a pandemic, as effectively happened, what's happening in Brazil with a new case like zika brings a whole new level of priority and has to be conducted very well with risk communication. Fortunately, there's a growing number of experts, documents, studies, discussions, and online references on the subject.

There's a group of experts at PAHO who are invited to our countries to assist ministerial communication teams, because it's so important for communication to be based on the principle of transparency. We must be absolutely transparent with information. And this obviously depends heavily on the sensitivity of the politician who handles this level of information.

Flávia Bueno: Picking up on what you said about the International Health Regulations and what Mónica said about the role of the press, it's interesting in this new version of the regulations that the WHO can use unofficial channels to declare an emergency of international proportions. It's precisely what we were saying about how what's notified in the media isn't necessarily the same as what's divulged by governments. Now, with the 2005 regulations, the WHO can declare an emergency based on unofficial information.

Jaime Benchimol: Rumors have huge historical force. I've been amazed at how many rumors have circulated in Brazil about zika, relating the disease to vaccines, the use of insecticides and pesticides. And now an extremely powerful force is weighing in, which is social media: Facebook, the internet. A sea of speculation, rumors, statements, evidence, and counterevidence is springing up everywhere. I've seen websites with great long texts, apparently convincing documents by environmentalists, and nothing's filtered out when the discussion is transferred to the mainstream press or discussions in the official and academic world – the discussions that take place between lettered elites, the traditional media. This social network “underworld” is incredibly powerful. It could be harnessed more creatively and smartly in public health crises like the one we're facing at the moment.

Ilana Löwy: Even without social media, rumors can be extremely effective. There are some studies by Africanist anthropologists about the role of rumors in campaigns. Of course, Facebook and Twitter just amplify them, but even without them, they still exist. The anthropologists who study the subject are right from a social perspective, like Didier Fassin's work on Aids in South Africa. They are social phenomena. We can't say they're conspiracy theories and so they aren't of interest. It's really important for them to be studied.

Marcos Cueto: A quick comment. When I was researching malaria, there were also a lot of rumors. I reached the conclusion that many of them had to do with the great social inequality, for example, between more developed northern Mexico and the south of the country. These marked inequalities spawn mistrust between different social strata and are sometimes reflected in health-, disease-, and epidemic-related subjects. And that leads to another question. Although Brazil has a name for being very tolerant, the subject of abortion is virtually proscribed. Any comments on this?

Flávia Bueno: Zika foregrounds a number of aspects of people's lives, including their sexual health and the gendered aspect of the epidemic. First, the cases of children with microcephaly are concentrated in the northeast, a poor area historically neglected by public policies. Second, that region is known across the country for its deep-rooted chauvinistic culture. Then there's the issue of the families who are breaking up because of Zika. There are men who are abandoning their families, and the weight of the epidemic is falling heavily on women's shoulders, which raises the whole question of contraception and family planning.

There's almost a kind of seasonal impediment on women's pregnancy. Sometimes they can't wait – there are biological questions involved. There are women who want to get pregnant and are being stopped; there's a whole discussion about this. I think this week there was a breakthrough when the Federal Supreme Court decided [November 29, 2016] to decriminalize abortion until the third month. That sets a legal precedent. So when new cases come up, lawyers will be able to refer to this ruling when they argue in favor of obtaining permission for women to abort by the third month if they so wish. It's a subject that has to be brought to the heart of the discussion.

Ilana Löwy: I'm not sure if it's a legal precedent or if it's a one-off.

Flávia Bueno: I thought it was just for that case.

Jaime Benchimol: When they make this ruling they set a legal precedent. So other judges can cite this Supreme Court ruling in other cases that come up.

Flávia Bueno: In the case of Zika, this is a debate that hasn't resonated so loudly in Brazil because we have waves of conservatism, a very strong evangelical lobby with great influence in the National Health Council.

Roberta Cerqueira: The case that was judged was outrageous: it was the case of that woman who was burnt to death. She'd had an abortion in a back-street clinic, had several complications,

and the clinic got rid of the body. The judge decided to set a legal precedent by not convicting the people who did the abortion, but they're still being prosecuted for the crime of disposing of a cadaver. It's a story that just goes to show how big a problem we have when it comes to contraception and zika.

The story reflects reality: it's precisely what happens. Debora Diniz has made a very good documentary – a video about women who are abandoned. There's a very high rate of abandonment and cases that are never even reported of women who have back-street abortions and end up dying. What I mean is, there's an epidemic of zika and of femicide.

Flávia Bueno: It has everything to do with the ability to pay. There's a huge question of inequality between those who have to have an abortion in any old clinic and then have the body hidden and burned, as was the case recently in Rio de Janeiro, and those who can afford to have expensive abortions in highly favorable conditions – upper middle class people; actually, people who are very well off. This penalizes poor, peripheral women who have children born with microcephaly, who need care their whole lives, and are being abandoned by their partners. It's a really complex problem. And zika brings this home much more powerfully, although it's a debate that hasn't been voiced so strongly in the country.

José Moya: This is the most serious aspect of zika: the virus's association with congenital malformations and how pregnant women react to evidence like that.

One of the things still to be done is to assess the impact this zika epidemic has had on infant, neonatal, and maternal mortality. As was the case with the H1N1 epidemic, which pregnant women were more at risk from – in some countries a slight increase in indirect maternal mortality caused by H1N1 was observed –, in the case of zika we must also investigate what impact it has on maternal and neonatal mortality.

There are various other problems, because malformations are sometimes only detected in the second trimester. And then what happens? Congenital malformations don't develop quickly – they can evolve throughout a 20-week period. So there's all this suffering and all this uncertainty for pregnant women when they have their periodic scans, and even 20 weeks afterwards they may end up finding out there's a zika-related congenital issue. But after 20 weeks – in the fourth, fifth month – what options do these women have? Some opt for high-risk terminations, because at such a late stage the risk of death for the mothers themselves is much higher. The opinions and actions towards this situation are very different, even within the organizations.

Ilana Löwy: It's a sexual rights problem. Everyone knows that abortion is very common in Brazil. The problem of criminalization doesn't affect whether a woman actually terminates a pregnancy, but how she does so. Apparently, one in every five women in Brazil have had an abortion. How many is that? Twenty million, twenty-five million women? It's a whole army.

The cases of deaths are terrible. Back-street abortions in Brazil are the number one cause of female mortality for gynecological reasons. Although the number of women who die isn't high, the number of women who have health problems resulting from backstreet abortions is very high. It's a huge problem.

Zika is a more complicated problem, because there are two variants. There's the question of abortions because of the risks and the question of abortions because of malformations. Abortion because of risks is when a woman has a confirmed zika infection in the first trimester of pregnancy. She might decide to use misoprostol, for instance, which is an abortion-inducing medicine you can get on the black market. It's not that hard.

Abortion because of malformations is a different problem. She may suspect or she may know. Microcephaly can sometimes be identified very late on in a pregnancy, in the last trimester. And even then it's not always identified. It has to be significant microcephaly. The absence of most of the corpus callosum in the brain can be identified in the 18th week, but only then by a very skilled ultrasound professional. The problem is that a poor northeastern woman will often not have access to a very good professional working with good quality equipment.

In France, if a woman's child is diagnosed with agenesis of the corpus callosum, they can normally get permission to abort. There may be some people with an absent corpus callosum who live well, but not many. The risk of neurological diseases is high. So in France, if anyone needs permission to have a late termination, agenesis of the corpus callosum is a routine justification. If she wants to have an abortion she can. But here in Brazil that would be illegal.

A wealthy woman who's afraid of zika can get the help of a top-rate professional. Here in Rio de Janeiro there are very good specialists. They're excellent and they charge a lot for their services. Normally, health insurance won't pay, but if the woman wants, she can pay for a private consultation. And if the risk of brain malformations is high, she can terminate the pregnancy in a safe setting, even if at a high cost.

It's very important to study poverty. But it's not feasible for everyone to go off to Campina Grande and observe Dr. Adriana Melo's patients. I think we also need to study privilege: what happens at clinics in [the Rio de Janeiro district of] Barra da Tijuca. You can't understand social inequality just by researching poverty.

Another issue is the precedent of rubella, which I'm really afraid of because of how dangerous it is. There was a major rubella epidemic in the early 1960s. In Europe, most of the women who had rubella had abortions. In fact, abortion was illegal in Europe until the late 1960s, early 1970s, but the doctors agreed to do the procedure for a number of reasons. In the USA it wasn't so straightforward. Some women had abortions, but not many. A study of epidemiologists from Columbia headed by Ezra Susser on the children of women who had rubella early on in pregnancy investigated the health status, 40 years later, of the children whose health had been classified as good at birth. They had had many other health problems later in life. In the cohort in question, there was up to 30% cognitive deficit and 20% schizophrenia – a very high percentage for such a major psychiatric condition.

Now we have a whole generation of children being born to mothers with zika, with many cases that haven't even been diagnosed, and many of these children are going to present conditions that we don't even yet know. Most of the children are from poor families, so if they have problems in their intellectual development or psychiatric problems, it's going to be very hard to tell whether the problems stem from the zika infection. As Dr. Adriana Melo has explained, these women are really poor. They've been abandoned and have very little help. It's normal for such children to have problems, including psychiatric ones. You might

say it's normal for such children to have problems, including psychiatric ones, and, based on this supposition, not attribute these problems to zika.

Marcos Cueto: The International Health Regulations are one of the few measures that aim to be supranational. Yet many entities, at least the multilateral ones, were founded with the idea of attaining a consensus across all countries. Now we have pandemics, like the Mexico case or zika, which sometimes require authorities to rise above immediate political interests. What challenges do you think the Brazilian health system and global health organizations are going to have to face?

Flávia Bueno: One reason why this epidemic is proving such a big challenge is because of political issues. I'm studying regional responses and of course I'm studying PAHO, because it's the WHO's representative in the Americas when it comes to implementing the International Health Regulations. But the other organizations are very slow in responding to the epidemic. There are some important diplomatic issues involved. For instance, Mercosur is completely paralyzed because it doesn't recognize the presidency of Venezuela. Then there's the issue of the impeachment of Dilma Rousseff in Brazil, which caused some unease in other countries, like Venezuela, Ecuador, and Bolivia, who recalled their diplomats when Michel Temer took over as president. All this has significant consequences, especially in Unasur, which has a very strong political component.

So I really think we're facing a huge political challenge, with changes in direction in the region's political scenario as a result of the emergence of new governments. And all these subjects we're discussing have a progressive component – the question of abortion, the question of addressing the social determinants of health. One of the challenges facing the Brazilian public health system is how to devise inter-sectorial and structuring actions, not just vertical ones. I understand what Jaime means when he talks about emergency issues, and perhaps what we have to do is think of two points of action: structuring action, tackling people's living conditions, the urban development of towns and cities, access to drinking water, nutrition; and another to address emergency issues. Some actions would probably have to be more vertical, more one-off, but nonetheless what's missing is more structural development work.

So far, the national response has been very weak in the way of bolstering infrastructure; it's more about research and development, a bit of international cooperation, lots about vector control and the development of clinical protocols. But I've seen very little in terms of long-term initiatives. These diseases – all of them – affect people's entire lives. They happen to people, people who are being affected, and studies like the ones being done by Debora Diniz or João Biehl, which shed a bit more light on this reality, are fundamental for global health studies of a political bent, like what I do. That's important for us to understand the interface between living conditions and the consequences of these epidemics, which sometimes seem so distant. They really do have an impact and need integrated and political responses, too.

Jaime Benchimol: I agree with everything Flávia's said. I think we're living through a very weird, sinister, worrying time. Globally speaking, we have a scenario that brings to mind somewhat the post-war years, with mass migrations of people to Europe, new public health

challenges, terrible human challenges. And then again we can see the rise of right-wing fascist movements, a phenomenon that can be seen the world over and which will end up having knock-on effects on the formulation of international policies. We're experiencing a very complicated situation in Brazil and Latin America as a whole. Progressive governments are in crisis, and in Brazil we're facing a serious dismantling of our infrastructure. The SUS project, based on the social determinants of health, is seriously jeopardized and there are very few intelligent, creative ideas being aired. Everything is being done in the wake of opportunism, the shake-ups caused by crisis after crisis, each feeding off the other: the economic crisis, the political crisis, the public health crisis...

Summer will soon be upon us. Forecasts have already been made and almost no preventive measures have been taken. The capacity of bankrupt state and municipal governments to take preventive measures is almost non-existent. In such circumstances, a public health crisis would be very serious, because the towns' and cities' health infrastructure would not have the capacity to cope with its effects. The hospitals are on their last legs. It's a very worrying state of affairs. In this context, synergy between policies, guidelines, international determinations, and actions taken on a national, state, and local level is completely compromised and at the mercy of circumstances.

Roberta Cerqueira: We're talking of Latin America, and I wonder if you could talk a little about Cuba.

José Moya: Cuba had a serious epidemic of hemorrhagic dengue in the 1980s. The public health infrastructure and social organization of the country meant a whole army of health workers were available, not just doctors, but across different sectors, with a whole mosquito control strategy. Whenever the number of mosquitos rose, it was kept under control because it was a government priority and counted on everyone's involvement. Health workers' commitment is fundamental and has made a huge difference, enabling the effective control of dengue over the last 20 years.

As for challenges, the International Health Regulations are certainly a means of divulging international public health risks and emergencies not necessarily based on official information. I think it's an important step forward in recent years, because there's a lot of information on social media and in the mainstream media. While 20, 30 years ago, ministries had a degree of control over information, that's no longer the case. While power was once about gathering information and then divulging it, power now lies precisely in sharing information as soon as possible, because that attracts recognition, which is fundamental for institutions, especially in health.

In the earlier regulations, from 1969, notification was only mandatory in the case of three diseases: yellow fever, bubonic plague, and cholera. It became clear that that was unsatisfactory, that many diseases were left out. In the late 1990s, there was a proposal for syndrome surveillance. They selected six syndromes, and put together the International Health Regulations around them. The regulations we have today are far more sensible. Any major international public health occurrence must be notified, and there's an annex that



presents an algorithm that indicates when a disease can effectively be considered a public health emergency of international concern.

It's not a matter of the WHO having exclusive autonomy. When, on February 1, 2016, the WHO committee declared that zika was a public health emergency of international concern, it was done after a meeting had been held involving specialists not just from PAHO/WHO, but also experts investigating the diseases in their own countries. It was based on those experts' recommendations that the committee took the resolution, which remained in force throughout 2016 until November 18, when the fifth meeting of the same group of experts was held, which showed there was sufficient evidence to draw a correlation between zika and congenital malformations and Guillain-Barré syndrome.

No-one wants women to have to go through this dreadful drama of a pregnancy with the risk of congenital malformations. Having a healthy, happy pregnancy is part of women's sexual and reproductive rights. Prevention is about doing whatever it takes for women not to get infected by zika and not to go through all this tribulation.

But it's a fact that the public health capacity of our Latin American countries is deteriorating badly. It's not a coincidence, but stems from a history going back some years now, and must make us rethink public health, its foundations, origins, and challenges. There are challenges on the clinical side, because all three diseases can develop severe, life-threatening forms. Another big challenge is in diagnostic, laboratory capabilities and social communication.

Ilana Löwy: I couldn't agree more: it's so important to organize prevention. And as José explained, it's important for women to be able to have safe, healthy pregnancies. Life isn't perfect; risk-free pregnancies don't exist. Abortion is a very tough decision, no woman wants it, so to avoid it we must develop contraception and sex education.

In Scandinavia and France, where there is excellent sex education, access to contraception, and free healthcare, the abortion rate is one woman in five, like in Brazil. And the same is the case in Norway, Sweden, and Denmark. Because accidents happen. There's no such thing as 100% safe. Women need all the help they can get to prevent getting pregnant if they don't want to. And they also need the public health system to be ready if something should go wrong. That applies to diseases in general, not just to zika. Everything that can be done must be done to minimize the risk, but there will always be some risk. Measures are needed to ensure good diagnoses and then to allow women to choose what to do. If the risk is high, the woman should have the information she needs to decide whether to have an abortion. If she doesn't want to, she must have help for her disabled child.

Flávia Bueno: On regulations, one of my questions – I particularly study emergencies in the WHO – how the organization declares them, the challenges involved, and how regional actors respond – is that of endemics in developing countries that have never become emergencies and are thus not discussed on the global sphere. This happens for several reasons: political will, who's actually affected, etc. Perhaps one of our challenges is to put other questions on the research agenda for funding beyond the ones that become global health emergencies. Chikungunya, for instance, hasn't attracted all that much attention, but we know that people sometimes end up suffering chronic pain for up to two years, making them unable to work.

This is also a challenge for research. What are we putting on the research agenda? Are we being guided just by these major global political actors? Shouldn't we also be protagonists in these choices?

Marcos Cueto: The last question I'd like to ask is: How can the social sciences contribute to understanding and orienting public policies for *Aedes* and zika?

Mónica García: People who work with health policies are always looking backwards to learn from the past. That's partly why these seminars of Sanjoy Bhattacharya's (Centre for Global Health Histories/University of York and WHO) are held. One question historians always ask themselves is: Why are we doing what we're doing and who for? I think – and this is very personal – that history as a discipline seeks primarily to comprehend other people with different mindsets and world views. So from this perspective it's very important to bear in mind what the other actors involved in the problem of diseases think. And that could be applied today. The role of the public isn't one of ignorant people who need to be informed. We need to look at the public again and understand what their role is, like in rumors, as Jaime and Ilana mentioned, or in situations of disease emergencies. The public is as important a player as the agencies that study diseases, scientists, or politicians.

The social sciences can help physicians and epidemiologists to consider these actors not as people with mistaken or erroneous ideas, but as actors with different ideas. In some cases, the families of patients have been very active agents in the production of knowledge. That's the kind of invitation we could make to history and the social sciences: to think about this active role of the population.

There's a field of knowledge devoted to the "popularization" of science, which you'll doubtless know, but I think it's still working from the same specialist/lay dichotomy. That's a distinction we may need to review. So I don't think history is there just for us to learn from past mistakes; I think history is also an attempt to make sense, to shine a light on other actors and other ways of seeing the world in this complex reality of diseases.

Jaime Benchimol: Mónica's raised some important points. In the last 20, 30 years, history and other social sciences have produced a considerable volume of studies about health, disease, public policies etc. That's made a difference; it makes a difference. The journal *Manguinhos* is proof of that: it's become a reference for people involved in health policymaking, for example. Quality academic output in the field of the social sciences and history helps because it produces important knowledge that ends up being heard.

There's another very important dimension. When Paulo Buss was part of that international commission that reviewed the social determinants of health, I was amazed that no historian or social scientist took part. Our historian colleague Sanjoy Bhattacharya was involved in a parallel initiative that resulted in a fabulous book,<sup>2</sup> but in the official commission there were no historians or social scientists. We still have a long way to go in terms of recognition.

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<sup>2</sup> COOK, Harold J.; BHATTACHARYA, Sanjoy; HARDY, Anne. *History of the social determinants of health: global histories, contemporary debates – new perspectives in South Asian history*. Himatnagar: Orient Black Swan. 2009.

Meanwhile, I don't know if I can generalize, but historians, sociologists, and anthropologists speak a lot to their own peers, which is important. There's significant transdisciplinary dialogue, but few successful cases of taking it to other spheres. Here at Fiocruz, we're always being invited to speak to journalists. The Zika crisis has thrown up a whole host of questions, and that's when we realize just how important historiographical work is, because it's being used and called on. But we need to write for the general public and speak to other audiences. Museu da Vida [Museum of Life] is one example of an important experiment in this respect, but generally speaking we speak very little to other audiences.

We have good quality communication, but in this other dimension I think we fall short. Ligia Bahia does it really well. She's a Brazilian public health specialist who's always in the newspapers defending her viewpoints and putting issues on the agenda. Like George Rosen used to do in the States. But rarely do sociologists, anthropologists, or historians do this – go out and speak to the mainstream press, social media, schools. Health historiography has taken great strides – today it's a recognized branch – but it's still not disseminated as well as it could be. I'm speaking here of Latin America, not Europe or the USA. In Latin America, there are few faculties of history and social sciences that incorporate our academic efforts – they're circulated in niches. And above all we need to forge organic ties with epidemiologists.

Ilana Löwy: The public's participation in health is really important. If I had the chance to choose a reform to do in Brazil, I'd follow the example of Steven Woloshin and Lisa Schwartz from Dartmouth College in the United States, a school of science journalism, to explain to them how to understand science, because that's such a crucial role. From what I can see, Brazilian journalists have trouble explaining science. Something else I think is important: for me, the aim of the social sciences is to make what is not visible visible. We're discussing Zika, chikungunya, and dengue, but I'd like to talk about congenital syphilis. The prevalence of congenital syphilis in Brazil is astounding. Brazilian Ministry of Health data talk of 6.5 infections per thousand people – although it should be added that the Brazilian system of notification is not the same as the ones in Europe or the States. If we were to use European criteria, the prevalence of congenital syphilis might be lower. In the USA it caused a scandal when they reported 11 cases per 100,000 people. It was a scandal because throughout Europe the congenital syphilis rate is practically zero. So it's a discussion that needs opening up. We can't just think about SUS, but also what's happened in terms of Zika diagnosis in the private healthcare system.

Something else I want to say has to do with what anthropologists, especially Africanists, call "open secrets." There are things we know; there are things we don't know and know we need to know; and there are things we don't know exist and that are important, like a Zika epidemic that no-one could have imagined would take place; and then there are things we know and don't want to know. And that's what's called an open secret. For instance, everyone knows you can get a decent abortion in Brazil if you can afford it, even if it's a subject that's avoided in public discourse.

Mónica García: And the social sciences have another function: to ask questions that make people uncomfortable. History also has the job of being a bit provocative. We historians and scientists are in a privileged position (if we're to believe Pierre Bourdieu): being able to think about the world, investigate how people get ill, is indicative of a privileged position. I believe the social sciences could help us always remember this position, because it's also instrumental in defining what kind of problems we address and what questions we ask about diseases.

