

## **Do sociodemographic differences shape the perception of the Zika virus and the employment of measures of prevention and care?**

Raquel Zanatta Coutinho (Departamento de Demografia e Cedeplar/UFMG)  
Gilvan Guedes (Departamento de Demografia e Cedeplar/UFMG)  
Marina Amorim (Departamento de Estatística/UFMG)  
Wesley Ferreira (Departamento de Estatística/UFMG)  
Bruna Firmino (Departamento de Demografia e Cedeplar/UFMG)

### **Abstract**

Previous study found that the perceptions regarding the Zika virus (ZIKV) are likely to be shaped by person's own experiences with the disease. For example, people who have been infected by ZIKV associate the disease with its most common symptoms, such as pain and rash. The perception of the virus, however, may vary by gender and SES. Using novel survey data collected in Governador Valadares, Brazil (a hotspot for vector-borne diseases), we evaluate if the meaning people attribute to the ZIKV varies according to their sociodemographic differences and mediates the way they employ measures of prevention and care amidst the ZIKV epidemics. Using a combination of Pearson Chi Square, Exponential Random Graph Models and count regression, we found that individual perception about ZIKV is shaped by gender and alter the employment of self-protection measures against the mosquito. Education does not shape perception regarding Zika, but change the odds of applying certain measures against the disease. Previous history of infection is the single most important element for applying measures of protection. We also find that sociodemographic groups (gender and education) tend to think alike regarding the epidemics. Lastly, people who had Zika are a group for whom the network of thoughts regarding Zika is concise and unique.

**Keywords:** Zika virus; Health Behavior Model; Social Representation; Homophily; Preventive measures

## INTRODUCTION

Zika virus, which appeared in South America late 2015, has been widely recognized as the one of the greatest epidemics of the century (Chang et al 2016). Although transmitted by the mosquito *Aedes aegypti*, the same vector responsible for Dengue and Chikungunya, Zika gained attention because the virus is able to cause Congenital Zika Syndrome, and more than 2 thousand cases of microcephaly have been detected in Brazil alone. At the same time that prevention efforts were moved toward instructing the population to destroy mosquito breeding sites (clean, standing water) and preventing bites by using repellents and implementing measures of self-protection, women trying to conceive were recommended to postpone pregnancy or strengthen measures of protection (Brasil, 2017). The virus is also transmitted sexually, although this type of transition has not received the same attention (Coutinho et al. 2017).

Despite the dramatic coverage, little is still known about how people are interpreting the disease, how they make sense of their own vulnerability, and if they are putting knowledge into actions. Perceptions of risk are fundamental when changes in health behavior are necessary (Brewer et al. 2007). The feeling of invulnerability, described in Taylor and Brown (1994), is responsible for an optimism that might freeze personal action and hold down behavior change (Joffe, 2003). Thus, behavior depends on beliefs (Chen and Land, 1996). The Health Belief Model (HBM), one of the most applied model in public health, postulated that health behavior is strongly affected by five factors: perception of susceptibility (perceived chance of acquiring the condition), severity of the risk (if it causes serious consequences), benefits (from preventing), barriers (if costs of behavior change is higher than costs of the consequences of not changing behavior), and general motivation. So, prevention, or the likelihood that an individual will perform a certain action, will be informed by what this person thinks related to these five factors (Chen et al. 1990).

Many examples in the literature link preventive measures against arboviruses (i.e. installation of mosquito nets, window screens, repellent use, and destruction of mosquito breeding sites) to high perception of risk (Phuanukoonon, 2006). On the other hand, certain measures fail to be put into practice. Given that perceptions are varied and might not be automatically translated into actions of prevention, we aim to find out how people can be combined into different groups of meanings about Zika, how these different perceptions might be associated with different kinds of

prevention and lastly, how cognitive affinities, or membership to certain clusters of thought, can be explained by important sociodemographic factors, such as social class, gender and history of infection.

With the results of this paper, we can better inform public health campaigns and future public policy that are tailored for a variety of audiences and thus have more chances of success.

## **DATA & METHODS**

This study used novel data on mental representations of the Zika virus for 150 urban residents of Governador Valadares, Minas Gerais, Brazil. The choice for Governador Valadares is due to the fact that the city is ranked third in the state for the LIRAA index (Quick Assessment of the Infestation Index by the *Aedes aegypti*), and is classified in the very high incidence cluster for Dengue in the country (Brasil, 2015). The 150 questionnaires were stratified into three main groups: 50 interviews on people never infected by any disease transmitted by the *Aedes aegypti* mosquito; 50 interviews on those ever infected by Dengue or Chikungunya, but not by Zika; and 50 interviews on those infected by Zika. Infection was based on self-reported answers provided by the interviewees. Each exposure group was further stratified into sex and socioeconomic status (SES), creating a 25 subgroup for each sex. Within each sex stratum, 12 and 13 individuals representing low and high SES status, respectively, were selected. This balanced stratified design provides the opportunity to vary the level of exposure, assuring some variation on sex and SES for each exposure stratum.

We collected data on the representation of Zika virus utilizing the Free Words Association Technique (Abric, 1994), with the following questions: 1) When I say the expression “ZIKA VIRUS” tell me the first five words or expressions that come into your mind, without thinking about them. 2) Now, I would like you to put them in order of importance for you, 1 meaning the most important and 5 the least important. 3) You mentioned that word/expression “FILL IN” was the most important for you. What does this word/expression mean to you? [*Open question*] 4) Why is this word/expression the most important to you?

Evocations were coded according to their meaning (Bradley, Curry and Devers, 2007) and then grouped into themes, which are “recurrent unifying concepts or statements about the subject of inquiry” (Boyatzis 1998 in Bradley, Curry and Devers 2007). Ten major themes were recognized and they represent the underlying meaning behind the codes: Symptoms, Consequences, Etiology (natural causes), Government and other social causes, Prevention, Chaos, Mosquito Breeding Sites, Treatment, Population's fault, and Vulnerable groups. In order to model network of thoughts, we use the newly developed Exponential Random Graph Model (figures can be seen attached).

## RESULTS

Aggregating people according to their networks of meaning results in the distribution of the sample in three different groups, as can be seen in the radar graphs attached.

The first group is formed by people whose meanings about Zika surrounds three major codes, *etiology*, *prevention* and *treatment*. The most cited word in this graph is disease, followed by hospital. In this group, fever is also cited, but because they appear in consonance with treatment and prevention, with words such as disease and awareness, we argue that those symptoms might be formed by information spread through health campaigns, which equally focus on preventive actions, alarming symptoms and where to go for treatment (Coutinho et al. 2017). We named this combination Public Campaigns.

The second group is formed by evocations about *prevention*, *mosquito breeding sites*, *etiology*, and *consequences*. We named this group Etiology. Among the most cited consequence, the word microcephaly was cited over 17 times and mosquito 48 times. Disease and standing water were cited 19 and 22 times each.

The last group is formed by people whose most salient codes are those about *symptoms* of Zika. We named them Symptoms. The most common cited symptoms are: Pain (cited by 48 people), Fever (31), Malaise (20) and Itch (17).

Around 36% of our sample had not been infected with Zika prior to the interview. Around 22% had had Dengue or Chikungunya. Forty-two percent have had Zika. Membership to each of the clusters is closely associated with previous history of infection (not shown). Our analysis indicate that people who have a history of infection or who have family members who had Zika have higher chances of being assigned to the *Symptoms* radar. While 66% of people with personal or family history of Zika belong to *Symptoms*, only 12% of those who have had no previous infection were classified as such. Given that lay thinking is informed by public campaigns, it makes sense that among these never infected individuals, 60% of them are assigned in the radar Public Campaigns. Respondents who have had Dengue or Chikungunya are equally distributed among these three graphs. This confirms the findings of Guedes et al. (2017): previous history of infection is able to shape network of meanings surrounding the epidemics and the higher the salience of Zika for personal experience, the more the maps of meanings will remind the symptoms of the epidemics.

Next, we ask, is prevention efforts informed by how people think? In other words, how do differences in prevention tactics are related to these clusters membership? We run logistic regression models of all measures of self-protection available in the dataset (delay pregnancy,

apply chemical repellent, apply electric repellent, use air conditioning, install air conditioning, stay in front of the fan, use condom during sexual intercourse, kill mosquito with the electric racket, destroy mosquito breeding sites) to see if membership to one of the clusters increased the odds of employing any specific action.

We found that the way people think about Zika triggers different forms of protection. Those in the public Campaigns and Symptoms have higher odds of applying actions to destroy mosquito breeding sites. Those in the Campaigns and Symptoms radar also have higher odds of using window screens, mosquito nets, kill and of using chemical and electrical repellent in the household. Those in the campaigns radar also report higher odds of using condoms during sexual intercourse because of Zika.

Perception regarding Zika, or the cluster membership, does not depend on education level, but is associated with gender, with men being a larger proportion of those in the Symptoms radar.

The use of home-made repellents is more expressive for people with college education, however. That group is also more likely to use electric or chemical repellent in the household (same odds of high school). Women have higher odds than men of using chemical repellent in the body and also of declaring postponing pregnancy because of Zika.

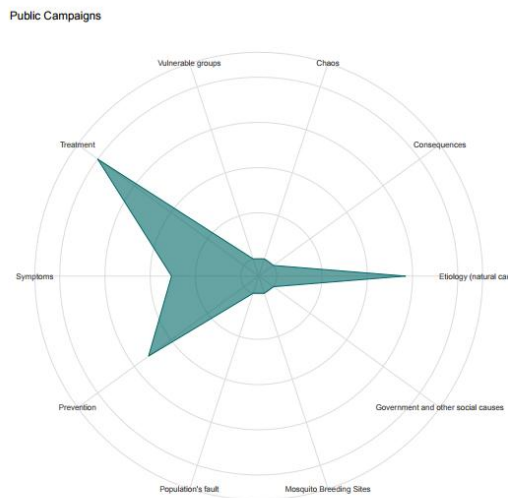
In terms of destroying mosquito breeding sites, those who had Dengue or Chikungunya have higher odds of people who have no disease or had Zika.

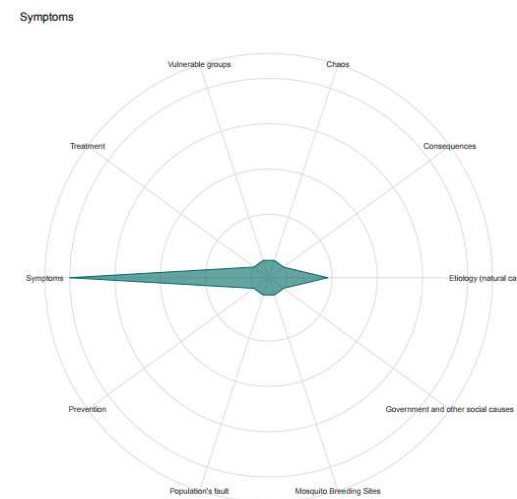
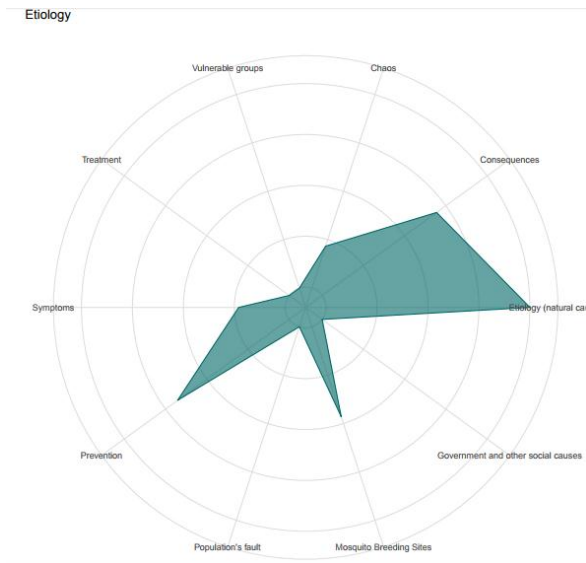
We then move to our third and last objective: is network affinity associated with other ego attributes, in other words, do groups think alike because they are homogenous in regarding to important sociodemographic factors, such as SES, gender, personal history of infection and history of infection of family members? The ERGM generated random graphs to test whether the cognitive affinity of homogenous groups in the networks of thought about Zika are not random. We find several important results (not shown). These odds ratio should be interpreted as the probability that a person with that certain attribute will have a) high prevalence, or have more connections b) homophily, or think similarly to other people just like oneself. In terms of prevalence of connections, compared to people who have not had any disease, those who have either Dengue or Chikungunya tend to have 20% more connections, in general. That means they have a more diverse map of meaning. Those who have Zika have fewer probability of connecting with others. Age is also important for connection. The younger the person, the higher the probability of connecting to others, which means young people share more perceptions regarding Zika than older persons, who have a more restricted network of meaning, with fewer number connections (3% decrease per one extra year of age).

In terms of homophily, the coefficient for gender is positive and significant. That means gender homophily is observed in social networks when people are linked by their shared meanings. While women tend to think more like other women, men tend to think more like other men.

Ego's history of infection is very determinant for their homophily, but the effect homophily is different for each category of history of infection. While those who had Zika and those who did not have any disease have higher chances of agreeing (or of having similar meanings), those who have Dengue or Chikungunya have fewer chances of agreeing (0.745). The coefficient for Zika is the highest recorded: 2.77 and very high level of significance.

## FIGURES





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