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Michelle Christine May Date

Influence of Women's Perceptions of Zika Virus on Family Planning Behavior in São Paulo, Brazil

By

Michelle Christine May
Master of Public Health

Hubert Department of Global Health

_____

Monique Hennink, Ph.D.
Committee Chair

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By

Michelle Christine May

Bachelor of Arts
Johns Hopkins University
2013

Thesis Committee Chair: Monique Hennink, Ph.D.

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
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ABSTRACT

Influence of Women's Perceptions of Zika Virus on Family Planning Behavior in São Paulo, Brazil

By Michelle Christine May

Zika virus was first detected in Brazil in 2015 and has greatly impacted pregnant women and their infants. The virus has since spread to numerous countries in South and Central America and the Caribbean. This study aims to understand how women's risk perceptions of Zika virus affects their family planning behavior. Qualitative interviews were conducted in Portuguese with women aged 20-40 years from high and low socio economic status focusing on perceptions of Zika virus and sexual and reproductive health practices and beliefs. Based on the 29 interviews conducted, all interviews were de-identified, transcribed verbatim, and uploaded to MAXQDA to begin thematic analysis. Study results found that young, nulliparous women and multiparous women did not have strong desires to become pregnant and believed it was wise to delay pregnancy plans until the Zika virus outbreak subsided. Older, nulliparous women felt a sense of urgency to have children and were willing to take risks and continue with their plans to become pregnant. Additional influencing factors were women's perception of relative risk, primarily how Zika was equated to dengue. Regional risk influenced women's perceptions of Zika virus, particularly how women viewed the greatest risks to be in the Northeast rather than in São Paulo. Lastly, health information influenced women's risk perceptions of Zika virus. These results indicate a need for improved public health messaging and communication about the risks and multiple ways Zika virus can be transmitted, and particular guidance for those women who are actively trying to conceive a child.

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TABLE OF CONTENTS

DEFINITION OF TERMS

CDC	Centers for Disease Control and Prevention
FIFA	Fédération Internationale de Football Association
PAHO	Pan American Health Organization
SUS	Sistema Único de Saúde (Unified Health System)
UNICEF	United Nations International Children's Emergency Fund
USP	University of São Paulo
WHO	World Health Organization

INTRODUCTION

Introduction and Rationale

First detected in the Zika forest in Uganda in 1947, Zika virus is transmissible to humans when bitten by an infected *Aedes aegypti* or *Aedes albopictus* mosquito, the same mosquito that transmits dengue and chikungunya. Of those infected with Zika virus, 80% are asymptomatic, while those who show symptoms experience fever, rash, joint pain, malaise, and conjunctivitis for a duration of two to seven days (PAHO, 2016). Symptoms of Zika virus are mild and similar to dengue, which often leads to a misdiagnosis. Zika virus can also be transmitted sexually from one infected partner to the other, even if the infected person is asymptomatic (CDC, 2017). Zika virus can also be transmitted from a pregnant woman to her fetus, which can lead to fetal abnormalities and birth defects such as microcephaly.

Since the outbreak of Zika virus was first detected in Brazil in 2015, the Brazilian Ministry of Health reported the highest number of probable Zika virus cases were found in the Northeast region of the country followed by the Southeast region. Both of these regions have climates that are conducive to mosquito breeding primarily during the summer months. The state of São Paulo, which is located in the Southeast Region, had 5,474 probable Zika virus cases (2.8%) of which 4,059 were women aged 10 to 49 (74.2%), and 1,145 (36.7%) were pregnant women (Ministério da Saúde, 2016). These statistics indicate that more women are showing symptoms of probable Zika virus infection than men, which display that women are quite vulnerable to Zika virus infection and may be more susceptible to the risks associated with Zika virus. One such risk is microcephaly, a brain disorder that is often identified by a baby's head circumference being smaller than the average baby's head circumference (CDC, 2016a; WHO,

2016b). Brazil's Ministry of health identified 10,232 suspected microcephaly cases among newborns and infants between 2015 and 2016, of which 2,205 were confirmed, 39 remain probable, and 2,829 remain under investigation (Ministério da Saúde, 2017). In the state of São Paulo, 53 notified microcephaly cases were confirmed, 32 are probable, and 305 remain under investigation (Ministério da Saúde, 2017). In February 2016, the World Health Organization (WHO) declared Zika virus a Public Health Emergency of International Concern due to the alarming increase in Zika virus and microcephaly cases, but ended the warning 9 months later.

The Brazilian Ministry of Health continues to monitor both Zika virus and microcephaly cases and PAHO has advised its Member States to monitor the situation and report any increase in newborns with symptoms of microcephaly, most notably smaller than average head circumference. The Brazilian Ministry of Health has stressed the need for prevention and protection against Zika virus, especially for pregnant women and those trying to conceive. It advised pregnant women to take precautions by wearing long sleeves and pants, using mosquito repellant and avoiding areas with stagnant water or areas with a high concentration of mosquitos. It has also advised women to avoid or delay getting pregnant during this Zika virus outbreak.

Although many scientific studies are currently being conducted in regards to Zika virus, there are still many uncertainties surrounding the virus, which makes it difficult to provide long-term guidance for women seeking to become pregnant (Carvalho et al., 2016). A majority of the peer-reviewed literature currently available examines the etiology of the Zika virus, medical analysis or reports of patients and miscarried fetuses, information about microcephaly, or sexual and reproductive health practices and rights. PAHO has numerous studies underway about women's contraceptive use, prenatal counseling, and abortion amid the Zika virus outbreak, but the results of those studies have not yet been published. There is very little published information

about women's perceptions of risk from the Zika virus, which is why this study will provide a much needed look at a small portion of women's perspective of Zika virus and their views on family planning, particularly their plans to have a child or delay pregnancy.

Problem Statement

Since the Zika virus outbreak in Brazil is relatively new, there are few published results available about women's perceptions of risk as a result of the Zika virus. There is a need to better understand women's risk perceptions from the Zika virus and how it is affecting their family planning behavior.

Purpose Statement

This study will examine the risk perceptions of women between the ages of 22 to 40 from high and low economic strata as it relates to Zika virus and how those perceptions are affecting their family planning behavior.

Research Question

How have women's risk perceptions of Zika virus affected their family planning behavior?

Significance Statement

Given that there is little information about women's perceptions about Zika virus and how it is affecting their views in regards to family planning, findings from these interviews will provide insight as to what factors influence women's risk perceptions and how those perceptions shape family planning behavior. It will help identify which groups of women are most at risk and identify areas to focus public health interventions.

LITERATURE REVIEW

Origins of Zika Virus

Zika virus was first detected in 1947 in a monkey in the Zika forest of Uganda, but was not identified in humans until the 1954 in Nigeria (Slavov et al., 2016; Carvalho et al., 2016). Zika virus spread to numerous countries in Africa, Asia, and the Pacific. In 2007 Micronesia's Yap Island saw the first large Zika virus outbreak (WHO, 2016). It then spread to French Polynesia, which reported approximately 19,000 cases between 2013 and 2014 (Slavov et al., 2016). In March 2015 the first official case of Zika virus was identified in Natal, the capital city of Rio Grande do Norte, a state in the Northeast of Brazil (Slavov et al., 2016). Although it is not clear how the virus spread to Brazil, many believe it came into the country during the 2014 Fédération Internationale de Football Association (FIFA) World Cup held in venues throughout Brazil's major cities. Since Zika virus was first identified in Brazil it has spread to numerous countries throughout South America, Central America, and the Caribbean. The Pan American Health Organization (PAHO) cites that "48 countries and territories in the Americas have confirmed autochthonous, vector-borne transmission of Zika virus since 2015" (PAHO, 2017a).

Symptoms & Transmission

Only 20% of those infected with Zika become symptomatic (PAHO, 2016). Symptoms include fever, rash, joint pain, malaise, and conjunctivitis for a duration of two to seven days (PAHO, 2016). Symptoms are mild and present similar to those of dengue, which often leads to a misdiagnosis of Zika virus. Zika virus is transmissible to humans when bitten by an infected *Aedes aegypti* or *Aedes albopictus* mosquito, the same mosquito that transmits dengue and chikungunya. The virus is also transmitted sexually from one infected partner to the other, even if that person is asymptomatic (CDC, 2017). Instances of Zika virus being transmitted through

blood transfusions were also reported in Brazil, but remained unconfirmed as further investigations are conducted (CDC, 2017). Additionally, the virus can be transmitted from a pregnant woman to her fetus. This is particularly problematic as it can lead to fetal abnormalities and birth defects such as microcephaly.

Magnitude of Zika Virus

PAHO published frequent reports regarding the cumulative number of Zika cases and congenital syndromes associated with Zika virus as reported by Member States. The most recent report published on March 30, 2017 show the number of confirmed autochthonous cases of Zika virus in Brazil since 2015 as 130,976 cases with an incidence rate of 166.04 per 100,000 population; 11 deaths were identified among Zika cases and there were 2,386 confirmed cases with congenital syndrome associated with Zika virus infection (PAHO, 2017b). PAHO also had data for its Member States grouped by sub regions. Central America[1] had 6,044 confirmed autochthonous cases of Zika virus, 77 imported cases, and 74 confirmed cases with congenital syndrome associated with Zika virus infection. The Southern Cone[2] had 51 confirmed cases, 67 imported cases, and 4 confirmed cases with congenital syndrome associated with Zika virus infection. Latin Caribbean[3] had 41,320 confirmed autochthonous cases of Zika virus, 205 imported cases, 5 deaths among Zika cases, and 121 confirmed cases with congenital syndrome associated with Zika virus infection. Non-Latin Caribbean[4] had 5,039 confirmed autochthonous

[1] The following countries were included in PAHO's grouping of Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama.
[2] The following countries were included in PAHO's grouping of the Southern Cone: Argentina, Chile, Paraguay, and Uruguay.
[3] The following countries were including in PAHO's grouping of Latin Caribbean: Cuba, Dominican Republic, French Guiana, Guadeloupe, Haiti, Martinique, Puerto Rico, Saint Barthelemy, and Saint Martin.
[4] The following countries were including in PAHO's grouping of Non-Latin Caribbean: Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Bonaire, St. Eustatius and Saba, Cayman Islands, Curacao, Dominica, Grenada, Guyana, Jamaica, Montserrat, Saint Kitts and

cases of Zika virus, 29 imported cases, 4 deaths among Zika cases, and 8 confirmed cases with congenital syndrome associated with Zika virus infection. The Andean[5] area had 14,623 confirmed autochthonous cases of Zika virus, 41 imported cases, and 149 confirmed cases with congenital syndrome associated with Zika virus infection. In comparison to these sub-regions in Latin America, Brazil had the highest number of confirmed autochthonous cases of Zika virus and the most confirmed cases with congenital syndrome associated with Zika virus infection, further emphasizing the magnitude and severity that Zika virus has had on Brazil. In February 2016, the World Health Organization (WHO) declared Zika virus a Public Health Emergency of International Concern. This warning concluded in November 2016.

According to data from the Brazilian Ministry of Health, there are a total of 211,770 cases of Zika virus (incidence of 103.6 per 100,000 inhabitants), a majority of which were concentrated in Brazil's Northeast region, but has since spread throughout Brazil. The number of probable cases of Zika virus in 2016 was 119,241; that decreased to 3,961 in 2017[6] (Ministério da Saúde, 2017). The incidence of fever as a result of Zika virus also decreased from 2016 (n=57.9 per 100,000 inhabitants) to 2017 (n=1.9 per 100,000 inhabitants) (Ministério da Saúde, 2017). The state of São Paulo followed a similar trajectory with a decrease in probable cases in 2016 (n=2,042) compared to 2017 (n=217); incidence of fever as a result of Zika virus decreased from 2016 (n=4.6 per 100,000 inhabitants) to 2017 (n=0.5 per 100,000 inhabitants) (Ministério da Saúde, 2017). The Ministry of Health's epidemiologic reports for the period of January 3, 2016 to August 13, 2016 registered 196,976 probable Zika virus cases of which 67.3%

Nevis, Saint Lucia, Saint Vincent and the Grenadines, Sint Maarten, Suriname, Trinidad and Tobago, Turks and Caicos Islands, Virgin Islands (UK), and Virgin Islands (US).

[5] The following countries were including in PAHO's grouping of the Andean region: Bolivia, Colombia, Ecuador, Peru, and Venezuela.

[6] The Ministry of Health's Epidemiologic Bulletin uses data from 2017 through week 10 (January 1, 2017 to March 11, 2017) and compares it to 2016 data during that same period (Ministério da Saúde, 2017).

(n=132,524) were women ages 10 to 49; 16.9% (n=16,264) of probable Zika cases were among pregnant women (Ministério da Saúde, 2016). 68% (n=47,498) of probable Zika virus cases among women ages 10 to 49 were in the Northeastern region, of which 13.5% were pregnant, while 68.3% (n-56,183) of probable Zika virus cases among women ages 10 to 49 were in the Southeast region, of which 18.7% were pregnant (Ministério da Saúde, 2016). The state of São Paulo, which is located in the Southeast region, had 5,474 probable Zika virus cases (2.8%) of which 4,059 were women (74.2%) ages 10 to 49, and 1,145 (36.7%) were pregnant women (Ministério da Saúde, 2016). The highest numbers of probable cases were located in the Northeast and Southeast regions, which have climates that are hospitable for mosquito breeding. This is particularly startling information because it indicates that more women are showing symptoms of probable Zika virus infection than men. This demonstrates that women are quite vulnerable to Zika virus infection, and may be more susceptible to the risks associated with Zika, such as the possibility of having a child with microcephaly.

Zika Virus Prevention

The Brazilian Ministry of Health conducted numerous awareness campaigns throughout the Zika virus outbreak focusing on prevention through mosquito elimination. Larger campaigns such as *Zika Zero* (Zero Zika) and most recently *Mosquito Não (*No Mosquito) emphasized eliminating the *Aedes* mosquito by preventing mosquitos from breeding by making sure there is no standing water, using mosquito repellent and insecticide, and being vigilant of mosquitos. One campaign, *Crianças Contra Zika* (Children against Zika), uses a series of animated videos and songs teaching children about methods to prevent mosquito breeding by helping to eliminate standing water. In February 2016, former president Dilma Rousseff ordered military staff to distribute flyers about the *Zika Zero* campaign, focusing on mosquito prevention techniques.

Fumigation efforts were also part of this campaign and conducted in many cities in the Northeast. Campaigns focusing on eliminating mosquito breeding grounds are extremely important because the *Aedes* mosquito can breed anywhere so long as there is some standing water and eggs can survive around six months without water (Jacobs, 2016). While the *Zika Zero* campaign was used widely in 2016, the new *Mosquito Não* campaign focuses more on the individual's responsibility to do their part to eliminate the breeding ground for mosquitos that cause dengue, Zika, and chikungunya. There is less emphasis on just Zika, but rather the elimination of all three viruses stemming from the *Aedes* mosquito.

The United Nations Population Fund (UNFPA), along with numerous Brazilian and international partners, launched a campaign focusing on sexual and reproductive health called *Mais Direitos, Menos Zika* (More Rights, Less Zika) primarily in Pernambuco and Bahia, two states in Brazil's Northeast region that were greatly affected by Zika. This community-based campaign targets both male and female adolescents and young adults to provide information about sexual and reproductive health rights and promote the use of condoms and insect repellent to minimize the impact of the Zika virus. In addition, the Ministry of Health, United Nations International Children's Emergency Fund (UNICEF) Brazil, and PAHO/WHO provided numerous informational pamphlets for pregnant women to avoid mosquito bites and other preventive guidelines. These efforts focus on combatting the mosquito by removing stagnant water, and personal protection, which includes using mosquito repellent, wearing pants and long sleeves, ensuring windows are closed or screens are in place to keep mosquitos out. Pregnant women should not only follow those guidelines, but also seek out a healthcare provider and attend regular pre-natal checkups; pregnant women are also advised to avoid travelling to areas where there is a high concentration of mosquitos.

Microcephaly

Microcephaly is a disorder whereby a baby's head circumference is smaller than a baby with a normal head circumference and can be either congenital – due to lack of brain development in utero – or developed after birth – the head stops growing after birth (WHO, 2016b; CDC, 2016a). A head circumference between 31.9 centimeters and 31.5 centimeters is considered normal for full-term newborns, while the head circumference for a baby with microcephaly is about 2 standard deviations less than the average head circumference for the age and gender of the child (Carvalho et al., 2016; CDC, 2016a). WHO reports that babies exposed to Zika virus in utero may lead to miscarriages and/or stillbirths, while those pregnancies that result in live births may have babies with developmental complications such as microcephaly, hearing and vision problems, and trouble swallowing (WHO, 2016b). WHO classifies those symptoms as congenital Zika virus syndrome. The Centers for Disease Control and Prevention (CDC) note that certain exposures during pregnancy can lead to developing microcephaly. These include rubella, toxoplasmosis, or cytomegalovirus infections, severe malnutrition, exposure to alcohol, drugs or other toxic chemicals, and lack of blood flow to the fetus (CDC, 2016a). While fetal ultrasounds can detect microcephaly towards the end of the second trimester, diagnosis primarily occurs after birth or shortly thereafter (WHO, 2016b). There is no treatment for microcephaly. WHO recommends early intervention and stimulation to assist with the child's mental and physical development. In addition, WHO notes that support and counseling services may be beneficial for parents who have a child with microcephaly.

In January 2016, scientists from the Instituto Carlos Chagas of Fiocruz in Curitiba found traces of Zika virus in the placenta of a woman who suffered a spontaneous abortion (miscarriage) (Globo, 2016). Another study conducted ultrasounds on two women who had Zika

virus symptoms in their first trimester. Fetal ultrasounds were conducted at 30 and 29 weeks gestation, respectively. In both cases, doctors identified smaller head circumferences, brain atrophy, calcifications, and other neurological developmental problems (Oliveira et al., 2016). Both examples show that the virus is transmissible from mother to fetus, further strengthening the Ministry of Health's hypothesis that there is a relationship between Zika virus and microcephaly. However, more research was necessary to confirm the causal link between Zika virus and microcephaly. After months of observation, laboratory testing, and epidemiologic studies, CDC believed there was enough evidence to confirm the association between Zika virus and microcephaly in April 2016. Researchers noted that there are still a number of uncertainties surrounding Zika virus and microcephaly, primarily in regards to some pregnant women becoming infected with the virus and giving birth to children with no visible deformities or abnormalities.

In the past year and a half microcephaly cases have substantially increased in areas where there is a high prevalence of Zika virus, predominantly in Brazil's Northeastern states. As a result of this large increase, Brazil declared a state of public health emergency in November 2015 (Ministério da Saúde, 2016). Brazil's Ministry of health identified 10,232 suspected cases among newborns and infants between 2015 and 2016, of which 2,205 were confirmed, 39 are probable, and 2,829 are under investigation. (Ministério da Saúde, 2017). This was in stark contrast to information from 2014 when only 150 infants were born with microcephaly (BBC, 2016). The Northeast region had the largest number of notified microcephaly cases followed (65.7%) by the Southwest region (20.6%), which follows a similar distribution pattern of probable Zika virus cases among women ages 10 to 49. Within these two regions, Pernambuco state had the highest percentage of notified microcephaly cases (21.3%), followed by the states

of Bahia (14.3%), Paraíba (9.0%), São Paulo (8.1%), and Rio de Janeiro (7.8%) (Ministério da Saúde, 2017). In the state of São Paulo, 53 notified microcephaly cases were confirmed, 32 are probable, and 305 remain under investigation (Ministério da Saúde, 2017). Data from the first two epidemiologic weeks in 2017 show 84 suspected microcephaly cases, of which 1 was confirmed and 75 remain under investigation (Ministério da Saúde, 2017). The majority of notified microcephaly cases were in the Southeast region (44%) followed by the Northeast region (38.1%), which is a shift from the 2015-2016 data. The state of São Paulo had the second highest number of notified microcephaly cases at 12, only behind Minas Gerais with 13 cases; of those 12 cases, 8 remain under investigation and 4 were discarded (Ministério da Saúde, 2017). 664 suspected spontaneous abortions and stillbirths as a result of Zika virus infection were reported between 2015 and 2016, of which 180 were confirmed and 12 were classified as probable; São Paulo had 86 suspected cases of which 13 were confirmed, 35 were probable, and 35 remain under investigation (Ministério da Saúde, 2017). There were 602 suspected cases of fetal deaths as a result of Zika virus infection, of which 206 were confirmed, 7 were probable, and 259 remained under investigation (Ministério da Saúde, 2017). In São Paulo there were 39 suspected cases of fetal deaths, of which 4 were confirmed and 15 remained under investigation (Ministério da Saúde, 2017). The Brazilian Ministry of Health continues to monitor these statistics and PAHO has advised its Member States to monitor the situation and report any increase in newborns with microcephaly symptoms, most notably smaller than normal head circumference.

Microcephaly Prevention

While the Ministry of Health continues to monitor the Zika outbreak and cases of microcephaly, it has stressed the need for prevention and protection, especially for pregnant

women and those trying to conceive. The Ministry of Health has advised pregnant women to take precaution to avoid contact with mosquitos by wearing long sleeves and pants, using mosquito repellant and avoiding areas with stagnant water or areas with a high concentration of mosquitos. It has also advised women to avoid or delay getting pregnant during this Zika virus outbreak. At the height of the outbreak, the CDC issued a travel alert warning pregnant women to avoid travel to Brazil and other Latin American countries where the Zika virus was occurring (CDC, 2016b). With the recent emphasis on this virus and the attention it has related to infants born with microcephaly, more consideration is being given to sexual and reproductive health rights and services in Latin American Countries.

The *Sistema Único de Saúde* (Unified Health System, SUS) provides free healthcare to nearly 74% of the population through public hospitals and health posts; SUS covers the cost of contraception except for the levonorgestrel-releasing intrauterine system and implants (Bahamondes et al., 2017). Additionally, condoms are widely available at health posts. A study conducted by Bahamondes et al. (2017) looked at the contraceptive sales from September 2014 to August 2016, which covered the height of the Zika virus outbreak in Brazil. Excluding condoms, the study looked at sales for oral contraceptives, vaginal and transdermal contraceptives, injectable contraceptives, long-acting reversible contraceptives, and emergency contraceptive pills. Oral contraceptives were the most popular contraceptive sold (90%), followed by injectable contraceptives (9.5%), and lastly long-acting reversible contraceptives (0.5%) (Bahamondes et al., 2017). The study did not find any increase in an already high contraceptive usage rate among women during this time period. Based on these results, the authors find that more should be done to offer women greater access to long-acting reversible contraceptives, as they are most effective at preventing unwanted pregnancies. Of women aged

15 to 49 years, 22 million are of reproductive age and are in need of contraception to mitigate chances of having an unintended pregnancy (Bahamondes et al., 2017).

There are many uncertainties surrounding Zika virus, which makes it difficult to provide long-term guidance for women seeking to become pregnant (Carvalho et al., 2016). For example, some researchers believe Zika virus will follow a similar pattern as dengue, whereby the virus will recur seasonally and peak during rainy seasons, while others believe enough of the population has been infected and obtained immunity that the virus will disappear for several years (Carvalho et al., 2016). Until more information about Zika virus and microcephaly becomes available, pregnant women are advised to take precautions and avoid travelling to areas where Zika virus is present, and to seek counsel from their doctor or healthcare provider. Due to this uncertainty concerning the spread of the virus and microcephaly, it is difficult to make definitive yes or no answers or recommendations, which is why prevention is a key way to handle the situation given the available facts (Diniz, 2016).

Other Studies about Zika Virus in Brazil

Since Zika virus and its association with microcephaly are relatively new, there is little information regarding women's perceptions about the virus, their perceptions of risk, and how those perceptions affect their intentions of becoming pregnant. A majority of the peer-reviewed literature available examines the etiology of the Zika virus, medical analysis or reports of patients and miscarried fetuses, and information about microcephaly. Other literature examined the repercussions of sexual and reproductive health practices, primarily the legality of abortion, not only in Brazil, but on other Latin American countries suffering from Zika virus. PAHO has started several research projects regarding Zika virus and its repercussions on those affected by the virus. Two studies in particular look at contraceptive use, prenatal counseling, and abortion

in the wake of the Zika virus outbreak. However, these have not yet been published and only the titles are available to the public. As a result, these qualitative interviews will provide a basis of information about women's perceptions regarding the state of their family planning in the wake of the Zika virus outbreak.

METHODOLOGY

Study Site

The state of São Paulo is located in Brazil's Southeast region; this region had the second highest number of probable Zika virus cases after the Northeast region. According to the Brazilian Ministry of Health, the state of São Paulo had 2.8% probable Zika virus cases (n=5.474); 74.2% (n=4,059) of those probable cases were among women between 10 and 49 years of age and 36.7% (n=1,145) of probable cases were among pregnant women (Ministério da Saúde, 2016). Data at the municipal level was not publically available. Given that probable cases of Zika virus were much higher among women than men at the state level and the virus's connection to microcephaly when present during gestation, there is cause to better understand women's perceptions of the virus, its risks, and how it may affect their behavior towards pregnancy in São Paulo.

With the assistance of a professor at the University of São Paulo's (USP) School of Public Health, it was decided that the study location would be conducted in urban areas in the city of São Paulo, Brazil. Urban areas could easily lead to a rapid spread of the virus due to its large population and structure of certain neighborhoods, particularly the close proximity of apartments. São Paulo is also one of the largest and most affluent cities in Brazil and South America, with large discrepancies in wealth; this characteristic allowed for diversity of female participants based on socioeconomic status and education level.

Study Population & Recruitment

Seeking a diverse population of women was key to identifying diverse perspectives about Zika virus and how it affected their behaviors towards family planning. Women eligible for this study were aged 18 to 40 years as this is the age range in which the highest number of live births

are recorded (Secretaria Municipal da Saúde de São Paulo, 2016) in the municipality of São Paulo in 2015. This age range included women from their peak reproductive period to those nearing the end of their reproductive cycle, which would enable diverse perspectives to be captured based on the women's stage in their reproductive life cycle.

Women were recruited based on their socio-economic status, which was inferred through years of schooling, workplace, and residency as proxies. It was assumed that women who had completed a college degree or more and had prominent careers, such as legal professions or academia, were of a higher socioeconomic status. Therefore, recruitment of higher socioeconomic women targeted those with advanced degrees and prominent career sites, which was why a gatekeeper at a prominent Brazilian law firm was used to recruit women working in the legal profession, and a gatekeeper was used to recruit women at USP. Paraisópolis is a well-known and large community that is associated with lower socio-economic status. Recruitment at a private community center in Paraisópolis allowed for recruitment of women living and/or working in this community. The head of the community center served as a gatekeeper to assist in the recruitment of women in Paraisópolis. In addition, snowball recruitment was also used to engage more women within the target age group. After each interview, I asked the participants if they knew women who met the recruitment criteria and would be willing to be interviewed. The participant would speak to their friends, family members, or colleagues and make an introduction. Many women were very eager to provide connections to friends and colleagues to participate.

Research Instruments

A semi-structured interview guide was used to discuss two main topic areas: perceptions of Zika virus and sexual and reproductive health practices and beliefs both prior to and in the

wake of the Zika virus outbreak. Interview guides were written in Portuguese and reviewed for grammatical accuracy and colloquially relevant phrasing by a Ph.D. student and professor at USP who were both native Portuguese speakers. The interview guide was then pilot tested and questions were refined for better clarity prior to data collection.

Data Collection

Interviews were conducted throughout a six-week period from June to August 2016. Table 1 shows the socio-demographic characteristics of participants. To provide diversity, women were recruited from locations representing different socioeconomic status, including a prestigious law firm and university, and a community center in Paraisópolis. I conducted all interviews with the women at the university and law firms and provided participants with chocolates. Three individuals with qualitative research experience and Portuguese language fluency conducted the interviews at Paraisópolis.

Rapport was built with women by asking them about their day, offering chocolates, and explaining the reason for the interviews. All women were explained of their rights and ability to refuse to answer any questions or end the interview at any time. It was expressed that they had the power to share as much or as little as they felt comfortable and that all transcripts would be de-identified to protect their anonymity. Women gave their verbal consent to participate in the study and consented to have the interview recorded. Interview times ranged based on how much time the participants had to commit to an interview and how willing they were to disclose their perceptions, which resulted in a range of interview times averaging approximately half an hour. Discussions were conducted with in-country collaborators to ensure cultural validation throughout data collection.

Table 1. Participants by age groups and socioeconomic status

	20-24 years	25-29 years	30-34 years	35-39 years	40-44 years
Higher SES	2	3	6	4	1
Lower SES	2	4	6	1	0

Data Analysis

Thematic analysis was used as the analytic approach in this study. All interviews were de-identified, transcribed verbatim in Portuguese, and uploaded into MAXQDA software to begin qualitative data analysis. Memos were written on each of the transcripts to identify emerging issues and common themes from the narratives. Inductive and deductive codes were developed into a codebook and listed in a codebook. Codes captured main issues and themes that emerged from the data in response to the research question. All transcripts were coded using codes from the codebook. Codes were compared for commonalities and contrasts in opinions using the various codes. Transcripts were analyzed numerous times to identify commonalities and differences among women's perceptions of Zika virus, particularly if there were any differences by age group or by socioeconomic status. Results were verified by continuing to return to the data to ensure they came from the transcripts.

Ethical Consideration

This study was submitted to Emory IRB for ethical clearance and deemed to be exempt because the information collected could not be generalized to external populations. All women were informed of their rights and power to provide as much or as little information as they felt comfortable and could end the interview at any time. Women were asked for their verbal consent to participate in the study and for their consent to record the interview.

Study Limitations

This study interviewed women aged 20-40 in urban areas. Therefore, the perceptions of women outside that age range were not identified, thereby limiting the study results only to urban women. In addition, the study did not include men.

RESULTS

Influences of Risk Perception of Zika Virus

Women discussed various reasons as to what influenced their risk perception of Zika virus. All women had some knowledge and understanding of Zika virus, the outbreak in Brazil, and subsequent microcephaly cases among infants. Women's perceptions of risk varied based on their intent to become pregnant, which was largely influenced by a woman's age and parity, relative risk, regional risk, and health information.

Intent to Become Pregnant

Although every woman believed she was susceptible to getting Zika virus, many did not believe that they were personally at risk. All women discussed that pregnant women (" *as gestantes*") were the most at-risk group if they were to contract Zika virus because of the risk of fetal transmission leading to microcephaly. Women cited the virus' effects on the baby's health as the main reason why pregnant women were most at risk. Depending on their age and parity, some women believed it was best for women to delay their plans to become pregnant until more information about the virus became available or until the risk subsided, while others were willing to take a risk and continue with their pregnancy plans.

Age & Parity

Age and parity shaped women's perceptions of the virus and whether women were willing to take risks and attempt becoming pregnant. Their thoughts on pregnancy differed based on the participant's age, whether they already had a child, and other external factors such as their financial stability. Women in the youngest age group (20-24 years) were nulliparous and had no intentions to become pregnant at the time being because they considered themselves too young or were not at a stage in their lives to become parents. They expressed the desire to have

children in the future, some ranging to within the following year to others not wanting a child until their late twenties or early thirties. One participant in this group had planned on having a baby prior to the Zika virus outbreak, but delayed those plans for fear of complications that may arise from catching Zika virus while pregnant, especially the fear of having a child with microcephaly. Since this participant is in her early twenties, she saw no negative consequences of delaying her pregnancy until the outbreak diminishes. The other three participants had no plans on having a baby before the Zika virus outbreak so their views on pregnancy did not change as a result of the outbreak. However, all 4 women thought it was best to delay pregnancy at least until more information about the virus became available and for the risks to subside.

Women in the 25-29 years of age group were split in terms of parity and desire to become pregnant. Those women of higher inferred socioeconomic status were nulliparous and expressed interest in having a child in the future, but believed it would be sensible to delay pregnancy plans at the moment: "If I were thinking about having a baby now I would postpone because I, I don't like to take risks, get it [I: yes] so if there is a chance that something will go wrong, I won't do it" (Transcript 19/ High SES/Age 25-29/nulliparous). In addition to the fear of contracting Zika virus while pregnant, one woman from this group also discussed financial reasons as a secondary factor influencing her decision to postpone her pregnancy plans. Women of inferred lower socioeconomic status had at the minimum one child. Those that already had two children expressed no desire to become pregnant again, while those with one child expressed a desire to have another child, but due to the Zika virus were waiting to become pregnant until the outbreak diminished.

Women between the ages of 30-34 varied in parity and desires to become pregnant. A majority of those in the inferred higher socioeconomic group were nulliparous and one was

primiparous. Many described their desires to have children or were not doing anything to actively prevent pregnancy. Only one woman expressed an interest to delay pregnancy until more information about the virus and its side effects were available, while three women expressed a strong interest in continuing with their pregnancy plans without delay. These women cited their age as a main factor in their decision. Those in the inferred lower socioeconomic group were primiparious or multiparous, the majority of whom expressed a desire to not have more children. Women in this group were more adamant about not becoming pregnant again not only because of Zika virus, but because of the economic instability and financial conditions in Brazil at the time the interviews occurred. More women in this group believed delaying pregnancy would be ideal as compared to those women in the higher socioeconomic group of the same age group.

Women in the 35-39 years of age group also varied in parity and desire to become pregnant. Two women in the inferred higher socioeconomic group were nulliparous and expressed a strong interest in having a child, so much so that they would not delay their pregnancy plans. However, one was willing to postpone at least until the winter to minimize her chances of being bitten by a mosquito. One woman was unsure about her intentions for another baby because she had to consider other factors that would increase her risk of complications during pregnancy, which were her age and Zika virus, in addition to her financial situation. Another woman who recently had two children and was pregnant during part of the Zika virus outbreak felt strongly about not having another child. The one woman from the inferred lower socioeconomic group was multiparous and did not intend to have more children.

The one participant in the 40-44 age group was primiparous and expressed an interest in having a second child, but she would not be as anxious to have another one because she already

has a child. She believed that it would be ideal if women could delay their pregnancies, but recognizes that women who do not have any children and are older in age may not be as willing to delay their plans to have a baby.

That participant's perceptions of a woman's age and parity affecting a woman's willingness to have a child were particularly relevant among the women interviewed. Most women who were in their twenties were more inclined to the idea of delaying pregnancy, whereas those women who were in their thirties and nulliparous were not as willing to delay pregnancy; they were willing to take the risk of possibly getting Zika virus if it meant they would have a chance at having a baby. These women said they would take extra precautions to avoid mosquitos should they become pregnant. It is interesting to note that a majority of the nulliparous women who would not delay their pregnancy were part of the inferred higher socioeconomic class.

Relative Risk

Women believed that everyone is susceptible to contracting Zika virus due to its various modes of transmission. They noted that the *Aedes* mosquito is endemic in Brazil and can also transmit dengue and chikungunya. Many women associated or connected Zika virus to other mosquito viruses that they already knew of, such as dengue. Women discussed having dengue or knowing someone who had contracted dengue. One woman stated that she does not fear getting Zika virus, but is more concerned with dengue. They knew that Zika virus symptoms were similar to dengue, which made it difficult to distinguish between the two viruses. They also were aware of other consequences or side effects of Zika such as Guillain-Barre Syndrome. The possible paralysis was not as widely discussed as microcephaly, but it still caused fear in some participants. One participant from São Paulo was more concerned with contracting Guillain-

Barré Sydrome than possible having a child with microcephaly because she had no plans on becoming pregnant anytime soon. Others briefly discussed the possible risk of getting Guillan-Barre Syndrome, but believed that was more closely related to chikungunya rather than Zika virus.

Since women were already familiar with mosquito prevention techniques as a result of dengue outbreaks, all women were aware of the importance of keeping their homes clean and free of stagnant water in order to eliminate possible mosquito breeding sites. Many women were familiar with mosquito prevention and protection techniques and were compliant with the elimination of stagnant water sources in their homes prior to the Zika virus outbreak. The main focus was eliminating mosquito breeding grounds: "The main focus here is eliminating mosquito breeding sources and not letting mosquitos proliferate. The main focus here is the mosquito" (Transcript 06/ High SES/Age 30-34/nulliparous). Additionally, women discussed having "*tomadas*" or mosquito repellent plugs that were placed in electrical sockets in their homes as a secondary protection against mosquitos. Women discussed killing mosquitos whenever they saw them, but in general would not alter their routine mosquito prevention habits as a result of Zika virus unless they were to become pregnant.

Regional Risk

Some women believed they had the same risk of getting the virus as any other person, but others believed their risk would be higher if they were to visit a location where there are already a high number of cases, such as the Northeast region of Brazil, or coastal areas. Overall, women were not as concerned about contracting Zika virus in São Paulo and believed it would be difficult to contract it in the city. However, some women believed that frequent travel between people from São Paulo or other cities in the Southeastern region to the Northeast of Brazil would

eventually increase their chances of getting the virus. Women's behavior in terms of mosquito protection varied when travelling to the Northeast. Some were very vigilant about using mosquito repellent while others had no concern for being bitten by mosquitos and went about their lives as usual. The trend to be more careful about mosquitos and following precautionary measures was more common among women travelling to the Northeast and beaches that tend to have an increased prevalence of mosquitos.

Women also discussed seasonality and the role it played in their risk perception. Many women were not concerned with mosquitos because it was winter at the time the interviews were conducted. Most women discussed the lower mosquito rates during winter months and also mentioned they were more covered (e.g. wearing pants and long sleeves) due to the colder temperatures. Women also stated that they were more likely to remember to use mosquito repellent in the summer, particularly whenever they were at the beach: "I only use repellent when I go to the beach" (Transcript 09/ High SES/Age 35-39/nulliparous). Another participant discussed how she has been taught to use repellent at the beach and how that has become a habit whenever she is at the beach. Women also discussed being more vigilant about mosquito prevention whenever they travelled to the Northeast or other mosquito prone areas.

Women mentioned that their friends outside of Brazil were more concerned for these women's risks of getting Zika virus than they were themselves. One woman spoke of her friend who lives in Europe that was worried for her safety and suggested she protect herself from getting Zika virus. The participant did not share those same fears. Another woman opined that the situation was not as dramatic as Americans perceived. It was interesting that in these examples, those who were more concerned about the Zika virus were in areas where there are few *Aedes* mosquitos. Women may be more prone to worry about the situation outside of Brazil

since they may be less accustomed to dealing with mosquito borne illnesses. Women in Brazil described dealing with other mosquito borne viruses, such as dengue or chikungunya, which may also minimize the severity of their risk perception towards the Zika virus.

Health Information

Women's health information about Zika virus varied in accuracy, but overall a majority of women knew basic facts about Zika virus, how it was transmitted, symptoms and side effects. A majority of the women identified that Zika virus is transmissible through mosquitos; some women correctly knew that it was transmissible via the *Aedes* mosquito, while others did not know the mosquito type but knew it was the same carrier as dengue. One participant from Paraisópolis said she did not know any symptoms or much information about Zika because Disney channel is always on the television in her house; there is a lack of information made available for her because a main source of information, which for many women is the media, is being used by her children, leaving her with no time to watch the news or special reports.

A majority of women in São Paulo and Paraisópolis were able to identify that microcephaly was a negative consequence of Zika virus among pregnant women. Many were aware of the Zika virus outbreak in the Northeast region of Brazil and that there were many infants being born with microcephaly in that region. Since that was widely discussed on multiple media outlets throughout Brazil, women were aware of the virus' effects on fetal brain development and the high risk it posed to pregnant women, particularly those living in the Northeast.

When asked how they knew this information, many said the media. Pressed to elaborate, women then identified television news reports, *"reportagens*," as their main source of information, followed by social media and Internet searches. Women who had a background in

academia or were pursuing higher education such as a Master's degree or Ph.D. stated that in addition to media sources they researched scholarly articles and reports by the Brazilian Ministry of Health, World Health Organization or other reputable scientific organizations in Brazil such as Fio Cruz. Those who had access to university settings attended lectures on the topic by subject-matter experts. Those women who were either pregnant at the time of the outbreak or were trying to become pregnant also sought the advice of their gynecologist.

In Paraisópolis women also received the majority of their information about the virus from news reports and also through discussions with friends, family members, and neighbors. One participant said that the local health posts had flyers about Zika virus and went around the community disseminating the information. Other women in Paraisópolis discussed the lack of information they received from the health posts or discussed the difficulty of getting an appointment. It was interesting to note that women from the same community had conflicting perspectives regarding the health post as a source of information about Zika virus. It appears that the reliability of the sources of information had some effect on the extent of women's knowledge of Zika virus and the accuracy of that information. Women also touched upon the topic of uncertainty, particularly the lack of information that was available about the long-term consequences of the virus. This uncertainty would affect their plans on pregnancy and also government and health policy recommendations.

Behavior Change as a Result of Risk Perceptions

Few women changed their mosquito protection habits as a result of Zika. Those who did change their behavior were primarily women who were either pregnant during part of the outbreak or actively trying to become pregnant.

Little Behavior Change

Most women did not see Zika virus as an imminent threat to their health because they had no plans to become pregnant. For these women, risk perception minimized their fear because many were already careful about mosquitos due to their knowledge and experiences when dealing with other mosquito borne illnesses such as dengue and chikungunya. Women were careful to eliminate possible mosquito breeding sites in their homes by eliminating stagnant water and sealing open water sources. Minor changes were noted when women travelled to the beach or Northeast region and they were more vigilant about protecting themselves from mosquitos. Women discussed being more vigilant about mosquito protection during the summer months because of the increased prevalence of mosquitos.

Women Attempting to Conceive

Overall, women said that if they were to become pregnant they would be more cautious about mosquito protection to avoid getting Zika virus. They all agreed that if women were trying to conceive, they should take extra precautions by using mosquito repellent, wearing long sleeves and pants, avoiding travel to Zika prone areas or areas with many mosquitos. Of those women interviewed, those who recently had a baby and were pregnant during the onset of the Zika virus outbreak, and those who were still actively trying to become pregnant were most likely to modify their behavior.

Participants who were pregnant during the start of the Zika virus outbreak changed their habits as it pertained to mosquito protection. For example, one woman who was pregnant during the outbreak was very careful of preventing mosquito bites. During the summer she would remain covered and avoided parks and other areas that had mosquitos: "Ah yes, it was very hot in Brazil and I ended up wearing clothes that were more suited for the cold, more covered [I:

mhmm] to try to minimize my risk of getting Zika, and I also avoided open spaces like parks or more outdoor places" (Transcript 12/ High SES/Age 35-39/ multiparous). Once she had her child, she was less worried about contracting Zika virus and stopped using mosquito repellent. Similar behavior was noted among women in Paraisópolis. One woman used a lot of mosquito repellent and avoided leaving her house because she was afraid to be bitten by a mosquito during her pregnancy: "I used a lot of repellent, avoided leaving the house….I was scared to death, and where I work there are so many mosquitos...." (Transcript 23/ Low SES/Age 25-29/multiparous). After the birth of her baby, she continued with precautions against mosquitos and placed a mosquito net above her baby's crib.

Women who expressed a willingness to take the risk and attempt to become pregnant were split between those who were willing to delay their pregnancy for a short time, predominantly attempting to become pregnant during the winter months, and those who would continue trying to become pregnant, regardless of the season. One woman was planning to have a second one when the Zika virus outbreak began, but decided to postpone her pregnancy plans. However, at the time of the interview she believed that news about Zika virus had diminished and that risks had diminished - "it lightened up" (Transcript 32/Low SES/ Age 25-29/primiparous) – to the extent that she said she would be willing to try for a second baby within the next year.

Women discussed their gynecologists' suggestions to plan pregnancies during the winter because there is a decreased chance of being bitten by mosquitos. One participant is in the 30-34 age group and expressed that she does not want to be an old mother, but also wants to minimize her risk of getting Zika without compromising her desire to become a mother. Since she was unable to become pregnant this past winter, she said she was willing to pause her pregnancy

plans until the following winter to try again: “Because of Zika virus, I tried to anticipate [mosquito season] and tried to become pregnant during the winter, but it didn’t take….but, in theory, I had plans to become pregnant, yes….but because of Zika I tried to anticipate [mosquito season] to lessen my risk” (Transcript 16/High SES/ Age 30-34/ nulliparous). Another participant in the 35-39 age group received similar guidance from her gynecologist, but was not as willing to plan her pregnancy to target the winter months. In her life it would be impossible to plan such things, like a pregnancy, she would begin to think of other risks that could occur during pregnancy that would make her not want to take any risks an become pregnant. She will try to remain calm about the situation and try to become pregnant. Another woman in this age group had a similar perspective in her attempt to continue to try to become pregnant. This participant believed that there would always be some kind of outbreak or risk that would cause women to fear becoming pregnant; if everyone was always afraid of complications during pregnancy, women would never become pregnant. Since she has a strong desire to have a baby, she will keep trying to conceive no matter the risk, but mentioned possibly delaying for a short period to avoid starting her pregnancy during the summer months primarily because she was travelling to the beach in the Northeast for the New Year.

DISCUSSION

Study results identified the various influences that shaped women's perception of risk from the Zika virus and how those perceptions affected their family planning behavior. Overall, women's age and parity had the greatest influence on their desire to postpone or continue with their pregnancy plans in the context of Zika. In addition, the relative risk of Zika virus in comparison with other viruses such as dengue, and the regional risk of Zika, and the type of health information received shaped their perceptions of Zika virus and family planning behavior. These issues are described in detail below and will help guide public health recommendations.

Age & Parity

Age and parity played a significant role in women's decisions on whether to continue with or delay their pregnancy plans. Nulliparous women aged 20-24 who had no desire to become pregnant any time soon, typically believed that delaying pregnancy was a good idea due to the Zika virus outbreak. Much of their decision-making is driven by their young age and potential to continue with a pregnancy at a later time. Many women reported that they were not in a stage in their lives when they wanted to begin a family; therefore, the Zika virus outbreak had little effect on their family planning behavior at this time. These women therefore expressed a disassociation with the risks of getting Zika virus, since they had little intention to get pregnant. Similarly, women aged 25-29 believed delaying pregnancy was sensible. Since these women were also young, they had time to have children in the future.

Women in their thirties were divided in their pregnancy intentions. Nulliparous women aged 30-39 who were of higher socioeconomic status expressed that they intended to continue with their pregnancy plans despite the risk of Zika virus, citing their advanced maternal age as a main reason. These women felt a greater sense of urgency to become pregnant because they had

no children yet and were therefore willing to continue with their pregnancy plans even though there was a possibility they could contract Zika. Most of these women who stated they would continue with pregnancy plans tended to be higher educated and in established careers. The additional time needed to obtain advanced degrees and to advance in their respective careers may have attributed to their nulliparous status. Primiparous and multiparous women aged 30-39 who stated that they did not want more children, tended to be of lower socioeconomic backgrounds. Since they already had at least one child, these women did not have that same sense of urgency to become pregnant again and risk getting Zika virus with the possibility of having a child with microcephaly. This reflects the fact that women of lower socioeconomic status are having children at an earlier age.

Since older, nulliparous women are the ones willing to take the risk and become pregnant, these women should be targeted with information informing them of the risk of Zika virus and encouraging them to seek counseling from their gynecologists and medical providers to closely monitor their pregnancies for any complications and fetal growth. WHO (2016b) and CDC (2016b) provide several recommendations for pregnant women to protect themselves from contracting the Zika virus. This information should be made available to all pregnant women, but especially older women who are trying to conceive during the Zika outbreak.

Relative Risk

Women reportedly believed they were susceptible to contracting the virus, which could be associated with two modes of transmission: mosquitos and sexual transmission. The *Aedes* mosquito thrives in Brazil and also carries dengue and chikungunya, which are two mosquito borne illnesses that frequently occur in Brazil. Even though women believe they are susceptible to getting Zika virus, they weighed the relative risk of Zika compared with other mosquito borne

illnesses such as dengue and chikungunya, and felt that the symptoms of Zika virus sounded mild in comparison with these other illnesses. Additionally, women were more concerned with Zika virus because of the possibility of having a child with microcephlay. Other risks factors, such as Guillain-Barre Syndrome were not as commonly discussed and was a large concern for one participant. Another participant associated Guillain-Barre Syndrome with chikungunya rather than Zika virus.

It is important for women to know about all possible side effects as a result of Zika virus, such as Guillain-Barre Syndrome, which could affect anyone with Zika, rather than highlighting only the concern for pregnant women due to microcephaly. Additionally, improving diagnosis of Zika virus is important so that those who show symptoms of Zika virus can either confirm that they have contracted the virus and receive appropriate treatment and counseling rather than being dismissed as only having dengue. This is important because if individuals are aware that they have contracted Zika virus, they may follow WHO or the Brazilian Ministry of Health's guidelines to avoid passing the virus to their partner via sexual transmission.

Regional Risk

Women discussed having a higher risk of contracting Zika virus if they were to travel to the Northeast, coastal areas, or other zones with large numbers of mosquitos. They viewed risk as a problem for people in these regions rather than themselves, connoting that the risk was in the Northeast and not near them in the city of São Paulo. A majority of women discussed travelling to the Northeast, either to visit family or for vacations. Since Zika virus has spread throughout Central and South America and the Caribbean, one can see how quickly the virus can spread to other locations. Therefore, women should receive better information about the virus's transmission, including both mosquito and sexual transmission, and learn of the travel risks to

certain areas. This is particularly necessary for pregnant women or those who are actively trying to conceive. Better public health messaging to relay the risks of Zika virus, its transmission, and ways to protect oneself should be given to everyone and not only to those women in geographic areas of increased risk.

Women also addressed how their perceptions of risk from Zika virus were much lower in the winter season. Women were not concerned about being bitten my mosquitos or getting Zika virus in the winter, but spoke about being more vigilant about mosquito protection in the summer, particularly when at coastal areas. Seasonality plays an important role because it appears that mosquito prevention does not take precedence during the winter months. However, no mention of sexual transmission was discussed in this scenario. Although sexual transmission can occur at any time, women were more concerned about mosquitos and discussed how their concern about mosquitos greatly decreased in the winter. More information should be shared about sexual transmission and prevention. It may be beneficial to assess the effectiveness of UNFPA's sexual and reproductive health campaign in the Northeast to see what aspects of it can be replicated in São Paulo.

Lastly, two women brought up that foreigners have a greater concern regarding Zika virus than those living locally. One woman who had a friend living in Europe said her friend outside of Brazil was greatly concerned for her health and well being in São Paulo and cautioned her to avoid mosquitos. The woman from São Paulo, however, did not share that concern. Another participant discussed the fact that Americans were greatly concerned with Zika in Brazil. Both regional and relative risk may be affecting women's perceptions about the severity of Zika virus. The interviewed women were not as concerned about Zika virus or its risks because they were accustomed to dealing with other mosquito borne illnesses. Women in Europe

and the United States do not have the same experience dealing with mosquitos and mosquito borne illnesses, thus, their risk perception may be greater. Conversely, the women in São Paulo do not appear as concerned about the novelty of Zika virus and associate it with other mosquito viruses with which they are already familiar. Health messaging should be improved both domestically and internationally to ensure that facts are accurately presented to the public.

Health Information

Results showed that almost all women had some knowledge of the Zika virus and mosquito protection habits, such as removing stagnant water sources in homes and using mosquito repellent. This knowledge seemed linked to women being accustomed to dealing with mosquitos due to previous *Aedes* mosquito prevention campaigns and the recent Zika outbreak. It appears that the Ministry of Health, WHO, and PAHO's recommendations about eliminating mosquito breeding grounds have strongly resonated with this group of women since many indicated that they are very vigilant about eliminating mosquito breeding sites in their homes. The close proximity of homes in the study sites could quickly lead to a mosquito outbreak should one occur. This aspect of personal responsibility spilling over into a neighborhood problem seems particularly important because the homes in Paraisópolis are located close to each other. Thus, neighbors could be quickly impacted if one family does not do its part to keep their home clean and devoid of stagnant water. This could be a reason why the Brazilian Ministry of Health placed such an emphasis on their mosquito elimination campaigns: *Zika Zero* (Zero Zika), *Mosquito Não* (No Mosquito), and *Crianças Contra Zika* (Children against Zika). All individuals need to do their part to help stop the spread of mosquitos.

However, information about sexual transmission of the virus seems to be absent in these campaigns. The interviewed women were more concerned with eliminating mosquitos that few

were worried of contracting Zika virus via sexual transmission. UNFPA's *Mais Direitos, Menos Zika* (More Rights, Less Zika) is an example of a community-based campaign to provide information about sexual and reproductive health rights and promote the use of condoms and insect repellent to minimize the impact of the Zika virus. This program is only in two northeastern Brazilian states most affected by Zika virus. It seems that women would benefit from similar programs in São Paulo to become better informed about ways they can protect themselves from the sexual transmission of Zika virus.

It is also important to have a set of standardized and consistent recommendations, especially in places that provide public health services such as health posts. Women in Paraisópolis had conflicting perceptions about the reliability and effectiveness of the health posts relaying information about Zika virus. One woman spoke about the difficulties she had in obtaining a doctor's appointment in order to discuss Zika virus. This is concerning because the health posts provide a great deal of medical information to the community. Women should be able to receive answers about their questions if not by a doctor, but by other trained professionals or health staff. One woman from Paraisópolis said she received no information about Zika virus from the health posts, while another woman from the same area said she received information from the health posts. Another women shared similar sentiments and said that volunteers from the health post walked around the community distributing information, but noted that this was done during the weekday when most people are out of the house working. She believed it would be better for health post volunteers or workers to visit the community on Sundays when most people are home. This change would reach a greater number of people. This excellent point illustrates the importance of community engagement. If a majority of women and men are not home when these health post volunteers go into the community, there may be sufficient cause to

suggest changing the dates or times of these visits to when more people are home, thereby increasing the number of people visited and informed about the virus.

Multiple women addressed the various sources of information and the media as the main source of their information about the virus. The media did not have many news stories about Zika virus during the popular evening news hours, focusing instead on the upcoming Rio 2016 Olympics and Brazil's political corruption scandal that dominated the news in June, July and August 2016. These months coincided with Brazil's winter. The lack of media emphasis on Zika virus at the time of the interviews, coupled with it being winter, may have affected women's perceptions of risk.

RECOMMENDATIONS

Improving public health messaging is one way to not only increase awareness about mosquito borne illnesses, but to also address ways to prevent transmission. The Ministry of Health has placed an emphasis on communications campaigns focusing on vector control for the general population. More targeted campaigns focused on sexual transmission of Zika virus and prevention would be a good supplement to existing vector control messages. Further research should look into the effectiveness of the UNFPA's *Mais Direitos, Menos Zika* (More Rights, Less Zika) campaign in the Northeast to see if a similar campaign should be done in São Paulo.

More should be done to relay information about Zika virus and microcephaly to women who intend to become pregnant. For example, women who want to have a child should be able to seek guidance from their medical provider and know that they are receiving the most relevant and medically accurate information. Women discussed receiving guidance to plan the start of their pregnancies during the winter, when there were fewer mosquitos. Women discussed discrepancies in how they received information about Zika virus, especially at the health posts. There should be a greater emphasis on ensuring that health information is relayed to the public so that women living in the same area do not receive different information.

The Ministry of Health advised women to delay pregnancy until the outbreak subsided, but that is not an option for some women, especially older, nulliparous women. As Carvalho (2016) discussed, the many uncertainties about Zika virus made it difficult to provide long-term guidance for women seeking to become pregnant. As more information becomes available, it is imperative that modifications to medical recommendations and guidelines for women trying to conceive be communicated to them and medical providers as soon as possible. One way that can be done is through the media, through television programming such as the news, and

informational campaigns explaining the revised guidelines in popular locations where women frequently visit, such as bus and metro stops.

Lastly, further studies should be conducted to assess whether influences of risk perception about Zika virus would change if interviews were conducted in the summer months instead of winter. It would be interesting to ascertain if women's family planning behavior would be different in the summer. Further studies should consider expanding the study sites to include rural populations outside the city of São Paulo to see how risk perceptions compare to urban populations and whether rural women share similar perspectives about pregnancy and or delaying pregnancy due to the virus.

CONCLUSION

Zika virus has greatly affected women and babies in Brazil since it was first detected in 2015. This study aimed to understand how women's risk perceptions of Zika virus affect their family planning behavior. Based on the information gathered from the 29 interviews with women aged 20-40 years of both high and low socioeconomic levels, results indicated that young, nulliparous women and multiparous women, regardless of their age, did not have strong desires to become pregnant at the moment and believed it was a wise to delay pregnancy plans until the Zika virus outbreak subsided. Older, nulliparous women felt a sense of urgency to have children and were willing to take risks and continue with their plans to become pregnant. Additional influencing factors were women's perception of relative risk, primarily how Zika was so easily equated to dengue, regional risk, particularly how women viewed the greatest risks to be in the Northeast rather than in São Paulo, and health information about Zika virus. These results indicate a need for improved public health messaging and communication about the risks and multiple ways Zika virus can be transmitted, and particular guidance for those women who are actively trying to conceive a child.

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