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Zika Testing Behaviors and Risk Perceptions Among Pregnant Women in Miami-Dade County, One Year After Local Transmission

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Abstract

Objectives This study sought to describe the knowledge and perceptions of pregnant women in Miami-Dade County concerning Zika virus (ZIKV) in their community, to characterize their testing behaviors, and to identify any barriers that would keep them from seeking testing.

Methods The Florida Department of Health in Miami-Dade County partnered with the Healthy Start Coalition of Miami-Dade to administer an assessment survey in eight OBGYN clinics from June to August 2017. The survey captured past ZIKV testing practices, attitudes towards testing, barriers to testing, risk perception of ZIKV in the participants' community, and ZIKV-related knowledge. Descriptive analyses were performed on variables of interest. Chi squared tests examined associations between categorical variables.

Results A total of 363 participants were included in the analysis. Of these, 203 (55.9%) thought they should be tested for ZIKV, and less than half of the participants reported having been previously tested (152, 41.9%). Participants with some high school education were significantly more likely than those with higher education levels to see ZIKV as a "big problem" in the community ($p = 0.0026$). There was a significant association ($p \leq 0.0001$) between women who thought that they should be tested, and those who perceived ZIKV to be a medium or big problem in their community.

Conclusions for Practice Health interventions that focus on increasing ZIKV knowledge should also place greater emphasis on risk communication when targeting the pregnant population. Having a higher risk perception may be more predictive of testing behaviors than having a lack of barriers or a high level of ZIKV-related knowledge.

Keywords Zika virus · ZIKV · Pregnant women · Testing · Risk perception · Assessment · Risk communication

Significance

Very little is known about the Zika virus (ZIKV) testing practices of pregnant women, and which factors encourage proper testing behaviors. Miami-Dade County, FL was the location of the first mosquito-borne ZIKV outbreak in the continental United States. This assessment study which was conducted among Miami-Dade's pregnant women is the first study of its kind to evaluate the risk perceptions and testing behaviors of pregnant women who experienced an ongoing ZIKV outbreak. To our knowledge, no systematic reviews currently exist on this topic.

Introduction

ZIKV, a vector-borne flavivirus similar to dengue and chikungunya, causes a very mild illness in healthy individuals, but is of particular concern for pregnant women. ZIKV can be transmitted vertically from infected woman to fetus, through sexual contact, and exposure to infected blood, but the primary route of transmission is through the bite of infected *Aedes aegypti* mosquitoes (Hayes 2009; Petersen et al. 2016). Only 20% of individuals infected with ZIKV will exhibit symptoms (fever, rash, joint pain, and conjunctivitis). ZIKV infection during pregnancy can result in the

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congenital disorder microcephaly, a condition in which a fetus's head and brain are underdeveloped, resulting in cognitive delays, vision and hearing loss, seizures and other developmental issues (Oduyebo et al. 2017; Rasmussen et al. 2016). ZIKV has also been associated with other anomalies such as stillbirths and miscarriages (Cauchemez et al. 2016; Mlakar et al. 2016). As ZIKV infection poses a threat for pregnant women and their unborn babies, it is imperative that pregnant women in areas of potential mosquito-to-human transmission be tested for ZIKV and educated on how to prevent ZIKV throughout the duration of their pregnancy (Petersen et al. 2016).

During the summer of 2016, an outbreak of ZIKV led to Miami Dade County being the site of the first reported case of locally-acquired ZIKV in the continental United States. A total of four active ZIKV transmission zones were identified in Miami-Dade County between July 29, 2016 and December 9, 2016 (Likos et al. 2016). As such, testing of all pregnant women was encouraged throughout the state. Beginning August 8, 2016, the Florida Department of Health (DOH) offered free ZIKV testing to all pregnant women in the state of Florida. Miami-Dade County remains at risk of ZIKV due to the presence of the virus' primary vector—the *Aedes* mosquito—and because of the County's status as a global tourist and trade destination, welcoming travelers from many ZIKV-endemic nations.

Previous studies have examined the knowledge of pregnant women on ZIKV. A December 2016 study conducted in the US Virgin Islands found that 67.3% of participants reported that ZIKV causes brain defects in infants, while only 34.6% knew that the virus is transmitted by mosquitoes (Prue et al. 2017). A 2016 study by the University of Texas assessed the knowledge, attitudes, and prevention practices among pregnant U.S. immigrants and found that 21% of study participants reported the cost of repellant as a barrier to ZIKV prevention (Berenson et al. 2017). In addition, a 2016–2017 study in Puerto Rico found that most women (98.1%) used at least one measure to avoid mosquitoes in their home, but only 45.8% of women reported wearing mosquito repellent (D'Angelo et al. 2017). There is limited knowledge, however, regarding the behaviors and attitudes of pregnant women in the United States regarding ZIKV testing. The purpose of this study was: (1) to describe the knowledge and perceptions of pregnant women in Miami-Dade County concerning the risk of ZIKV in their community, (2) to characterize the behaviors and attitudes of pregnant women regarding testing, and (3) to seek out any barriers that would keep a pregnant woman from seeking testing.

Methods

The Florida Department of Health in Miami-Dade County (DOH-Miami-Dade) partnered with the Healthy Start Coalition of Miami-Dade (HSCMD)—designated by the State of Florida's Department of Health to serve as Miami-Dade County's prenatal and infant care coalition. DOH-Miami-Dade and HSCMD administered an assessment survey in the waiting rooms of eight OBGYN clinics affiliated with HSCMD, selected based on being the largest HSCMD clinics in Miami-Dade County, over the course of 3 months from June to August 2017. The eight clinics were located in the North Miami, South Miami, and Kendall neighborhoods of the county, representing low, medium, and high socioeconomic populations. The survey consisted of a twenty-question pamphlet and was completed independently of an administrator's help. Inclusion criteria for this study required a participant to be pregnant and 18 years or older. The survey was distributed in three languages: English, Spanish, and Haitian Creole. OBGYN clinic staff were trained by the DOH-Miami-Dade Epidemiology program on how to obtain verbal consent, distribute and collect the survey for pick-up by DOH-Miami-Dade. Upon registration, clinic patients were recruited into the study by clinic staff upon meeting inclusion criteria.

The survey was tailored to address the three aims previously outlined: to describe the ZIKV knowledge and perceptions of pregnant women, to characterize their behaviors and attitudes regarding testing, and to identify barriers to testing. Demographic information was captured for all respondents and included questions on age (to ensure inclusion criteria was met), gender, race/ethnicity, educational level, zip code, pregnancy status (to ensure inclusion criteria was met), where the participant receives the majority of their health information, if respondents had been previously tested for ZIKV virus, and if so, where they had been tested. Knowledge was measured with questions on whether or not the participants could name the four most common symptoms of ZIKV virus infection, identify the different routes of ZIKV transmission, answer whether or not ZIKV is associated with microcephaly, and identify the different testing options for a pregnant woman in Miami-Dade County. Perceptions questions focused on whether or not pregnant women perceived ZIKV virus as a significant problem in their community. Health seeking behaviors were analyzed with questions on attitudes towards testing, previous testing practices, whether participants had discussed ZIKV virus with their OBGYN, and perceived level of risk in their communities. Barriers to testing were measured with participants selecting the reasons as to why they would choose not to be tested for ZIKV virus.

The data was analyzed using SAS version 9.4. Descriptive analyses were performed on variables of interest, and Chi squared tests were conducted to examine associations between categorical variables. This study was compliant with and approved by the Florida Department of Health Institutional Review Board (IRB), which required informed consent from all study participants.

Results

A total of 396 participants responded to the survey, of whom 363 (91.7%) were pregnant, completed the survey in full, and met the inclusion criteria for analysis. Of the 363 pregnant women who completed the survey, 219 (60.3%) were Hispanic, 191 (52.6%) were aged 25–34, and 112 (30.9%) had completed some college. Completion of the surveys by language were: 252 (69.4%) completed in English, 104 (28.7%) completed in Spanish, and 7 (1.9%) completed in Haitian Creole (Table 1).

ZIKV Knowledge and Perceptions

A majority of participants reported receiving their health information from three main sources: their doctors (246, 67.8%), social media (123, 33.9%), and television (104, 28.7%). The results of our study reflected some desire to seek additional health information online, with "Internet" being the most commonly listed source of additional information in the free-response "Other" category (9, 1.7%).

Most participants had previously heard of ZIKV (354, 97.5%) and the majority had heard of ZIKV from television (278, 76.6%) and/or their doctor (270, 74.4%) (Table 2). When asked about how ZIKV is transmitted, 347 participants (95.6%) correctly identified mosquito bites as the primary route of transmission. Additionally, 276 participants (76.0%) correctly identified that the virus can be transmitted from infected woman to fetus; 210 participants (57.8%) correctly identified sexual intercourse as a transmission route; and 158 participants (43.5%) correctly identified blood exposure as a transmission route. Though the majority of the participants were able to correctly identify three out of the four transmission routes of ZIKV, some also selected incorrect

Table 1 Demographics

Demographics	Total N (%)
Total participants	363 (100)
Age range	
18–24	105 (28.9)
25–35	191 (52.6)
35+	62 (17.1)
Rather not share	5 (1.4)
Race/ethnicity	
Non-Hispanic white	31 (8.6)
Non-Hispanic black	64 (17.6)
Hispanic	219 (60.3)
Other	30 (8.3)
Rather not share	19 (5.2)
Education	
Some high school	35 (9.6)
High school graduate	95 (26.2)
Some college/associate	112 (30.9)
Bachelor	57 (15.7)
Graduate	44 (12.1)
Rather not share	20 (5.5)
Language	
English	252 (69.4)
Spanish	104 (28.7)
Haitian Creole	7 (1.9)

Table 2 Knowledge and perceptions

	Total 363 (100) N (%)
Have you heard of Zika	354 (97.5)
Where did you first hear about Zika	
Television/radio	278 (76.6)
Personal physician/nurse	270 (74.4)
Social media	191 (52.6)
Family	122 (33.6)
Symptoms	
Fever[a]	163 (45.0)
Rash[a]	91 (25.0)
Joint pain[a]	86 (23.7)
Conjunctivitis[a]	42 (11.6)
Flu-like	25 (6.8)
Asymptomatic[a]	4 (1.1)
Incorrect symptoms	133 (36.6)
Transmission routes	
Mosquito bites[a]	347 (95.6)
In utero[a]	276 (76.0)
Sexual intercourse[a]	210 (57.8)
Blood[a]	158 (43.5)
Dirty water	60 (16.5)
Fly bites	53 (14.6)
Coughing/sneezing	33 (9.1)
Zika and birth defects	307 (84.5)
Testing site recognition	
OBGYN office	286 (78.8)
Primary care physician	243 (66.9)
Free clinics at DOH	243 (66.9)
Local urgent care/ER	211 (58.1)

[a]Correct answers

transmission routes such as dirty water (60, 16.5%), fly bites (53, 14.6%), and cough (33, 9.1%) (Table 2).

When asked to list the four most common symptoms of ZIKV, many participants correctly responded with "fever" (163, 45.0%), "rash" (91, 25.0%), "joint pain" (86, 23.7%), and "conjunctivitis" (42, 11.6%), the four main symptoms of ZIKV infection. Conversely, over a third of the participants listed symptoms that are inconsistent with ZIKV virus infection; these answers were categorized as "other" (133, 36.6%) in the analysis. Examples of the free responses listed in the symptoms category which were grouped into "incorrect symptoms" include: "flu-like symptoms" and "birth defect" (Table 2).

ZIKV Testing Behaviors and Attitudes

Two-hundred and twelve participants (58.4%) recalled an OBGYN speaking to them in the past about the possibility of ZIKV testing. Similarly, 203 participants (55.9%) thought they should be tested for ZIKV. There were discrepancies observed between testing attitudes and behaviors with less than half of the participants reporting having been previously tested (152, 41.8%). Of those participants who had been previously tested, the majority reported having been tested through their OBGYN or primary care physician (107, 57.2%) (Table 3). While 105 (28.9%) of the women considered ZIKV to be a "big problem" in their community, 76 (20.9%) considered ZIKV to be "not a problem," and 94 (25.9%) participants answered that they were "not sure" whether ZIKV was a problem in their community or not (Table 3). Education level was found to be significantly associated with perception of ZIKV in the community ($p = 0.0026$). Participants who perceived ZIKV to be a "big problem" were also more likely to have been tested for ZIKV in the past. Similarly, there was a significant association ($p \leq 0.0001$) between women who thought that they should be tested and those who perceived ZIKV to be a medium to big problem in their community. Demographic variables were not associated with risk perception (Table 4). Higher risk perception was more closely associated with positive attitudes towards testing rather than with having a higher level of knowledge about ZIKV itself.

Table 3 Behaviors and attitudes

	Total 363 (100) N (%)
Participants tested	152 (41.8)
Doctors/OBGYN office	107 (57.2)
Emergency room/hospital	10 (5.3)
Health department	17 (9.1)
Other	17 (11.1)
Rather not share	1 (0.6)
OBGYN talked about testing	212 (58.4)
Thought they should be tested	203 (55.9)
Is Zika a problem in the community	
Big problem	105 (28.9)
Medium problem	47 (13.0)
Small problem	41 (11.3)
Not a problem	76 (20.9)
Unsure	94 (25.9)

Barriers to ZIKV Testing

Over two-thirds of participants did not list any reasons and/or barriers that would keep them from seeking and receiving ZIKV testing. Among the participants that did list reasons or barriers, the most commonly chosen answers were "I don't know where to get tested" (57, 15.7%) and "I'm not concerned about ZIKV" (56, 15.4%). Some participants chose the "other" option (58, 16.0%) and provided free-response answers such as "Nothing would stop me from getting tested" (17, 29.3%) and "I've already been tested" (7, 12.1%).

Discussion

The results of this study can provide public health professionals and clinicians in Miami-Dade County and in other comparable communities with an improved understanding of their patients' knowledge of ZIKV, their risk perception regarding ZIKV, and of their attitudes and practices regarding testing. However, among women who gave birth in Miami-Dade County between 2014 and 2016, 63.1% were Hispanic, 20.2% were Non-Hispanic Black, 14.5% were Non-Hispanic White, and 2.2% were of other race/ethnicities. Of note, our study demographics were representative of the county, except for "Other" and "Non-Hispanic White" women. We believe this is due to the demographics of those who may utilize HSCMD clinics (typically lower-income women who have many risk factors associated with poor health outcomes). These results are likely representative of pregnant women seeking services at HSCMD clinics.

Almost all participants correctly identified mosquitoes as the primary route of transmission of ZIKV and recognized that ZIKV can be spread vertically from an infected woman to her unborn child. Fewer participants, however, correctly identified blood transfusions and sexual contact as a transmission route (Table 2).

Risk perception is often regarded as a catalyst for certain behavior changes, such as seeking health information (Ferrer and Klein 2015). Likewise, health interventions often focus on increasing knowledge to elicit behavior change in individuals (Ryan 2009). Results from this study indicate

Table 4 Risk perception associations

	Big problem n (%)[a]	Medium problem n (%)[a]	Small problem n (%)[a]	Not a problem n (%)[a]	Unsure n (%)[a]	*p* value (Chi square)
Total answered	105 (28.9)	47 (13.0)	41 (11.3)	76 (20.9)	94 (25.9)	
Do you think you should be tested? (yes)	77 (37.9)	30 (14.7)	26 (12.8)	29 (14.3)	41 (20.2)	< 0.001[b]
Education						0.0026[b]
Some high school	14 (40.0)	2 (5.7)	1 (2.9)	7 (20.0)	11 (31.4)	
High school graduate	34 (35.8)	6 (6.3)	7 (7.4)	23 (24.2)	25 (26.3)	
Some college/associate	33 (29.5)	13 (11.6)	13 (11.6)	18 (16.1)	35 (31.3)	
Bachelor	12 (21.1)	15 (26.3)	8 (14.0)	12 (21.1)	10 (17.5)	
Graduate	9 (20.5)	8 (18.2)	11 (25.0)	9 (20.5)	7 (15.9)	
Knowledge of transmission routes						0.0001[b]
None correct	2 (20.0)	0 (0.0)	0 (0.0)	0 (0.0)	8 (80.0)	
1 answer correct	24 (22.9)	2 (4.3)	2 (4.9)	3 (4.0)	11 (11.7)	
2 answers correct	27 (25.7)	9 (19.2)	12 (29.3)	18 (23.7)	26 (27.7)	
3 answers correct	26 (24.8)	17 (36.2)	13 (31.7)	32 (42.1)	23 (24.5)	
4 answers correct	26 (24.8)	19 (40.4)	14 (34.2)	23 (30.3)	26 (27.7)	
Age range						0.1011
18–24	33 (31.4)	11 (10.5)	10 (9.5)	24 (22.9)	27 (25.7)	
25–35	51 (26.7)	29 (15.2)	21 (11.0)	35 (18.3)	55 (28.8)	
35+	20 (32.3)	7 (11.3)	10 (16.1)	17 (27.4)	8 (12.9)	
Rather not share	1 (20.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (80.0)	
Race/ethnicity						0.5192
Non-Hispanic White	8 (25.8)	6 (19.4)	6 (19.4)	6 (19.4)	5 (16.1)	
Non-Hispanic Black	17 (26.6)	7 (10.9)	5 (7.8)	15 (23.4)	20 (31.3)	
Hispanic	61 (27.9)	29 (13.2)	26 (11.9)	45 (20.6)	58 (26.5)	
Other	13 (43.3)	4 (13.3)	3 (10.0)	7 (23.3)	3 (10.0)	
Rather not share	6 (31.6)	1 (5.3)	1 (5.3)	3 (15.8)	8 (42.1)	
Language						0.0997
English	62 (24.6)	36 (14.3)	31 (12.3)	54 (21.4)	69 (27.4)	
Spanish	38 (36.5)	11 (10.6)	10 (9.6)	22 (21.2)	23 (22.1)	
Haitian Creole	5 (71.4)	0 (0.0)	0 (0.0)	0 (0.0)	2 (28.6)	

[a]All percentages are row percentages

[b]A p-value ≤ 0.05 was considered statistically significant

that in this specific population, higher perception of risk was not significantly associated with increased knowledge and higher education levels (Table 4).

Very few participants listed barriers to testing or reasons as to why they would not get tested for ZIKV. The most commonly listed reason for not seeking testing was "I don't know where to get tested." There was no significant association between any one barrier and the participants' desire to be tested or their risk perception of ZIKV.

While data analysis found no difference in testing practices or in attitudes towards testing across demographic variables, differences were identified in the relationship between testing behaviors and/or attitudes and risk perception. Among the pregnant women surveyed in this study, getting tested and the desire to be tested were associated with perception of the virus as a problem in one's community (Table 4). The women in this sample were not dissuaded from testing by perceived or actual barriers and were more amenable to testing based on their own perception of risk.

Health messaging and outreach plans must place more emphasis on educating pregnant women about sexual contact and blood transfusion as possible transmission routes, particularly because these gaps in knowledge are persistent across different surveyed populations (Berenson et al. 2017; Prue et al. 2017). OBGYNs should be encouraged to continue to discuss ZIKV with their patients, but it might be beneficial to format more educational ZIKV messaging for online platforms and sites, as pregnant women utilize internet searches and websites to supplement the education that they receive from their doctors (Guo et al. 2017). Targeted

web-based educational resources may be more effective in reaching pregnant women, especially when time with physicians is inherently limited.

Better messaging is also needed to communicate where pregnant women can be tested for ZIKV, as the lack of this knowledge was the most commonly listed barrier to seeking or receiving testing. Other barriers such as lack of transportation and convenient clinic hours should not be disregarded completely, but public health workers and clinicians should realize that mitigating these barriers among this population might not help to assure that more pregnant women are tested.

A significant limitation of this study included being unable to ascertain the response rate of this survey, as clinics did not record the number of pregnant women offered to take the survey nor the number who refused to participate. Additionally, given the nature of the survey recruitment, it is possible that individuals completed the survey regardless of meeting inclusion criteria, as evidenced by the 8.3% of participants who indicated that they were not pregnant during completion of the survey. In addition, being a written survey, it is possible that it did not capture individuals who may be unable to read. Lastly, this survey did not ask women about recent international travel to an area with active transmission, nor whether their spouses had traveled to an at-risk area, as these may influence whether a woman believes she should be tested for ZIKV.

Conclusion

Further research is needed to study the association between ZIKV risk perception and ZIKV knowledge levels in pregnant women. This information could be very useful for health communications professionals and educators in areas where ZIKV transmission may occur. Health interventions that focus on increasing knowledge should also focus heavily on risk communication when targeting the pregnant population in Miami-Dade and in comparable communities.

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Compliance with Ethical Standards

Conflict of interest Neither party received any financial support for thework performed during this study, and neither party had any conflicts of interest.

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