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Zika Prevention Behaviors Among Women of Reproductive Age in Puerto Rico, 2016

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Abstract

Introduction: Zika virus is primarily transmitted through mosquito bites. Because Zika virus infection during pregnancy can cause serious birth defects, reproductive-aged women need protection from Zika virus infection. This report describes Zika virus prevention behaviors among women aged 18–49 years and assesses whether pregnancy status and healthcare provider counseling increases Zika virus prevention behaviors.

Methods: A population-based cell phone survey of women aged 18–49 years living in Puerto Rico was conducted in July–November 2016. Data were analyzed in 2018–2019. Prevalence estimates and 95% CIs were calculated for Zika virus prevention behaviors. Adjusted prevalence ratios were estimated to examine the association of pregnancy status with healthcare provider counseling on Zika virus prevention behaviors, controlling for age, education, and health insurance status.

Results: Most women reported using screens on open doors/windows (87.7%) and eliminating standing water in/around their homes (92.3%). Other Zika virus prevention behaviors were less common (<33%). In adjusted analysis, pregnant women were more likely than women not at risk for unintended pregnancy to report using mosquito repellent every/most days (adjusted prevalence ratio=1.44, 95% CI=1.13, 1.85). Healthcare provider counseling was associated with receiving

professional spraying/larvicide treatment (adjusted prevalence ratio=1.42, 95% CI=1.17, 1.74), sleeping under a bed net (adjusted prevalence ratio=2.37, 95% CI=1.33, 4.24), using mosquito repellent (adjusted prevalence ratio=1.57, 95% CI=1.40, 1.77), and wearing long sleeves/pants (adjusted prevalence ratio=1.32, 95% CI=1.12, 1.55).

Conclusions: Receipt of healthcare provider counseling was more consistently associated with Zika virus prevention behaviors than pregnancy status. Healthcare provider counseling is an important strategy for increasing the uptake of Zika virus prevention behaviors among women aged 18–49 years.

INTRODUCTION

Zika virus (ZIKV) infection during pregnancy is a cause of congenital microcephaly and other brain and eye defects and has been associated with neurodevelopmental abnormalities.^{1–7} The highest risk of brain and eye defects is associated with ZIKV infections in the first trimester of pregnancy.^{2,8} ZIKV is primarily transmitted through mosquito bites; therefore, mosquito bite avoidance behaviors, including using mosquito repellent, wearing long-sleeved shirts and pants, and using screens on open doors and windows, are the primary prevention methods.^{9,10} Condoms are also recommended to prevent sexual transmission of ZIKV.¹¹

On December 31, 2015, Puerto Rico was the first jurisdiction in the U.S. to report local transmission of ZIKV.¹² Reported cases peaked in August 2016 and steadily declined, with lower levels of ZIKV transmission continuing into 2017.^{9,13,14} As part of the emergency response to ZIKV, the Puerto Rico Department of Health (PRDH) and partners implemented several community interventions to promote ZIKV prevention. These efforts focused on pregnant women. The U.S. Department of Agriculture's Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) program provided an orientation on ZIKV infection and prevention to all pregnant women enrolled in WIC during the ZIKV outbreak; 87% of women who gave birth in 2016 were enrolled in WIC. In addition, pregnant women enrolled in WIC were offered free residential mosquito spraying services. Approximately 26,000 ZIKV prevention kits containing insect repellent, condoms, a mosquito bed net, larvicide, and educational materials were distributed, primarily to pregnant women.¹⁵ Finally, a comprehensive multimedia ZIKV prevention campaign was launched with public service announcements, print and digital materials, and community engagement events. Campaign goals included educating pregnant women and communities about ZIKV prevention and providing resources for women to practice ZIKV prevention behaviors.^{15,16}

Because many pregnancies are unintended and early pregnancies may be unrecognized, women of reproductive age need to practice ZIKV infection prevention.^{9,17,18} To understand prevention behaviors among women of reproductive age in Puerto Rico, the Centers for Disease Control and Prevention and PRDH developed and implemented a population-based reproductive health survey during the peak of the ZIKV epidemic in Puerto Rico. Survey data were analyzed to (1) describe ZIKV prevention behaviors among women of reproductive age, (2) investigate whether pregnancy status is associated with the use of

ZIKV prevention behaviors, and (3) investigate whether talking to a healthcare provider about ZIKV was associated with increased use of ZIKV prevention behaviors.

METHODS

Study Sample

Leveraging the existing PRDH Behavioral Risk Factor Surveillance System infrastructure, a population-based, reproductive health survey was conducted among women of reproductive age from July to November 2016. Women aged 18–49 years who were living in Puerto Rico at the time of the survey were eligible. Data were weighted to provide population-based estimates for Puerto Rico. Survey methods have been described previously.¹⁹ Briefly, the 48-question survey asked about demographics, contraceptive use, sexual activity, and ZIKV prevention behaviors. A simple random sample of Puerto Rico cell phone numbers was purchased from Marketing Systems Group, Inc. Interviewers from PRDH called sampled cell phone numbers repeatedly until someone answered or until the number was tried at least 6 times. Of answered calls, 3,169 respondents met eligibility criteria; of those, 3,059 agreed to participate. The cooperation rate was 97% (percentage of contacted and eligible participants who completed the survey). The overall response rate was 69% (calculated using completed interviews in the numerator and an estimate of all eligible participants in the denominator). The survey was reviewed by human subjects experts at the Centers for Disease Control and Prevention and was determined to be a nonresearch, public health practice activity used for disease control program or policy purposes during an emergency response.²⁰ Interviewers obtained verbal consent from all participants. For this analysis, women who reported already having ZIKV infection ($n=187$) were excluded.

Measures

The following ZIKV prevention behaviors were measured: always using screens on open doors and windows around homes or keeping unscreened doors and windows closed (*yes/no*), eliminating standing water in and around house and yard at least once per week (*yes/no*), receiving professional indoor/outdoor spraying or larvicide treatment in the 3 months before the interview (*yes/no*), sleeping under a mosquito bed net (*every night, most nights, some nights, rarely, never*), using mosquito repellent (*every day, most days, some days, rarely, never*), and wearing long sleeves and long pants outside (*every day, most days, some days, rarely, never*). Because the use of mosquito bed nets was not common (<50 respondents), the responses were collapsed to ever versus never use. In addition, responses to the use of mosquito repellent and wearing long sleeves/pants were collapsed to using *every day/most days* versus *some days/rarely/never use*.

To determine pregnancy status at the time of the interview, women responded to questions about pregnancy, sexual activity, and pregnancy prevention. *Sexually active* was defined as reporting sex with a man in the last 3 months or reporting being married or in a long-term relationship with a man. Women were categorized into 4 mutually exclusive groups:

1. pregnant—women who reported that they were pregnant at the time of the interview;

2. desiring/ambivalent about pregnancy—sexually active women not using contraception who desired pregnancy in <12 months or were ambivalent about pregnancy;
3. at risk for unintended pregnancy—sexually active women who were not pregnant, were not desiring/ambivalent about pregnancy, and did not report infertility, menopause, or having had a hysterectomy, including women who did and did not use contraception; and
4. not at risk for unintended pregnancy—nonsexually active/non-pregnant women and women reporting infertility, menopause, or having had a hysterectomy.

To determine receipt of healthcare counseling about ZIKV, women were asked whether a doctor, nurse, or other healthcare providers talked to them about ZIKV at any time (*yes/no*). The following demographic variables were controlled for in regression models: age (18–24 years, 25–34 years, 35–49 years), education (less than high school, high school graduate, more than high school), and health insurance status (private, Medicaid/public, no insurance).

Statistical Analysis

Data were analyzed in 2018 and 2019. Weighted prevalence estimates and 95% CIs for ZIKV prevention behaviors overall and by pregnancy status and the receipt of healthcare counseling on ZIKV for women of reproductive age were calculated. The relationship between the 2 factors of interest—pregnancy status and receipt of healthcare counseling on ZIKV—was assessed using the Rao–Scott chi-square test. To examine the association between pregnancy status and receipt of healthcare counseling on each of the ZIKV prevention behaviors, prevalence ratios were estimated from modified Poisson regression models using a robust error variance procedure.²¹ Age, education, and health insurance were included in the models to control for confounding. Modified Poisson regression models were constructed and stratified to examine the association between pregnancy status/intentions and healthcare provider counseling on ZIKV prevention behaviors. All analyses were conducted in SAS, version 9.4, using weighted survey methods to account for sampling weights.

RESULTS

The analysis included 2,872 sampled women representing 746,251 women aged 18–49 years in Puerto Rico. At the time of the interview, few women were pregnant (2.0%, 95% CI=1.5, 2.5) or desiring/ambivalent about pregnancy (4.2%, 95% CI=3.5, 4.9), and most reported not having received healthcare provider counseling on ZIKV (76.0%, 95% CI=74.3, 77.6) (Table 1). A high percentage of women reported using screens on open doors or windows or reported always keeping doors and windows closed (87.7%, 95% CI=86.4, 89.0) and eliminating standing water in and around their homes at least once a week (92.3%, 95% CI=91.2, 93.4) (data not shown). Other reported ZIKV prevention behaviors were less common: receiving professional spraying or larvicide treatment in or around the home (15.4%, 95% CI=14.0, 16.9), ever sleeping under a bed net (2.3%, 95% CI=1.7, 3.0), the use of mosquito repellent every day or most days (32.5%, 95% CI=30.7, 34.4), and wearing

long sleeves and long pants every day or most days when they went outside (21.0%, 95% CI=19.4, 22.6).

Pregnancy status was significantly associated with receipt of healthcare counseling on ZIKV: 78.6% of pregnant women reported talking to a healthcare provider about ZIKV compared with 29.4% of women desiring/ambivalent about pregnancy, 22.7% of women at risk for unintended pregnancy, and 23.4% of women not at risk for unintended pregnancy ($p<0.0001$, data not shown). In stratified regression models, there was no evidence of a heterogeneous effect of pregnancy status on ZIKV prevention behaviors according to receipt of healthcare counseling on ZIKV or not (data not shown).

Pregnancy status was not associated with receiving professional services for mosquito control in the last 3 months, always using screens on open doors and windows, or eliminating standing water around the home, in crude or adjusted analyses (data not shown). A higher percentage of pregnant women reported sleeping under a bed net than women not at risk for unintended pregnancy (10.5% vs 2.7%, Figure 1), but this association was not statistically significant in the multivariable model (adjusted prevalence ratio [APR]=1.63, 95% CI=0.60, 4.47, data not shown). Pregnant women were more likely to report using mosquito repellent every day or most days than women not at risk for unintended pregnancy (57.2% vs 33.1%, Figure 1; APR=1.44, 95% CI=1.13, 1.85, data not shown). A higher percentage of pregnant women reported wearing long sleeves and pants every day or most days than women not at risk for unintended pregnancy (29.1% vs 21.1%, Figure 1), but this difference was not statistically significant in the adjusted model (APR=1.28, 95% CI=0.85, 1.93, data not shown).

Receipt of healthcare provider counseling was associated with increased reporting of all the assessed ZIKV prevention behaviors (Figure 2). After adjusting for pregnancy status, age group, education, and health insurance, receipt of healthcare provider counseling was significantly associated with a 137% increase in sleeping under a bed net (APR=2.37, 95% CI=1.33, 4.24), 42% increase in receiving professional spraying or larvicide treatment (APR=1.42, 95% CI=1.17, 1.74), 32% increase in wearing long sleeves/pants every day or most days (APR=1.32, 95% CI=1.12, 1.55), and a 57% increase in using mosquito repellent every day or most days (APR=1.57, 95% CI=1.40, 1.77). In addition, receipt of healthcare provider counseling on ZIKV was associated with small increases in using screens on open doors and windows (APR=1.07, 95% CI=1.04, 1.11) and eliminating standing water in and around the home (APR=1.03, 95% CI=1.00, 1.06) (Table 2).

DISCUSSION

Although ZIKV infection generally results in mild illness, the same infection during pregnancy can cause serious birth defects. Because of these adverse risks in offspring, prevention of ZIKV infection during pregnancy remains a central focus during epidemics.^{1,2,6,8} It is important that these prevention efforts target both women who are pregnant and those at risk of becoming pregnant, particularly because the highest risk of adverse fetal/infant outcomes has been associated with ZIKV infection early in pregnancy.^{2,8} In this population-based survey among women of reproductive age conducted at the peak of

the ZIKV outbreak, most women used screens on open doors and windows and eliminated standing water from around their homes and yards. Other ZIKV prevention behaviors were less common. Although this study was among the broader population of reproductive-aged women, findings are similar to the results from 2 other surveys conducted around the same period in Puerto Rico targeting pregnant and postpartum women.^{15,22}

Overall, healthcare provider counseling was more consistently associated with ZIKV prevention behaviors than pregnancy status. The limited effect of pregnancy status on ZIKV prevention behaviors was surprising given that most prevention efforts in Puerto Rico targeted pregnant women, such as the distribution of ZIKV prevention kits and free professional spraying through WIC. In 2016, among women who gave birth in Puerto Rico, 87% were enrolled in WIC.¹⁵ Data were not collected on WIC participation; therefore, this could not be adjusted for in multivariable models.

This survey has several key strengths. First, the survey had a large sample size, had a relatively high response rate, and was weighted to provide population-based estimates. This reproductive health survey was the only population-based survey to assess ZIKV prevention behaviors among women of reproductive age in Puerto Rico during the outbreak. In addition, the survey was implemented in July 2016 just before ZIKV transmission peaked in Puerto Rico, so reported ZIKV prevention behaviors coincided with the period that women were at the highest risk.

Limitations

The survey and analysis are also subject to several limitations. First, the survey collected cross-sectional data, which precluded establishing a temporal relationship between the factors of interest and the initiation of ZIKV prevention behaviors. Secondly, information was not collected on exposure to community interventions to promote ZIKV prevention, such as receipt of ZIKV prevention kits. Therefore, this was not able to be considered in the analysis. In addition, although the sample size was large, only 2% of respondents reported being currently pregnant, consistent with 2016 estimates of fertility and birth rates in Puerto Rico.²³ The small sample of pregnant women led to wide CIs for some associations, and as such, the strength or direction of an independent association could not be concluded. Finally, women were asked whether they talked to a healthcare provider about ZIKV but were not asked whether they had seen a healthcare provider or the content of the counseling received. Therefore, it could not be determined whether a healthcare visit occurred or whether the counseling was consistent with recommendations.

CONCLUSIONS

Although there have been no confirmed cases of ZIKV in Puerto Rico since 2018,²⁴ low-level endemic transmission has been documented in areas with previous ZIKV outbreaks.^{25,26} Areas in the Americas with recent ZIKV outbreaks are predicted to have cyclical outbreaks, with low-level endemic transmission for 10 years followed by a large epidemic.²⁷ This suggests the need for long-term interventions to protect women of reproductive age from ZIKV infection. The findings from this reproductive health survey can be used to inform future prevention messaging and campaign strategies more broadly.

Future campaigns may consider targeting all women of reproductive age rather than focusing on pregnant women. Encouraging healthcare providers who treat reproductive-aged women to communicate ZIKV prevention messages is also an important consideration. Future studies should further examine the determinants of healthcare counseling and the content of counseling about ZIKV and the prevention of mosquito-borne diseases.

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SRE, RMS, RSR, HG, ASM, DJJ, MAH, and CKSM designed and implemented the survey. SRE, RMS, JB, AS, JFC, and CKSM developed the statistical analysis plan. SRE analyzed the data. All authors participated in reviewing and interpreting the results and contributed substantively to the writing of the manuscript.

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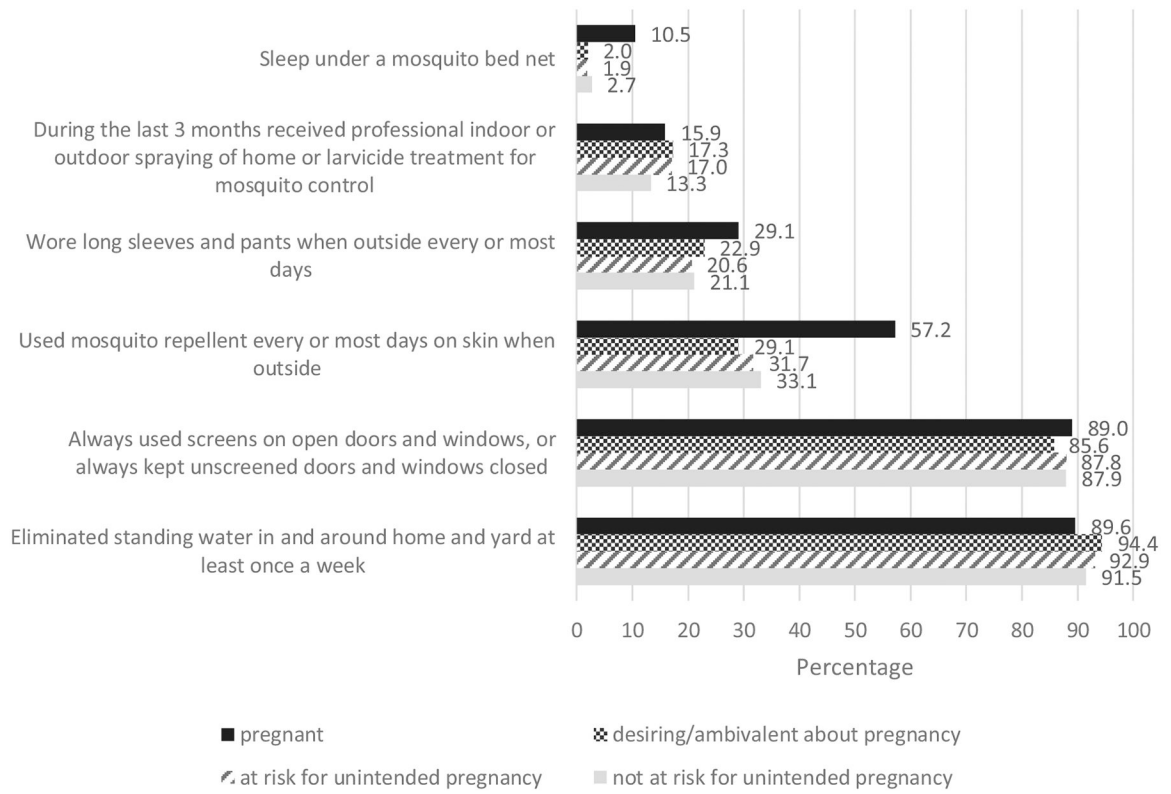


Figure 1. Zika virus prevention behaviors among women of reproductive age by pregnancy status, Puerto Rico 2016.

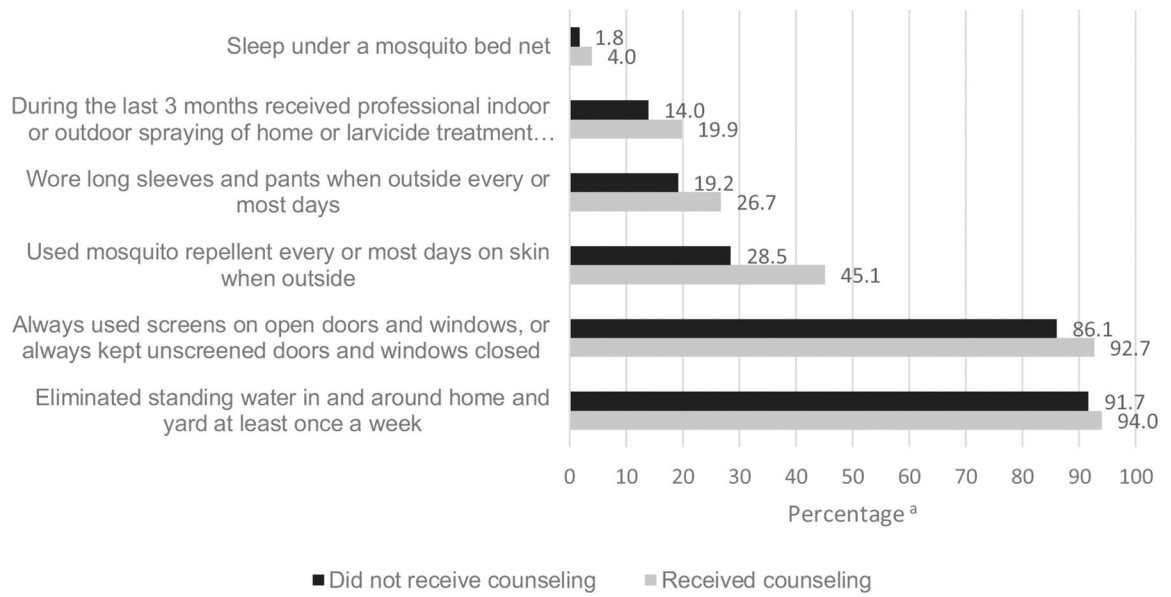


Figure 2. Zika virus prevention behaviors among women of reproductive age by receipt of healthcare provider counseling, Puerto Rico 2016.
^aWeighted percentage.

Table 1. Characteristics of Women of Reproductive Age (18–49 Years), Reproductive Health Survey, Puerto Rico, 2016

Characteristics	<i>n</i> (unweighted)	% (weighted)	95% CI (weighted)
Overall	2,872	100	—
Age group, years			
18–24	561	23.7	(22.0, 25.5)
25–34	956	30.2	(28.4, 31.9)
35–49	1,355	46.1	(44.2, 48.1)
Education completed ^a			
Less than high school	166	5.5	(4.6, 6.4)
High school	678	24.8	(23.1, 26.5)
Some college	870	30.8	(28.9, 32.6)
College	1,157	38.9	(37.0, 40.8)
Health insurance ^b			
Private/through employer	1,129	37.8	(35.9, 39.7)
Medicaid or other public insurance	1,592	57.8	(55.9, 59.7)
No insurance	122	4.4	(3.6, 5.2)
Pregnancy status ^c			
Pregnant	66	2.0	(1.5, 2.5)
Desiring or ambivalent about pregnancy	150	4.2	(3.5, 4.9)
At risk for unintended pregnancy	1,751	56.0	(54.0, 58.0)
Not at risk for unintended pregnancy	870	37.8	(35.9, 39.8)
Received healthcare provider counseling on Zika			
Yes	724	24.0	(22.4, 25.7)
No	2,148	76.0	(74.3, 77.6)

^a One missing response.

^b A total of 29 responses were missing.

^c A total of 35 women could not be classified owing to missing/refused responses.

Zika Virus Prevention Behaviors Among Women of Reproductive Age by Health Counseling, Puerto Rico 2016

Table 2.

Variables	Crude prevalence ratio, estimate	Adjusted prevalence ratio, ^a estimate (95% CI)
Sleep under a mosquito bed net	2.24	2.37 (1.33, 4.24)
Received healthcare counseling on Zika	ref	ref
Did not receive healthcare counseling on Zika		
During the last 3 months, received professional indoor or outdoor spraying of home or larvicide treatment for mosquito control	1.42	1.42 (1.17, 1.74)
Received healthcare counseling on Zika	ref	ref
Did not receive healthcare counseling on Zika		
Wore long sleeves and pants when outside every or most days	1.39	1.32 (1.12, 1.55)
Received healthcare counseling on Zika	ref	ref
Did not receive healthcare counseling on Zika		
Used mosquito repellent every or most days on the skin when outside	1.58	1.57 (1.40, 1.77)
Received healthcare counseling on Zika	ref	ref
Did not receive healthcare counseling on Zika		
Always used screens on open doors and windows or always kept unscreened doors and windows closed	1.08	1.07 (1.04, 1.11)
Received healthcare counseling on Zika	ref	ref
Did not receive healthcare counseling on Zika		
Eliminated standing water in and around the home and yard at least once a week	1.03	1.03 (1.00, 1.06)
Received healthcare counseling on Zika	ref	ref
Did not receive healthcare counseling on Zika		

^aModified Poisson regression models with a robust error variance procedure used to estimate prevalence ratios; models adjusted for receipt of healthcare counseling on Zika, age group, education, and health insurance.

Note: Boldface indicates statistical significance at 95% CI.