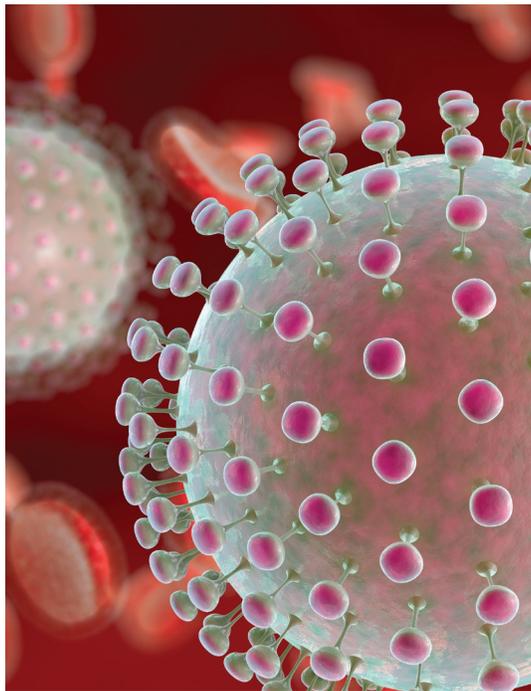


U.S. Public's Perception of Zika Risk:

Awareness, Knowledge, and Receptivity to Public Health Interventions



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About PiR²: The program on Population Impact, Recovery, and Resilience (PiR²) applies social science theory and methodology to complex population issues associated with disaster-related or stressor-related recovery and resiliency. For more information please contact the director, Dr. David Abramson, at david.abramson@nyu.edu

SUMMARY

The public health sector is presently on high alert for evidence of local transmission of the Zika virus in the continental United States as well as infections that have been acquired elsewhere and imported into the U.S. A number of national, state, and local health officials are actively engaged in vector control, surveillance, and diagnostic and communication activities focused on the Zika virus. Even if major outbreaks do not materialize, public health officials are concerned about the possibility of a sharp increase in babies born with congenital birth defects and other neurological deficits linked to Zika viral infections among pregnant women.

This high level of situational awareness and concern within the public health sector, though, is not mirrored among the general public. Although most U.S. residents are generally aware of the virus, their specific knowledge regarding the virus's symptoms and transmission routes is incomplete, their personal sense of threat of Zika infection is relatively muted, and their receptivity to various public health intervention strategies varies by such factors as their gender, their age, and their political ideology, among other characteristics. According to surveys of the U.S. population conducted by the program on Population Impact, Recovery, and Resilience at NYU's College of Global Public Health, over 80% of U.S. residents are aware of the Zika virus, but fewer than 40% know that the viral infection may be asymptomatic, may cause severe birth defects, and may be sexually-transmitted. Only about a third of Americans believe that they or their families are at risk for contracting the infection; that sense of risk is about ten percentage points higher in the southern states. Support for public health interventions varies greatly, as well: approximately 60% of Americans who are aware of the virus are in favor of providing access to federally-funded abortion services for women at risk of delivering a baby with severe birth defects, approximately 50% support delaying pregnancy, and approximately 40% endorse indoor insecticide spraying by public health officials.

Furthermore, it turns out that increased risk perception and knowledge of the Zika virus do not, in and of themselves, explain why U.S. residents endorse specific public health interventions. Public confidence in government and political ideology are also strongly associated with these strategies. U.S. residents who are confident in government are nearly twice as likely to support indoor spraying campaigns as are people who are not confident in government. Additionally, U.S. residents who identify as Democrats are nearly seven times as likely as those who identify as Republicans to support access to federally-funded abortion services for pregnant women infected with the virus.

Public health officials responsible for formulating risk messaging campaigns about Zika should be aware of these and other underlying factors that may influence the public's support of various public health interventions. Simply educating the public to the potential risks and dangers of Zika infection may be insufficient to appropriately mobilize the public in the event of major outbreaks. These are among some of the initial findings identified by researchers at NYU's program on Population Impact,

Recovery and Resilience (PiR²). The research team is conducting an integrated portfolio of studies to track and examine the evolving risk perception of Zika in the U.S.

BACKGROUND

The Zika virus that emerged from South America in the past year poses a novel threat to humans. Similar to West Nile virus, malaria, or dengue, Zika is a vector-borne disease carried by mosquitoes. Unlike those viral infections, Zika is unique in that it may also be contracted as a sexually-transmitted viral infection, similar to HIV or syphilis, although its level of infectiousness as a sexually-transmitted disease is still uncertain and appears to be considerably less than that of HIV or syphilis. Furthermore, its most susceptible victims appear to be babies in utero, who are at risk for microcephaly and other neurological and developmental disabilities. With mothers an unwitting vector, pregnancies and women's reproductive health and decision-making are among the most critical arenas for public health attention.

Because of these multiple transmission pathways—and the scientific uncertainty about the virus's infectiousness—the hazards which place women and their babies at risk encompass a range of environmental, social, and behavioral risk factors, which proves challenging for public health officials responsible for communicating Zika's threat to their constituents. Furthermore, it is difficult for public health officials to gauge the public's receptivity to various interventions. Public health strategies include **environmental** tactics focused on controlling mosquito populations through aerial and indoor spraying, larvacide deployment, elimination of mosquito breeding grounds, and the potential introduction of genetically-modified mosquitoes; **behavioral** strategies focused on promoting physical and chemical barriers to mosquitoes (insecticides and window screens) and on reproductive-related decision-making (delaying pregnancy, using contraceptives, or avoiding travel to areas with Zika infections); and **clinical** interventions, including screening and testing for infection and the availability of pregnancy termination services. To date, there is no vaccine to prevent Zika infection or an anti-viral countermeasure to treat it.

Compounding Zika's challenge is that it is mainly a silent infection. Four out of five people infected with Zika show no symptoms. Among those who do, the symptoms are often somewhat mild and short-lasting, and can include fairly non-descript symptoms such as a rash, fever, and headache. It is still unknown how infectious asymptomatic individuals are, and it is equally unknown how long the virus incubates in blood and semen.

To date, the Zika virus has been reported in 50 countries in the Americas and the Caribbean and is making inroads to the continental United States. As of October 19, 2016 there have been 137 locally transmitted cases of Zika, all of them in Florida, more than 3,800 travel-related cases, 32 sexually-transmitted cases,

and 899 Zika-infected pregnant women identified through laboratory testing in the United States¹. Puerto Rico has reported over 23,000 locally-acquired Zika infections. According to the United States Pregnancy Registry, as of mid-September there have been 22 liveborn infants with birth defects due to Zika and 5 confirmed pregnancy losses with birth defects in the U.S. Public health officials in Puerto Rico are presently monitoring over 1,600 Zika-infected pregnant women.

Given the absence of medical countermeasures such as vaccines or treatments, the basic public health strategy in the United States has been to focus on aggressive vector control campaigns in areas likely to be breeding grounds for the two species of mosquito that are known to carry the virus, *Aedes Aegypti* and *Albopictus*, and to be prepared to mobilize quickly in the event that outbreaks occur. Much of the strategy is predicated on targeted risk communication. As such, it is critical for public health officials to know their potential audiences, the public's knowledge and attitudes about Zika, and the public's general receptivity to the most common public health strategies and messages.

NYU'S ZIKA RISK PERCEPTION STUDIES

The program on Population Impact, Recovery, and Resilience (PiR²) is engaged in several studies examining the evolving perceptions of risk to the Zika virus among U.S. residents, with a particular emphasis on women of child-bearing age. The first of these studies, funded by the National Science Foundation (NSF), relies upon a series of four nationally-representative population surveys conducted over the span of a year to examine how various social, scientific, and policy cues influence the U.S. public's perception of the risk of the Zika virus over time, as well as the public's receptivity to various clinical, environmental, and behavioral interventions. The specific aims of this research are to: (1) chart the trajectory of risk salience as exposure and certainty of the Zika virus increases; (2) identify and analyze the impact of social, scientific, and policy cues on risk salience; and (3) describe and analyze group differences in the evolving attitudes related to risk perception, as well as receptivity to policy, programmatic, and clinical interventions. The first two points of data collection for this project are used as the basis of this Briefing Report.

This report is based on telephone surveys with 2,464 randomly selected U.S. residents over two waves of data collection. The first survey of 1,233 U.S. residents was conducted in April and May of 2016 and the second was conducted with 1,231 U.S. residents in July and August of 2016. The surveys were conducted in English and Spanish by Social Science Research Solutions (SSRS), using a single-stage, random-digit-dialing (RDD) sample of landline telephone households and randomly-generated cell phone numbers. The sample frame included an oversampling of women of child-bearing age (between the ages of 18-45) living in the southern tier states of Florida, Alabama, Mississippi, Louisiana, and Texas. The data were weighted to represent the adult U.S. population. The margin of error is +/- 4.5%.

1. SOURCE: <https://www.cdc.gov/zika/geo/united-states.html>, Oct 9, 2016

Measures of population knowledge about the Zika virus, risk perception, and receptivity to various interventions were analyzed as overall population rates, and were also categorized by age, gender, household income, highest level of education, region, and political ideology. Weighted bivariate associations and unadjusted and adjusted logistic regressions were conducted to first examine the factors influencing awareness and knowledge of Zika among the U.S. population and women of child-bearing age, and then to see how knowledge, risk perception, and demographics related to intervention receptivity. Selected data tables are appended at the end of this Briefing Report.

The second study currently being conducted by NYU, and funded by the Robert Wood Johnson Foundation (RWJF), focuses on a panel of 240 women of child-bearing age who will be surveyed multiple times over the next year. This panel was recruited using a dual-strategy sampling strategy. Part of the panel was drawn from the NSF study: all women of child-bearing age interviewed as part of the baseline survey were invited to join the panel. Among 355 eligible women, 222 women agreed to follow up and 75 of them participated in the panel. The panel was supplemented with 165 women of child-bearing age recruited from an online national sampling frame coordinated by Qualtrics Panels. This Zika Women's Health Study provides an opportunity to examine how one particularly high-risk population, women of child-bearing age, respond to an evolving threat.

FINDINGS TO DATE

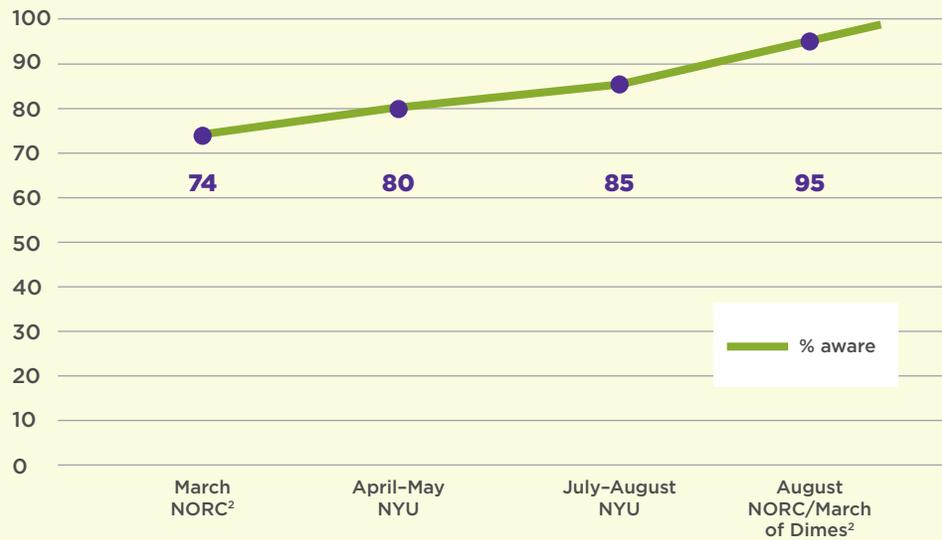
Awareness is Not Knowledge

Awareness and knowledge of the Zika virus are distinct constructs. At its most basic, **awareness** reflects the broadest appreciation of the existence of the Zika virus. Figure 1 illustrates how U.S. public awareness of Zika has changed in a short period of time, as reflected in data from this NYU study¹ and a similar population survey conducted by NORC. The proportion of the American public aware of Zika increased from 74% in March to close to 95% in August, rising in fairly linear fashion.

In order to estimate public **knowledge** about the Zika virus we constructed a measure that encompassed a respondent's understanding that the Zika virus could (1) cause birth defects, (2) be expressed as an asymptomatic infection, and (3) be sexually transmitted. While this sets a relatively high threshold for being informed about the disease, it also reflects the disease's pathogenic and infection profile and the characteristics that set Zika apart from other mosquito-borne or sexually transmitted diseases.

1. Unless otherwise noted, all the data reported in this briefing memo and in the data tables were drawn from the NSF-funded national probability sample of 2,464 U.S. residents.

Figure 1. Trends in the percent of the population aware of the Zika Virus



As reported in Table 1, below, although the proportion of the U.S. population or the subset of women of child-bearing age who are **aware** of Zika increased from April to July, more specific **knowledge** about the virus remained low and did not change over time. The seven to nine percentage point increase in awareness between surveys represents a statistically significant difference, whereas the smaller change in the proportion of people knowledgeable about the virus is not significant.

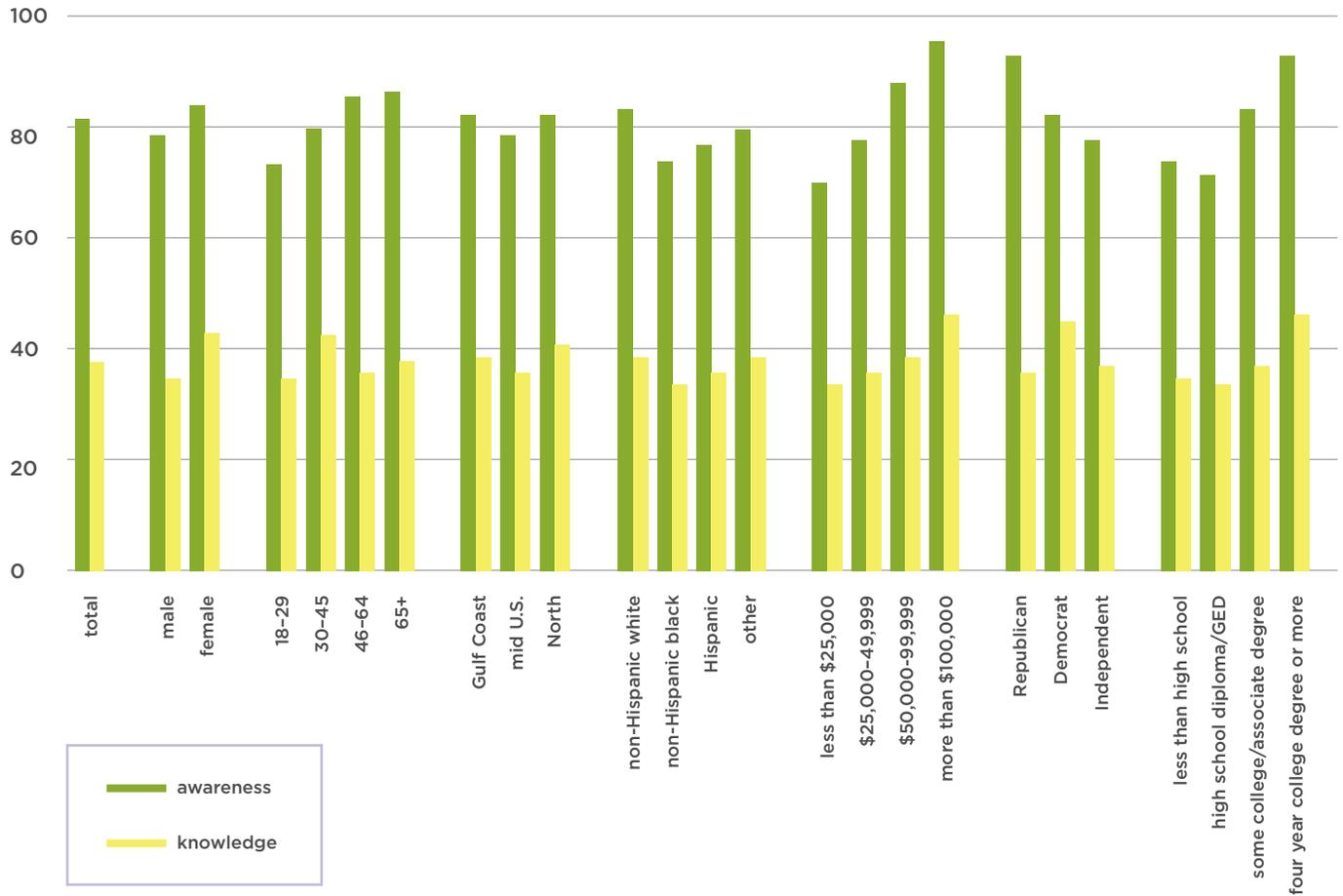
Table 1. Awareness and Knowledge of Zika, U.S. population and Women of Child-Bearing Age

	APRIL–MAY 2016	JULY–AUGUST 2016
% of U.S. population aware of Zika	77.9	84.8
% of women of child-bearing age aware of Zika	75.7	84.6
% of U.S. population knowledgeable of Zika	38.7	38.2
% of women of child-bearing age knowledgeable of Zika	41.8	45.0

1. apnorc.org/projects/pages/the-zika-virus-americans-awareness-and-opinions-of-the-us-response.aspx

2. www.norc.org/PDFs/MarchofDimes/Report_March_of_Dimes_NORC_Zika_Poll_090616.pdf

Figure 2. Demographic Differences in Awareness and Knowledge of Zika



As shown in Figure 2, and detailed in Data Tables 1 and 2 appended to this report, there are socio-demographic differences in who is aware of and knowledgeable about Zika. Among the overall U.S. public, the wealthiest, the most educated, and Republicans are most likely to be aware. Women and adults with higher education are also more likely to be knowledgeable about the virus and Democrats are more knowledgeable than Independents or Republicans. There are fewer socio-demographic differences when the analysis is restricted to women of child-bearing age, between the ages of 18-45 (as illustrated in Data Table 2 in the appendix), and they are slightly different than the overall U.S. population. Among these younger women, those with higher incomes and greater education are more likely to be aware of Zika, but only political ideology separates the women when it comes to knowledge: women who identify as Democrats and Independents are approximately twice as likely to be knowledgeable about the Zika virus as are Republican women (46% versus 24%).

We conducted weighted regression analyses to examine the independent effects of various socio-demographic characteristics and their relationship with awareness and knowledge, holding all other factors constant. These crude and adjusted odds ratios are presented in Data Table 3. These multi-variate analyses confirm some of the bi-variate findings: women, those who are older, and those with greater income

are more likely to be aware of Zika, all other factors being equal. Education and Republican party affiliation are no longer significant. In considering who is more knowledgeable, only women and those who reported a Democratic party affiliation are more knowledgeable. We also considered whether different types of primary information sources are associated with greater awareness and knowledge. We categorized the types of information sources as: (1) conventional media, such as broadcast, print, or online news; (2) social media, friends, and family; (3) one's personal doctor; or (4) government. Those who list their primary source of information about Zika as conventional media are four and a half times as likely to be aware of Zika as are those who rely upon social media, friends, and family as their primary source of information. As illustrated in Data Table 3, those who list government as their primary source of information (and this may be at any level, from federal to state to local) are more knowledgeable than those who report other sources of information.

Implications: Focusing on conventional media may be a key way to increase awareness about Zika. Non-Hispanic Blacks, young adults, and those in the lowest income bracket are key demographic groups that are currently the least likely to be aware of Zika, and most likely to benefit from targeted messaging. Government is a trusted source of information for the public seeking the facts on Zika. Information from government sources is driving knowledge among the public regardless of most demographic factors. To increase knowledge among the public, risk communicators may consider direct governmental communication campaigns (such as public service announcements) to supplement conventional and social media efforts.

Intervention Receptivity is varied and influenced by risk and knowledge.

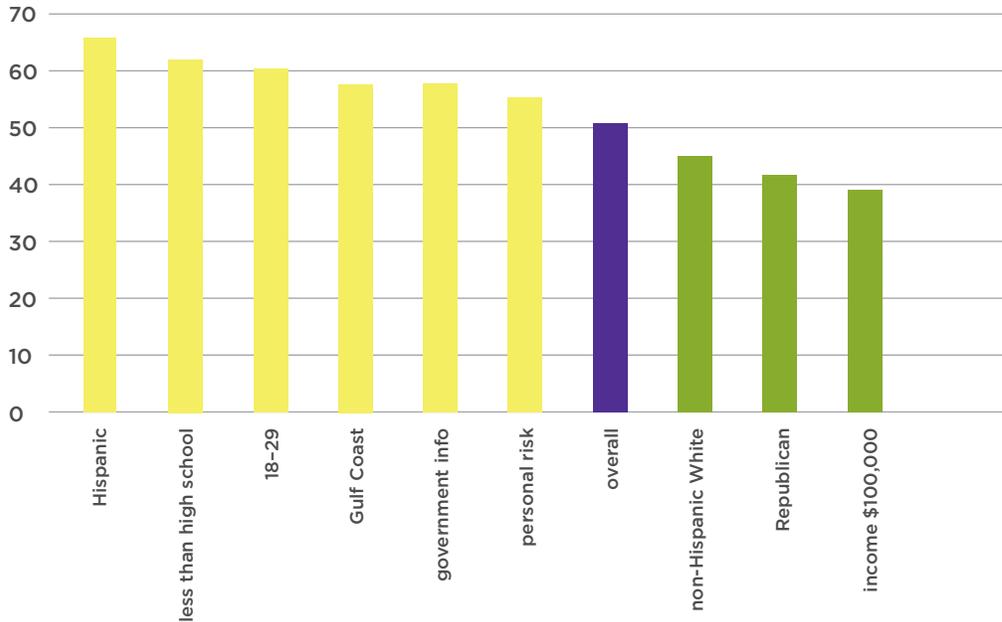
U.S. residents, and in particular women of child-bearing age, are receptive to some of the key public health strategies that could mitigate the threat of Zika. We examined receptivity to three specific interventions: the behavioral intervention of delaying pregnancy, the environmental intervention of indoor spraying, and the clinical intervention of supporting access to federally-financed abortion services for Zika-infected pregnant women. As noted before, among the overall U.S. population, 50% would delay pregnancy by a year or more; 39% would agree to indoor spraying; and 62% supported the availability of federally-financed abortion services.¹

As we did with Zika awareness and knowledge we conducted bi-variate and multi-variate analyses. The bi-variate analyses suggested that there were a number of socio-demographic characteristics that divided people's receptivity to these public health interventions. The more nuanced multi-variate regressions suggested a slightly different story.

1. The question wording for the interventions is as follows: (1) "Do you agree or disagree with the government using targeted indoor spraying inside some homes?" (2) "In terms of actions you might take yourself, how likely would you be to delay getting pregnant, perhaps for a year or more, because of public health warnings?" (3) "Some pregnant women may learn that their unborn child has a birth defect as a result of a Zika infection. Should the government make sure that services are available for women who wish to terminate their pregnancy as a result?"

First we analyzed the **behavioral** intervention of delaying pregnancy. As illustrated in Figure 3, those more likely to delay pregnancy included Hispanics, those with less than a high school education, those in the highest income bracket, young adults, those living in the Northern states, those attending to government sources for information, and those who believe they are at greater personal risk for Zika. Those least likely to delay pregnancy included Non-Hispanic Whites, those making over \$100,000 annually, and Republicans.

Figure 3. Most and least likely to delay pregnancy (%)

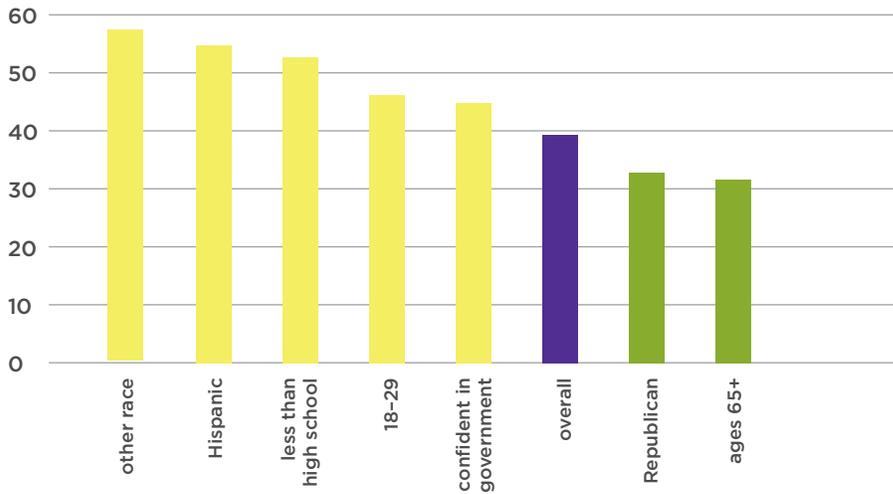


When taken together in a regression analysis though, as shown in Data Table 6, most of these demographic predictors are not significant. Rather, willingness to delay pregnancy is driven by two factors: a sense of being at personal risk for Zika, and living in the Gulf Coast states. All other factors being equal, U.S. residents who believe they are at risk for the Zika virus are one and a half times as likely to delay pregnancy as those who do not think they are at elevated risk, and residents of the Gulf Coast states are 1.6 times as likely to delay pregnancy (regardless of their sense of risk or any of the other factors tested).

Implications: Targeted, risk-focused messaging can enhance receptivity to strategy of delaying pregnancy. Individuals who live in the Gulf Coast states may already be more likely to be receptive to such a behavioral intervention.

The public was least receptive to the **environmental** strategy of having public officials conduct indoor spraying. As illustrates in Figure 4, those who identify as Hispanic were most likely to support intervention, as were U.S. residents with less than a high school education, young adults, and those who were confident in government. Republicans and older adults were the least likely to support this intervention.

Figure 4. Most and least likely to support indoor spraying (%)

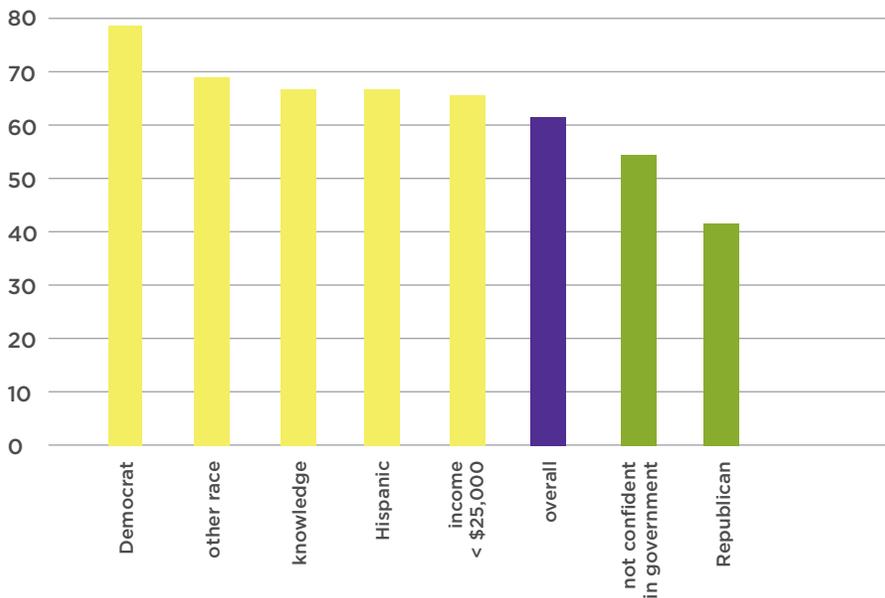


As illustrated in the adjusted odds ratio in Data Table 6, all of the factors identified in the bi-variate analysis persist, except for Republican party affiliation, which is no longer statistically significant.

Implications: Since confidence in government is important to increase receptivity to indoor spraying, communication campaigns should demonstrate the knowledge and ability of governmental actors overall, and especially in regard to the Zika virus. Confidence in government appears to be independent of political affiliation.

Clinical strategies, represented here by whether an individual supports federally available abortion services for pregnant women impacted by the Zika virus, had the highest overall support, at over sixty percent. Democrats and those most knowledgeable of the Zika virus were most likely to support this intervention. Those who were not confident in government and Republicans were least likely to do so, as illustrated in Figure 5.

Figure 5. Most and least likely to support federally funded abortion availability (%)



As shown in Data Table 6, Democrats, Independents, and those who are most knowledgeable about Zika were most likely to support access to federally-financed abortion services, all other factors being equal. Those making between \$25,000 and \$100,000 were nearly half as likely to support this strategy, as were individuals living in the Gulf Coast.

Implications: Clinical strategies such as abortion services present the most complicated picture for messaging design. While politics and certain demographic characteristics affect receptivity to intervention, so does knowledge. Increasing knowledge may be one of the few ways to increase receptivity to clinical strategies such as federally-funded abortion services. With limited alternative clinical strategies at this time, creating a knowledgeable public may increase support for increased testing and awareness among pregnant women, as well as the acceptability of enhanced access to pregnancy-termination services for those who need them due to Zika-related birth defects.

In addition to the public opinions about public health interventions reported above from the NSF-funded study, in the RWJF-funded Zika Women’s Health Study we asked women of child-bearing age what protective actions they had taken to prevent Zika infection in the prior three months. As illustrated in Table 2, nearly two-thirds of women reported wearing long sleeves or using bug spray, a little under a third sprayed their home for mosquitoes, and fewer still changed their travel plans or used birth control measures to avoid the Zika virus. For the most part, these behaviors did not vary by the women’s level of knowledge about Zika or by their sense of being personally at risk for contracting the virus. There were two exceptions to this: women who did believe that Zika could be sexually transmitted were much more likely to engage in birth control practices to avoid Zika infection, and those women who felt that they were personally at risk for Zika infection were much more likely to change travel plans.

Table 2. Actions taken by women of child-bearing age to avoid Zika infection, between June – August 2016

% of women who wore long sleeves or used bug spray	64.9
% of women who sprayed home for mosquitoes	29.9
% of women who changed travel plans	18.5
% of women who used condoms or abstained from sex	10.9

IN SUMMARY

Although there have been limited outbreaks of Zika infection in the continental United States, the threat of the Zika virus remains present—in terms of Zika infections contracted elsewhere and imported into the U.S., in terms of babies born with congenital and neurological defects, and in terms of the constant vigilance necessary to limit the vectors (such as mosquitoes and their breeding grounds) and hosts (people unknowingly carrying the Zika virus). In the absence of medical countermeasures such as vaccines and anti-viral treatments, the most effective tools relate to prevention, mitigation, and surveillance. For all of these, risk communication is critically important in order to generate support for public health intervention campaigns, and to encourage those population practices that can limit viral transmission. Among the key findings from this initial analysis of U.S. public attitudes, behavior, and knowledge are the following:

- 1.** Understanding the public's primary source of information for public health threats such as Zika is a critically important factor in promoting awareness and knowledge. Those members of the public who said that conventional channels such as broadcast, print, and online news media served as their primary source of information were nearly five times as likely to be aware of Zika than were those who relied upon family, friends, or social media. And those who relied upon government sources of information were nearly three times as likely to be knowledgeable about Zika as were those who relied upon informal sources and social media. Although this does not account for the “amplification” effect that can occur with media of many types—for example, in which a governmental pronouncement or a scientific finding is first amplified by conventional media and then further amplified by social media—it does suggest that the most basic means for educating the public about the general contours of a threat such as Zika may still rely upon the more traditional channels of conventional media and government campaigns.
- 2.** Promoting different public health interventions may require different communication strategies, particularly during a period of evolving scientific certainty. In this analysis we examined a behavioral, an environmental, and a clinical intervention. No single factor was associated with increasing the public's receptivity to all three of these interventions. The public was more receptive to a behavior change such as delaying pregnancy if they believed themselves at personal risk. However, that heightened personal risk was not associated with their willingness to accept a government program of indoor spraying. Instead, the public's willingness to accept that type of environmental intervention was much more related to their overall confidence in government. Lastly, the public's appetite for a clinical option such as federally-financed abortion services for Zika-infected pregnant women was associated with greater knowledge about Zika, regardless of their political ideologies. Risk communicators should consider highlighting different aspects of their messages—whether increasing knowledge of transmission routes, conveying the actual risks posed by various vectors, or promoting the trustworthiness of government or public health organizations—depending upon the intervention they wish to advance.

- 3.** As with any potential health threat it is useful to know the public's appetite for various public health interventions, and the factors that would either spur or inhibit their acceptance of such actions, before the threat appears. The public health and scientific communities may be mobilized and vigilant about widespread Zika outbreaks, but for the moment, at least, the public is neither alarmed nor particularly activated about it.

Data Table 1. Weighted bivariate associations between Zika awareness and knowledge and demographics (row%)

	Aware of the Zika virus			Knowledge Zika causes birth defects, can be sexually transmitted, and people can be asymptomatic		
	Yes	No	p-value	Yes	No	p-value
Overall (row %)	81.3	18.7		38.4	61.6	
Gender						
Male	78.3**	21.7	0.008	35.2*	64.8	0.024
Female	84.1	15.9		41.3	58.7	
Age						
18-29	71.5***	28.5	<0.001	35.6	64.4	0.41
30-45	79.7	20.3		41.6	58.4	
46-64	85.9	14.1		36.7	63.3	
65+	86.2	13.8		38.2	61.8	
Region						
Gulf Coast	82.9	17.1	0.122	38.7	61.3	0.361
Mid US	78.9	21.1		36.4	63.6	
North	83.4	16.6		40.6	59.4	
Race						
Non-Hispanic White	84.4***	15.6	<0.001	39.3	60.7	0.616
Non-Hispanic Black	71.8	28.2		33.9	66.1	
Hispanic	76.1	23.9		35.9	64.1	
Other	79.6	20.4		39.3	60.7	
Household Income						
Less than \$25,000	69.5***	30.5	<0.001	34.3	65.7	0.088
\$25,000-49,999	77.7	22.3		36.5	63.5	
\$50,000-99,999	88.3	11.7		38.1	61.9	
More than \$100,000	95.5	4.5		45.0	55.0	
Political Views						
Republican	90***	10	<0.001	36.7	63.3	0.058
Democrat	82.2	17.8		43.9	56.2	
Independent	78.2	21.8		37.1	62.9	
Education Attained						
Less than high school	74.5***	25.5	<0.001	34.6***	65.4	<0.001
High School Diploma/GED	70.9	29.1		31.5	68.5	
Some college/Associates Degree	85.1	14.9		38.7	61.3	
Four year college degree or more	92.4	7.6		45.3	54.7	
Confident government can address Zika issue						
Yes	84.4***	15.6	<0.001	40.7	59.3	0.061
No	76.6	23.4		35.4	64.6	
Primary Source of Information about the Zika virus						
Family/Friends/Social Media	64.1***	35.9	<0.001	34.4**	65.6	0.004
News/Tv/Radio	89.9	10.1		38.6	61.4	
Doctor	18.3	81.7		29.1	70.9	
Government	79.7	20.1		66.2	33.8	

Continued

	Aware of the Zika virus			Knowledge Zika causes birth defects, can be sexually transmitted, and people can be asymptomatic		
	Yes	No	p-value	Yes	No	p-value
Believe personally at risk for Zika						
Yes				43.5*	56.5	0.021
No				36.9	63.1	
Believe community at risk for Zika						
Yes				42.2*	57.8	0.028
No				36.1	63.9	

* p < 0.05

** p < 0.01

*** p < 0.001

Data Table 2. Weighted bivariate associations between Zika awareness and knowledge and demographics among Women of Child-Bearing Age (row%)

	Aware of the Zika virus			Knowledge Zika causes birth defects, can be sexually transmitted, and people can be asymptomatic		
	Yes	No	p-value	Yes	No	p-value
Overall (row %)	80.0	20.0		43.4	56.6	
Age						
18-29	77.1	22.9	0.386	38.5	61.5	0.233
30-45	81.4	18.6		45.9	54.1	
Region						
Gulf Coast	86.5	13.5	0.142	44.4	55.6	0.634
Mid US	75.5	24.5		40	60	
North	80.2	19.8		46.6	53.4	
Race						
Non-Hispanic White	83.1	16.9	0.463	43.5	56.5	0.789
Non-Hispanic Black	72.9	27.1		38.9	61.1	
Hispanic	77.1	22.9		41.1	58.9	
Other	79.8	20.2		51.8	48.2	
Household Income						
Less than \$25,000	72.2**	27.8	0.002	36.7	63.3	0.13
\$25,000-49,999	72.6	27.4		36.7	63.3	
\$50,000-99,999	86.5	13.5		41.5	58.5	
More than \$100,000	97.4	2.6		58.4	41.6	
Political Views						
Republican	87.4	12.6	0.43	23.8*	76.2	0.027
Democrat	83.1	16.9		46.4	53.6	
Independent	78.9	21.1		45.9	54.1	
Education Attained						
Less than high school	66.6**	33.4	0.007	33.6	66.4	0.601
High School Diploma/GED	72.4	27.6		41	59	
Some college/Associates Degree	81.6	18.4		41.4	58.6	
Four year college degree or more	89.9	10.1		48.4	51.6	
Confident government can address Zika issue						
Yes	81.9	18.1	0.307	45.9	54.1	0.365
No	76.5	23.5		39.8	60.2	
Primary Source of Information about the Zika virus						
Family/Friends/Social Media	70.5***	29.5	<0.001	39.0	61.0	0.075
News/Tv/Radio	86.7	13.3		44.2	55.8	
Doctor	22.2	77.8		30.9	69.1	
Government	97.7	2.3		74.3	25.7	
Believe personally at risk for Zika						
Yes				53.7*	46.3	0.034
No				39.5	60.5	
Believe community at risk for Zika						
Yes				49.1	50.9	0.083
No				37.9	62.1	

* p < 0.05

** p < 0.01

*** p < 0.001

Data Table 3. Weighted multivariate logistic regressions for predictors of Zika awareness, knowledge, and demographics

	Crude Odds Ratio for Aware of Zika	Adjusted Odds Ratio for Aware of Zika	Crude Odds Ratio for Knowledge about Zika	Adjusted Odds Ratio for Knowledge about Zika
	OR (CI)	OR (CI)	OR (CI)	OR (CI)
Gender				
Male	ref.	ref.	ref.	ref.
Female	1.46 (1.10, 1.94)	1.51 (1.00, 2.29)	1.29 (1.03, 1.61)	1.32 (1.01, 1.73)
Age				
18-29	ref.	ref.	ref.	ref.
30-45	1.57 (1.07, 2.28)	1.25 (0.72, 2.17)	1.29 (0.90, 1.85)	1.28 (0.83, 1.99)
46-64	2.44 (1.67, 3.55)	1.30 (0.73, 2.33)	1.05 (0.76, 1.46)	1.11 (0.73, 1.71)
65+	2.49 (1.62, 3.81)	2.12 (1.05, 4.27)	1.12 (0.79, 1.58)	1.26 (0.80, 1.96)
Region				
North	ref.	ref.	ref.	ref.
Mid US	0.74 (0.54, 1.03)	1.15 (0.72, 1.83)	0.84 (0.65, 1.08)	0.83 (0.62, 1.12)
Gulf Coast	0.96 (0.66, 1.40)	1.33 (0.78, 2.28)	0.92 (0.69, 1.23)	0.90 (0.64, 1.28)
Race				
Non-Hispanic White	ref.	ref.	ref.	ref.
Non-Hispanic Black	0.47 (0.32, 0.69)	0.51 (0.29, 0.89)	0.79 (0.54, 1.17)	0.76 (0.47, 1.23)
Hispanic	0.59 (0.41, 0.85)	1.29 (0.69, 2.42)	0.87 (0.62, 1.21)	1.05 (0.67, 1.62)
Other	0.72 (0.43, 1.22)	0.58 (0.26, 1.28)	1.00 (0.56, 1.58)	0.81 (0.46, 1.43)
Household Income				
Less than \$25,000	ref.	ref.	ref.	ref.
\$25,000-49,999	1.53 (1.07, 2.19)	1.12 (0.69, 1.81)	1.10 (0.78, 1.57)	1.03 (0.69, 1.53)
\$50,000-99,999	3.33 (2.16, 5.13)	2.55 (1.54, 4.24)	1.18 (0.84, 1.67)	1.06 (0.71, 1.58)
More than \$100,000	9.37 (4.36, 20.15)	5.50 (2.09, 14.43)	1.57 (1.09, 2.25)	1.29 (0.82, 2.01)
Political Views				
Republican	ref.	ref.	ref.	ref.
Democrat	0.51 (0.32, 0.81)	0.76 (0.39, 1.49)	1.34 (1.01, 1.80)	1.60 (1.13, 2.27)
Independent	0.40 (0.26, 0.62)	0.60 (0.33, 1.08)	1.01 (0.76, 1.35)	1.08 (0.77, 1.51)
Education Attained				
Less than high school	ref.	ref.	ref.	ref.
High School Diploma/GED	0.83 (0.55, 1.25)	0.62 (0.33, 1.18)	0.87 (0.56, 1.34)	0.65 (0.38, 1.12)
Some college/Associates Degree	1.94 (1.27, 2.99)	1.19 (0.60, 2.36)	1.19 (0.78, 1.82)	0.96 (0.56, 1.63)
Four year college degree or more	4.17 (2.57, 6.74)	1.62 (0.76, 3.45)	1.57 (1.05, 2.35)	1.15 (0.67, 1.97)
Confident government can address Zika issue				
No	ref.	ref.	ref.	ref.
Yes	1.65 (1.24, 2.19)	1.65 (1.07, 2.52)	1.25 (0.99, 1.57)	1.06 (0.80, 1.41)
Primary Source of Information				
Family/Friends/Social Media	ref.	ref.	ref.	ref.
News/Tv/Radio	5.00 (3.52, 7.11)	4.65 (2.88, 7.50)	1.20 (0.84, 1.70)	1.14 (0.74, 1.75)
Doctor	0.13 (0.07, 0.23)	0.09 (0.04, 0.23)	0.78 (0.25, 2.45)	0.68 (0.19, 2.37)
Government	2.20 (0.92, 5.24)	1.65 (0.61, 4.47)	3.73 (1.65, 8.41)	2.88 (1.18, 7.01)
Time of Data Collection				
May-June 2016	ref.	ref.	ref.	ref.
July-August 2016	1.65 (1.24, 2.19)	2.16 (1.45, 3.21)	0.99 (0.79, 1.23)	1.13 (0.87, 1.47)

**bolded odds ratios indicate significance*

Data Table 4. Weighted multivariate logistic regressions for predictors of Zika awareness, knowledge, and demographics among WCBA

	Crude Odds Ratio for Aware of Zika	Adjusted Odds Ratio for Aware of Zika	Crude Odds Ratio for Knowledge about Zika	Adjusted Odds Ratio for Knowledge about Zika
	OR (CI)	OR (CI)	OR (CI)	OR (CI)
Age				
18-29	ref.	ref.	ref.	ref.
30-45	1.29 (0.72, 2.34)	2.34 (1.02, 5.43)	1.35 (0.81, 2.25)	1.49 (0.77, 2.87)
Region				
North	ref.	ref.	ref.	ref.
Mid US	0.76 (0.37, 1.55)	1.43 (0.48, 4.22)	0.76 (0.40, 1.46)	0.84 (0.38, 1.87)
Gulf Coast	1.57 (0.79, 3.14)	2.70 (0.97, 7.55)	0.91 (0.52, 1.62)	1.29 (0.61, 2.71)
Race				
Non-Hispanic White	ref.	ref.	ref.	ref.
Non-Hispanic Black	0.55 (0.25, 1.19)	0.19 (0.05, 0.69)	0.83 (0.40, 1.72)	0.39 (0.15, 1.03)
Hispanic	0.68 (0.33, 1.41)	0.58 (0.18, 1.91)	0.91 (0.48, 1.71)	0.97 (0.42, 2.23)
Other	0.80 (0.27, 2.39)	0.39 (0.09, 1.62)	1.40 (0.57, 3.41)	0.91 (0.33, 2.58)
Household Income				
Less than \$25,000	ref.	ref.	ref.	ref.
\$25,000-49,999	1.02 (0.49, 2.10)	0.44 (0.16, 1.22)	1.00 (0.45, 2.21)	0.59 (0.24, 1.45)
\$50,000-99,999	2.47 (0.95, 6.41)	1.66 (0.53, 5.16)	1.22 (0.58, 2.55)	0.89 (0.38, 2.10)
More than \$100,000	14.6 (4.88, 43.48)	4.14 (0.87, 19.72)	2.42 (1.10, 5.30)	2.29 (0.83, 6.30)
Political Views				
Republican	ref.	ref.	ref.	ref.
Democrat	0.71 (0.25, 1.96)	4.36 (0.94, 20.28)	2.77 (1.38, 5.55)	6.01 (2.38, 15.17)
Independent	0.54 (0.20, 1.47)	1.33 (0.36, 4.97)	2.72 (1.36, 5.44)	3.83 (1.56, 9.41)
Education Attained				
Less than high school	ref.	ref.	ref.	ref.
High School Diploma/GED	1.31 (0.51, 3.37)	2.31 (0.60, 8.90)	1.38 (0.45, 4.22)	0.78 (0.16, 3.73)
Some college/Associates Degree	2.22 (0.90, 5.51)	3.50 (0.99, 12.40)	1.40 (0.48, 4.09)	1.51 (0.33, 6.79)
Four year college degree or more	4.48 (1.65, 12.11)	3.61 (0.85, 15.30)	1.85 (0.65, 5.32)	1.23 (0.26, 5.68)
Confident government can address Zika issue				
No	ref.	ref.	ref.	ref.
Yes	1.38 (0.74, 2.59)	1.28 (0.57, 2.88)	1.28 (0.75, 2.19)	1.09 (0.56, 2.16)
Primary Source of Information				
Family/Friends/Social Media	ref.	ref.	ref.	ref.
News/Tv/Radio	2.71 (1.39, 5.31)	2.81 (1.22, 6.47)	1.24 (0.70, 2.22)	0.90 (0.45, 1.80)
Doctor	0.12 (0.03, 0.42)	0.06 (0.01, 0.33)	0.70 (0.08, 5.97)	0.94 (0.10, 8.41)
Government	17.54 (3.57, 86.10)	5.40 (0.54, 53.65)	4.53 (1.18, 17.41)	3.88 (1.08, 13.94)
Time of Data Collection				
May-June 2016	ref.	ref.	ref.	ref.
July-August 2016	1.75 (0.98, 3.14)	2.43 (1.07, 5.50)	1.14 (0.69, 1.88)	1.46 (0.78, 2.73)

**bolded odds ratios indicate significance*

Data Table 5. Weighted bivariate associations between Zika Interventions and covariates, knowledge, and risk perception among those aware of Zika (+/-3 percentage points at the 95% confidence interval)

	Would delay pregnancy by a year or more due to health warnings			Receptive to government using indoor spraying in homes to control mosquitoes			Government should make abortion available to Zika infected pregnancy		
	Yes	No	p-value	Yes	No	p-value	Yes	No	p-value
Overall (row %)	50.2	49.8		39.3	60.7		61.5	38.5	
Gender									
Male	48.5	51.5	0.24	43.2**	56.8	0.002	61	39	0.71
Female	51.8	48.2		35.5	64.5		62	38	
Age									
18-29	60.3***	39.7	<0.001	46.7***	53.3	<0.001	67	33	0.26
30-45	52.1	47.9		43.1	56.9		58.9	41.1	
46-64	47.2	52.8		37.1	62.9		61.2	38.8	
65+	39.7	60.3		30.9	69.1		60.8	39.2	
Region									
North	46.1*	53.9	0.01	40.5	59.5	0.87	58	42	0.13
Mid US	50.4	49.6		39	61		60.2	39.8	
Gulf Coast	57.8	42.2		38.8	61.2		64.9	35.1	
Race									
Non-Hispanic White	45***	55	<0.001	35***	64	<0.001	58.9*	41.1	0.05
Non-Hispanic Black	53.5	46.5		39.8	60.2		63.9	36.1	
Hispanic	66.1	33.9		54.5	45.5		67.8	32.2	
Other	53.4	46.6		58.4	58.4		69.5	30.5	
Household Income									
Less than \$25,000	54**	46	0.005	41.1	58.9	0.77	67.6*	35.4	0.04
\$25,000-49,999	54.5	45.5		38.2	61.8		58.7	41.3	
\$50,000-99,999	48.7	51.3		39	61		57.7	42.3	
More than \$100,000	39.2	60.8		41.9	58.1		65.9	34.1	
Political Views									
Republican	40.9**	59.1	0.003	32.2*	67.8	0.013	40.7***	59.3	<0.001
Democrat	53.7	46.3		41.3	58.7		79.3	20.7	
Independent	51.4	48.6		40.8	59.2		60.6	39.4	
Education Attained									
Less than high school	61.9**	38.1	0.007	52.6***	47.4	<0.001	64.9	35.1	0.35
High School Diploma/GED	51.5	48.5		35	65		57.9	42.1	
Some college/Associates Degree	49.0	51.0		33.7	66.3		62.8	37.2	
Four year college degree or more	45.3	54.7		43.8	56.2		63.2	36.8	
Confident government can address Zika issue									
Yes	53.9**	46.1	0.001	44.8***	55.2	<0.001	65.5***	34.5	<0.001
No	44.4	55.6		29.7	70.3		54.8	45.2	
Primary Source of Information									
Family/Friends/Social Media	49.1	50.9	0.75	43.4	56.6	0.58	60.5	39.5	0.97
News/Tv/Radio	50.1	49.9		38.3	61.7		61.9	38.1	
Doctor	53.9	46.1		40.5	59.5		59.0	41.0	
Government	57.9	42.1		40.2	59.8		64.2	35.8	

Continued

	Would delay pregnancy by a year or more due to health warnings			Receptive to government using indoor spraying in homes to control mosquitoes			Government should make abortion available to Zika infected pregnancy		
	Yes	No	p-value	Yes	No	p-value	Yes	No	p-value
Time of Data Collection									
May-June 2016	55***	45	<0.001	38.2	61.8	0.43	64.4*	35.6	0.05
July-August 2016	45.5	54.5		40.2	59.8		58.9	41.1	
Believe personally at risk for Zika									
Yes	56.2**	43.8	0.004	40.8	59.2	0.48	62.5	37.5	0.64
No	46.7	53.3		38.7	61.3		61.1	38.9	
Believe community at risk for Zika									
Yes	53.3***	46.7	<0.001	39.1	60.9	0.55	62.1	37.9	0.7
No	44.7	55.3		40.8	59.2		61	39	
Knowledge of Zika's Characteristics									
Yes	53.4	46.6	0.12	39.5	60.5	0.9	67.9***	32.1	<0.001
No	48.5	51.5		39.8	60.2		58.2	41.8	

* p < 0.05

** p < 0.01

*** p < 0.001

Data Table 6. Weighted multivariate logistic regressions for the association between Zika interventions and knowledge, risk perceptions, and covariates among those aware of Zika

	Crude Odds Ratio for Delay Pregnancy	Adjusted Odds Ratio for Delay Pregnancy	Crude Odds Ratio for Indoor Spraying	Adjusted Odds Ratio for Indoor Spraying	Crude Odds Ratio for Abortion Availability	Adjusted Odds Ratio for Abortion Availability
	OR (CI)	OR (CI)	OR (CI)	OR (CI)	OR (CI)	OR (CI)
Gender						
Male	ref.	ref.	ref.	ref.	ref.	ref.
Female	1.14 (0.91, 1.43)	1.04 (0.79, 1.42)	0.72 (0.59, 0.89)	0.81 (0.61, 1.08)	1.04 (0.83, 1.31)	1.12 (0.83, 1.53)
Age						
18-29	ref.	ref.	ref.	ref.	ref.	ref.
30-45	0.71 (0.51, 0.99)	0.79 (0.49, 1.27)	0.87 (0.63, 1.19)	0.67 (0.42, 1.05)	0.70 (0.48, 1.03)	0.61 (0.36, 1.00)
46-64	0.59 (0.43, 0.80)	0.63 (0.39, 1.00)	0.67 (0.50, 0.90)	0.61 (0.39, 0.94)	0.78 (0.55, 1.10)	0.71 (0.44, 1.17)
65+	0.43 (0.30, 0.61)	0.49 (0.30, 0.83)	0.51 (0.37, 0.70)	0.51 (0.32, 0.82)	0.76 (0.53, 1.09)	0.75 (0.45, 1.24)
Region						
North	ref.	ref.	ref.	ref.	ref.	ref.
Mid US	1.19 (0.92, 1.53)	1.28 (0.89, 1.82)	1.01 (0.79, 1.28)	0.79 (0.57, 1.10)	0.82 (0.63, 1.06)	0.82 (0.57, 1.17)
Gulf Coast	1.60 (1.19, 2.15)	1.64 (1.08, 2.49)	1.07 (0.82, 1.41)	1.02 (0.70, 1.48)	0.74 (0.55, 1.01)	0.61 (0.41, 0.91)
Race						
Non-Hispanic White	ref.	ref.	ref.	ref.	ref.	ref.
Non-Hispanic Black	1.41 (0.99, 1.99)	1.34 (0.77, 2.34)	1.78 (0.84, 1.65)	0.94 (0.57, 1.53)	1.24 (0.82, 1.87)	0.96 (0.57, 1.62)
Hispanic	2.38 (1.72, 3.31)	1.50 (0.89, 2.51)	2.13 (1.58, 2.87)	1.95 (1.22, 3.10)	1.47 (1.04, 2.10)	0.99 (0.59, 1.68)
Other	1.40 (0.90, 2.16)	1.47 (0.77, 2.82)	1.27 (0.84, 1.92)	1.09 (0.61, 1.96)	1.59 (0.98, 2.59)	1.14 (0.55, 2.35)
Household Income						
Less than \$25,000	ref.	ref.	ref.	ref.	ref.	ref.
\$25,000-49,999	1.02 (0.73, 1.42)	1.29 (0.82, 2.05)	0.89 (0.65, 1.21)	0.89 (0.58, 1.36)	0.68 (0.47, 0.99)	0.61 (0.38, 0.97)
\$50,000-99,999	0.81 (0.58, 1.12)	1.15 (0.73, 1.81)	0.92 (0.68, 1.25)	0.87 (0.56, 1.32)	0.65 (0.46, 0.93)	0.51 (0.31, 0.83)
More than \$100,000	0.55 (0.38, 0.79)	0.77 (0.45, 1.31)	1.04 (0.75, 1.44)	0.97 (0.61, 1.54)	0.93 (0.64, 1.35)	1.02 (0.59, 1.77)
Political Views						
Republican	ref.	ref.	ref.	ref.	ref.	ref.
Democrat	1.67 (1.23, 2.27)	1.36 (0.89, 2.07)	1.48 (1.12, 1.97)	1.18 (0.81, 1.73)	5.58 (4.04, 7.72)	6.84 (4.51, 10.36)
Independent	1.53 (1.14, 2.06)	1.16 (0.78, 1.74)	1.45 (1.11, 1.91)	1.29 (0.90, 1.86)	2.25 (1.68, 3.01)	2.26 (1.59, 3.21)
Education Attained						
Less than high school	ref.	ref.	ref.	ref.	ref.	ref.
HS/GED	0.65 (0.44, 0.97)	0.57 (0.32, 1.04)	0.48 (0.34, 0.70)	0.46 (0.27, 0.78)	0.74 (0.48, 1.15)	0.59 (0.32, 1.07)
Some college	0.59 (0.40, 0.88)	0.71 (0.39, 1.28)	0.46 (0.32, 0.66)	0.53 (0.32, 0.90)	0.93 (0.59, 1.40)	0.77 (0.43, 1.40)
4 yr college+	0.51 (0.35, 0.75)	0.55 (0.30, 1.02)	0.70 (0.50, 0.99)	0.85 (0.50, 1.43)	0.93 (0.61, 1.40)	0.79 (0.43, 1.46)
Confident government can address Zika issue						
No	ref.	ref.	ref.	ref.	ref.	ref.
Yes	1.47 (1.16, 1.85)	1.23 (0.88, 1.72)	1.92 (1.53, 2.40)	1.80 (1.21, 1.50)	0.57 (1.23, 1.99)	1.27 (0.93, 1.72)
Primary Source of Information						
Family/Friends/Social Media	ref.	ref.	ref.	ref.	ref.	ref.
News/Tv/Radio	1.04 (0.76, 1.41)	1.44 (0.89, 2.34)	0.81 (0.61, 1.08)	0.89 (0.57, 1.41)	1.06 (0.74, 1.51)	1.13 (0.69, 1.83)
Doctor	1.21 (0.68, 2.17)	1.05 (0.30, 3.65)	0.89 (0.50, 1.56)	1.13 (0.36, 3.60)	0.94 (0.31, 2.80)	0.81 (0.17, 3.91)
Government	1.42 (0.66, 3.07)	1.61 (0.52, 4.94)	0.88 (0.44, 1.74)	0.76 (0.30, 1.93)	1.17 (0.50, 2.75)	1.15 (0.38, 3.49)

Continued

	Crude Odds Ratio for Delay Pregnancy	Adjusted Odds Ratio for Delay Pregnancy	Crude Odds Ratio for Indoor Spraying	Adjusted Odds Ratio for Indoor Spraying	Crude Odds Ratio for Abortion Availability	Adjusted Odds Ratio for Abortion Availability
	OR (CI)	OR (CI)	OR (CI)	OR (CI)	OR (CI)	OR (CI)
Time of Data Collection						
May-June 2016	ref.	ref.	ref.	ref.	ref.	ref.
July-August 2016	0.68 (0.55, 0.85)	0.80 (0.59, 1.10)	1.09 (0.88, 1.34)	1.24 (0.94, 1.63)	0.79 (0.63, 1.00)	1.01 (0.75, 1.38)
Believe personally at risk for Zika						
No	ref.	ref.	ref.	ref.	ref.	ref.
Yes	1.46 (1.13, 1.89)	1.45 (1.02, 2.07)	1.09 (0.86, 1.39)	0.91 (0.65, 1.25)	1.06 (0.83, 1.36)	1.17 (0.82, 1.66)
Believe community at risk for Zika						
No	ref.	ref.	ref.	ref.	ref.	ref.
Yes	1.14 (1.09, 1.81)	1.05 (0.74, 1.51)	0.93 (0.74, 1.17)	0.92 (0.67, 1.27)	1.05 (0.83, 1.33)	1.03 (0.73, 1.46)
Knowledge of Zika's Characteristics						
No	ref.	ref.	ref.	ref.	ref.	ref.
Yes	1.22 (0.95, 1.57)	1.22 (0.90, 1.67)	0.99 (0.78, 1.24)	0.97 (0.73, 1.28)	1.52 (1.19, 1.93)	1.41 (1.05, 1.91)

*bolded odds ratios indicate significance