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Amanda E. Sorensen, Rebecca C. Jordan, Shannon LaDeau

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Amanda E. Sorensen, Rebecca C. Jordan, Shannon LaDeau

Amanda E. Sorensen[1*], Rebecca C. Jordan[1], Shannon LaDeau[2]

[*]Corresponding Author

[1]Department of Human Ecology, Rutgers University. 59 Lipman Drive-Room 104, New Brunswick, NJ 08901

[2]Cary Institute of Ecosystem Studies. 2801 Sharon Turnpike, Millbrook, NY 12545

Abstract

Emergence of invasive vector species and the diseases they carry present a clear danger to the public as well as a challenge for scientists and experts to control effectively. Given the urgent need to address this phenomenon, we suggest that desired public action towards these invasive vectors can be motivated through intentional framing in science communication. In this paper, we sought to evaluate the effect of framing about ZIKV (Zika virus) on reported willingness to comply with mosquito prevention action. Post framing intervention, we found a significant increase (N=26, p<0.001) in individuals willing to take preventative action against mosquitoes. By methodically investigating best communication practices, this study and others can help practitioners mobilize communities to address large-scale ecological problems. Additionally, the principles outlined here may be transferrable to other communication efforts about ecological issues outside of ZIKV and mosquitoes.

Introduction

Global climate change has been linked to many ecological problems (i.e., phenology shifts and mismatches, invasive species establishment, biodiversity loss) as a driver or aggravator. Beyond the bio-physical threats climate change poses, it has also been subject to politicization through active media campaigns to highlight uncertainties in climate science to sow doubt of climate change's existence (Zehr, 2000). This rampant politicization of science (Pielke, 2002) makes engaging with local communities (Donlan et al., 2003) and persuasive science communication (McNutt, 2013) increasingly important to address ecological problems.

One area that has been little explored in the ecological literature to address these issues of community engagement and persuasive communication is intentional employment of frame theory from the communication sciences. Framing, or frame theory, is a set of theoretical perspectives that focuses on how individuals interpret and communicate reality (Goffman, 1974). By employing frame theory, one can promote a particular interpretation or evaluation of events/issues by emphasizing particular facets over others (Nisbet & Mooney, 2007). Framing scientific issues can help scientists make issues more relevant to different audiences (Nisbet & Mooney, 2007), and thus broaden public support for scientific issues. A recent study on the effect of framing in public support of environmental conservation found that individuals who identified as environmentalist ranked protecting the environment highly when it was framed as "ecosystem services." Conversely, those who did not identify as environmentalists ranked protecting the environment highly when it was framed as "environmental security" (Sorensen et al., 2015). Framing has successfully influenced public support and encouraged desirable actions regarding other politicized, hot-button scientific topics like vaccinations in the public health domain (McRee et al., 2010).

In the public health domain, misinformation campaigns (much like climate change denial) has distorted individual decision-making. As an example, there has been long-lasting negative impacts on vaccination rates (Freed et al., 2010) and public health communication efforts around vaccinations (Flaherty, 2011), due to falsified science published decades ago (Wakefield et al., 1998-retracted). Despite this research being retracted, misinformation campaigns persist that reduce trust in vaccines and reduce individual vaccination rates. Recently there has been extensive effort by scientists in the field to address this problem by employing framing research to influence vaccination behavior. Researchers have found that the willingness to get a vaccine is greater if the framing focuses on positive health outcomes versus the risk of negative outcomes without a vaccine (Ferguson & Gallagher, 2007). This type of framing work has been used extensively in the public health disciplines to increase vaccination compliance with great success (Allen et al., 2010). Given these successes in the public health literature in employing framing, we argue these methods could also be applied to ecological issues as well.

Framing in Ecology

To explicitly investigate framing in an ecological context, the authors wanted to test whether employing framing could influence public behavior in the context of an ecological issue. The invasive *Aedes* spp. mosquitoes and Zika virus (here-to-forth ZIKV) were used here as a case study of the efficacy of framing ecological issues influencing public behavior. This is an ideal system to test this because (1) *Aedes* spp. mosquitoes are difficult to manage through mosquito control mechanisms without community participation (Unlu et al., 2011), (2) winter warming due to global climate change will continue to expand the effective range where *Aedes albopictus* can persist (Rochlin et al., 2013) making it a persistent issue, and (3) there has been a wide variety of messaging around ZIKV, often sensational (Rohde, 2016), similar to prior examples highlighted above in the public health domain.

About ZIKV

ZIKV has become an international health threat, primarily because it is associated with infant microcephaly when the mother is infected during pregnancy (Paploski et al., 2016). ZIKV is also associated with Guillain-Barré syndrome and other neurological and autoimmune complications (Paploski et al., 2016). While *Aedes aegypti* is commonly cited as the main vector of ZIKV (Cao-Lormeau et al., 2014), the Asian Tiger Mosquito (*Aedes albopictus*) which is a public health threat in its own right (see Medlock et al., 2012 for review), is also capable vectors (Wong et al., 2013). A vector is a living organism that can transmit infectious diseases between humans, or from animals to humans. The risk for ZIKV transmission is greatest in equatorial regions; however, the United States is also at risk in regions where either of the predominant *Aedes* spp. (*aegypti or albopictus*) vectors are present.

Given the need to control mosquitoes as a potential transmitter of ZIKV (among other diseases), we suggest that community action to prevent the spread can be motivated through specialized framing around ZIKV communication to increase public compliance and preventative behaviors. Practitioners are seeking new approaches for *Aedes* spp. mosquito control (beyond creating mosquito ditches to drain mosquito habitat and broad application of adulticide and larvicide) as many of the previously developed mosquito control methods do not consider the different life history and behavioral traits of *Aedes* spp. from other mosquitoes.

Aedes albopictus is referred to as an urban mosquito because urban areas provide a plethora of container-breeding habitats, thus enabling high population densities (Fonseca et al., 2013). Many of these habitats are on private property (e.g., residential backyards, construction areas, condemned houses, etc.), making them inaccessible to mosquito control workers. *Aedes albopictus* is also commonly associated with low socioeconomic areas because juveniles readily develop in unmanaged containers that are more likely to

accumulate in disadvantaged neighborhoods (LaDeau et al., 2013), though it can also persist in higher socioeconomic areas where residents have features that hold water (i.e., container gardens, bird baths) (Unlu et al., 2011). Additionally, a feedback loop can exist between the two socioeconomic areas where the breeding habitats in lower socioeconomic areas are eliminated or reduced, but high socioeconomic areas harbor pools of mosquitoes that lead to recolonization (Unlu et al., 2011). In urban areas that are characterized by this type of feedback loop, it is particularly important to have compliance at the household level across neighborhoods.

Objectives of Study

In this paper, we sought to (1) evaluate the effect of current ZIKV communication framing on public behavior, (2) create a new frame emphasizing "collective action" and (3) test for shifts in resident behavior towards willingness to comply with mosquito prevention action using the new frame. We are specifically interested if these small changes in framing-based communication tactics can lead to changes in resident behavior. This work is exploratory in nature and was carried out in West Baltimore, Maryland, USA because it is characterized by this relationship of closely intertwined high/low socioeconomic areas, making the residents a target audience for these types of interventions.

We used a multiple step approach to investigate how framing impacts resident behavior in West Baltimore. (1) we performed an initial frame analysis of the current ZIKV communication efforts in West Baltimore to identify common frame elements. (2) we conducted semi-structured interviews (n=60) with residents to understand community perceptions of ZIKV risk and severity, to investigate the efficacy of current communication materials, and to inform our alternative frame. Using results from these first two steps, we developed our alternative frame for communication about ZIKV. (3) we present findings from a second round of interviews (n=26) that reveal perceptions of the alternative frame in addition to results

from a pre/post questionnaire addressing resident behavior toward ZIKV and mosquitos. As these three steps are progressive in this study, we report them out in entirety (methods and results) before reporting on the next step.

Current ZIKV Communication Frame

Frame analysis is often characterized as the way in which researchers tease apart the processes or ways in which a frame is presented in communication (Devereux, 2007). We evaluated the communication materials on ZIKV (flyers, pamphlets, etc.) published by the CDC and the DHMH (Maryland Department of Health and Mental Hygiene) that were being distributed in this community through various organizations. In this evaluation, we aimed to establish what the dominant frame valance of ZIKV communication is for this region.

Methods

The authors were only interested in informational communication materials being distributed by public health and governmental organizations to investigate how science-based organizations are communicating about ZIKV. During spring 2016, we collected flyers and informational pamphlets that were distributed by various organizations within West Baltimore. Only informational communication materials focused on ZIKV prevention, intended for a general audience, were kept for analysis (i.e., those flyers specifically for pregnant women were not kept). We used eight flyers/informational pamphlets as the communication materials for this analysis (see associated online material for original flyers). We used the content analysis framework developed by Matthes & Kohring (2008) as a guide for coding the flyers. In coding, we looked at what type of behavior towards mosquitoes was being encouraged and drew inferences as to

why. Coding was completed independently by the first and second authors and then compared and integrated to generate a single frame in April 2016.

Outcomes

The analysis identified a single dominant frame valance of "personal safety" or "individual action" (see Table 2) in these communication materials. In this frame, the emphasis for protecting against ZIKV is to prevent the individual from getting the virus. This frame is congruent with the findings from the survey mentioned earlier where individuals felt that getting ZIKV was very severe and dangerous for them, regardless of whether or not they were part of the vulnerable population. What is missing in this messaging is the notion that an individual protecting oneself helps to prevent others from getting ZIKV.

Establishing Community Perceptions of ZIKV

Methods

We opportunistically sampled the population of residents in four local parks, making two site visits per park during May and June 2016 until we had completed surveys with 15 people per park (60 surveys total). The four parks were distributed across neighborhoods representing the socio-economic gradient of West Baltimore: two parks in the low SES tier, one park in the medium SES tier, and one park in the high SES tier (see Little et al., 2017 for neighborhood selection process). We visited the parks once on a weekday and once on a weekend from 8am to 6pm each visit with the goal of completing one interview per hour. Adult park users were approached at random and asked to participate in the study. To establish how the community viewed the severity and perceived danger of ZIKV, the researchers developed a brief 10-minute survey comprised of two ranking questions and one free-response question. In the survey development, we largely followed the work of Weinstein (1982) and Wang et al. (2009). We developed our hypothesis about individual responses based on work by Bond & Nolan (2011). These questions were

piloted with a small subset of participants. All participants were compensated $5 for their time. For the two ranking questions, each respondent rated five diseases they could encounter in the coming year (most serious to least serious) for perceived likelihood of infection and severity if they were infected: four common to the Baltimore, MD region (common cold, food poisoning, flu, strep throat) and the fifth being ZIKV. Sixty-one percent of respondents rated ZIKV as the most serious illness and felt that they were as likely to get ZIKV as the other illnesses (See Table 1). Participants were then asked in free-response format about why they ranked ZIKV as they did and their current behavior towards mosquitoes.

Outcomes

From these responses, 73% of individuals did not know *why* ZIKV poses serious risks. When asked about their likelihood of infection, 80% identified the risk as being minimal and thought they could avoid infection. Only slightly more than half intended to protect themselves from ZIKV and, of those that did, very few were using effective strategies that would have an impact on their likelihood of being bitten by mosquitoes (i.e., strategies recommended by the Center for Disease Control). The CDC cites effective strategies of ZIKV prevention as: using mosquito repellant when outside, taking precautions or avoiding travel in known infested areas, covering up with clothing, and reducing mosquito breeding habitat. Individuals reported using the following strategies to protect against ZIKV: swatting the mosquitoes when they saw one land on them, smoking to deter mosquitoes, spraying the mosquitoes with insect repellant, and not going outside when they believed mosquitoes were out. Though the seriousness of this illness is high, it was clear that the respondents were relying on not being one of the persons becoming infected. This result suggests that individuals do not have an informed sense of risk, especially as related to preventive action, which falls in kind with phenomenon observed in the unrealistic optimism literature (see Weinstein, 1982; Armor & Taylor, 2002).

Additionally, no participants were able to describe typical symptoms of ZIKV infection. Many reported they felt that because concern was so high both for pregnant and non-pregnant persons, symptoms of the illness were quite serious for all people. All were unaware that most individuals who get ZIKV do not experience symptoms (Symptoms CDC), and therefore do not know they could be contributing to the spread. The notion that personal action and protection would help prevent the spread of the virus to others was seldom realized in this community. Further, emergent from the interview responses, respondents did not recognize that ZIKV is most serious for vulnerable populations (e.g., pregnant persons), and most will not know that they are infected. Based on the above findings, that authors argue that framing communication about ZIKV by encouraging prevention as a means of protecting others (i.e., breaking the transmission cycle) could encourage an alternative perspective on health and behavioral management. Indeed, this shared responsibility frame has been shown to be effective in other disciplines when framing science communication to drive behavior change (i.e., increasing vaccination compliance (Vietri et al., 2012)). Additionally, the lack of preventative mosquito control reported by the respondents to this survey, which has also been found in studies of community action towards mosquitoes (Jordan et al., in review), suggests current communication strategies are not successful in spurring action to address mosquito-related issues. Given that mosquito control is important beyond the individual's needs, much like vaccines, we argue that reframing messaging to a shared responsibility frame may increase compliance. Having now established current framing of ZIKV communication materials from national and local health institutions and community perceptions of ZIKV, the authors wanted to test how reframing ZIKV information could influence public behavior towards mosquitoes.

New ZIKV Frames

Our frame of ZIKV communication focuses on a "collective action" frame valance, where the burden of protecting unborn babies from ZIKV is the responsibility of the collective community, not just pregnant

women (see Table 3). We hypothesized that by explicitly changing the frame valance from a "personal safety" to "collective action," individuals will report greater willingness and compliance in taking action to protect oneself against ZIKV. This shift in communication from "personal safety" or individual benefits to "collective action" or societal benefits (i.e., getting a vaccine will help protect those who cannot like immune-compromised or young children) has been shown to be effective in increasing vaccination rates and reduce "free-riding" (Betsch et al., 2013).

Methods

Similar to other framing studies from the public health literature (see Gerend & Shepherd, 2007; McRee et al., 2010), the intervention was broken down into three parts to test whether our framing of ZIKV and mosquito information affected behavior: (1) a pre-survey, (2) the framed narrative, and (3) a post-interview. Prior to starting the survey, potential participants were asked an open-ended question of where they had seen or gotten information about ZIKV to establish that they had been exposed to the available CDC and/or DHMH ZIKV materials. Participants who had indeed gotten ZIKV materials were asked to participate. Participant recruitment is described below.

In the pre-survey, participants were asked if they had experienced recent communication efforts or messaging about ZIKV recently and whether they currently take action to prevent mosquito bites and ZIKV in response to those materials (2 binary survey items). We then asked participants to read a brief narrative created with the "collective action" frame valance. In this narrative, preventing ZIKV was discussed as a collective action with an emphasis on breaking the transmission cycle (see Table 4 for frame comparison). In the post-intervention interview, individuals were asked if they would now take action to prevent themselves from getting ZIKV (1 binary survey item), and in a free-response interview question, connect how their action would help pregnant women and unborn babies. All interview and

narrative materials can be accessed in the online supplementary materials. A McNemar's test, a non-parametric test for paired nominal data, was used to test the effect of the intervention. All statistical analyses were performed in SPSS Statistical software (Version 22.0).

All respondents (N=26) were residents from West Baltimore, Maryland surveyed over 3 months (July, August, September) in 2016. These participants were a mixed convenience sample of West Baltimore residents who lived in our focal areas (see Little et al., 2017). Some of the respondents (n=12) were recruited from a local, multi-year mosquito citizen science program that worked with residents in four neighborhoods of West Baltimore. The rest (n=14) of the respondents were recruited locally from parks within these four neighborhoods but were not affiliated with the citizen science program.

Outcomes

To ensure that there were no significant differences between the two sample populations due to some of the respondents engaging in the citizen science program, and any outcomes were due to the framing intervention, a Mann-Whitney U test for independent non-parametric data was performed on the pre-framing interview responses. We found that there was no significant difference ($U=76.5$, $Z=0.28$, $p<0.05$) in responses regarding compliance with personal mosquito protection between the sample populations prior to the framing intervention, allowing us to treat this as one sample population.

From the pre-survey, of our 26 respondents, 3 reported that they were already taking preventative action to protect themselves from mosquito bites (2 individuals from the citizen science program and 1 individual who had no connection to the citizen science program). Post framing intervention, we found a significant shift in respondents' reported behaviors (McNemar's test, N=26, $p<0.001$), with no significant

differences between where participants were recruited (citizen scientists versus park recruited participants). Nineteen of the 23 who previously were not protecting themselves from mosquitoes, reported they were going to take action after the intervention. Four reported they would not take action to protect themselves against ZIKV before or after the intervention. The intervention did not affect the three individuals who were already taking action to protect themselves, reporting they would continue to do so.

To probe further about the respondents' understanding of why their actions to protect themselves against ZIKV would be help the broader community, participants were asked a free-response follow up interview question, "How does your taking care to avoid the Zika virus help those who are pregnant?" Because one part of the framing intervention narrative was explicitly linking self-protection to protection of others, we expected all participants to connect these ideas in their response. We used a mixed inductive/deductive coding scheme (see Chi, 1997) to code participant responses for inclusion of direct or indirect reference to individual action having broader positive impacts. Participant responses were evaluated by the first and second authors independently and compared for inter-coder reliability. Inter-coder reliability was 97%, and in instances where coders disagreed, coders had a discussion to come to an agreement. Of the 26 respondents, 12 referenced some aspect of their individual behavior benefiting others (e.g, "*protecting myself will help prevent babies being born with problems*", "*fewer mosquitoes carrying the virus if I don't get the virus*"). 13 respondents did not connect the ideas that their own behavior can have broader effects and only emphasized self-protection (e.g., "*all women should have bug spray*", "*I will avoid mosquitoes so I don't get sick*"). One individual believed that their actions would have no effect and thus they could not protect their self, or others, from ZIKV.

Discussion

This research suggests that urban resident behavior towards ZIKV, and more broadly towards *Ae. albopictus,* can be influenced through simple reframing of current communication. Particularly, in explicitly connecting the two ideological congruent ideas (i.e., protecting self=protecting others, breaking the transmission cycle) for individuals, we see increased willingness to comply with mosquito prevention by the respondents in our study. To address the issue of controlling invasive disease vector mosquitoes, it is clear that we need new methods and strategies that emphasize the efficacy of collective action by local communities.

The results of this study, in considering best practices in communication strategies, can help practitioners mobilize communities to take action. This is particularly important considering many of the opportunities to communicate scientific issues and influence public behaviors are brief or one-time events. In these constrained instances, if the goal is to change or influence people's behavior regardless of their background knowledge on the system/issue, communicators must be particularly intentional with their messaging. In our study, even though not all participants were able to explicitly connect their behavior to protection of vulnerable populations, they still reported being willing to take action after the framing intervention. Further investigation is needed to tease apart whether it is necessary for the broader public to understand the mechanisms behind how their actions will help protect vulnerable persons. Additionally, it is well known that social networks also play an important role in how information, as well as misinformation, is spread (Acemoglu et al., 2009; Bakshy et al., 2012) and therefore influence behavior. Research into the intersection of framing, social networks, and behavior is needed to better understand their relationships and the broader influences of these relationships. Importantly, if minor changes in how mosquito control issues are communicated can influence how people behave towards the system, this type of cross-disciplinary research may have important implications for how scientists should develop their communication strategies.

Limitations

This study measured respondents' behavioral intent towards mosquitoes, and the literature shows that reported behavioral intent, or their planned behaviors/actions, can differ from actual behavior (Barr, 2004). The complexity between behavioral intent and actual behavior warrants further research into behavioral intent and actual behavior in the context of mosquito control. Additionally, it is possible that simply engaging respondents in the interview process, thus highlighting ZIKV, may be enough to elicit reported behavioral change. All participants in this study reported being exposed to passive informational material (flyers or pamphlets) about ZIKV prior to participating in the study. Perhaps personally engaging with individuals using communication material that has been framed for that audience may make a bigger impact on resident behavior than passive informational materials. While it is likely not possible to talk with each resident in a community individually, this suggests the importance of planning and evaluating communication strategies holistically (from how the message is framed to dissemination through social networks). Finally, this study focused on residents of West Baltimore, which is a highly urban area that is characterized by inequity and segregation (U.S. Census Beurau, 2013; Engel, 2013), therefore the findings of this study may only be relevant to similar urban communities. However, as the invasive mosquitoes capable of transmitting ZIKV are predominately urban mosquitoes (Fonseca et al., 2013), it is even more important to explicitly consider urban communities when thinking about messaging around invasive mosquito control and disease prevention. While the authors have taken the first steps in establishing potential efficacy of employing framing in messaging around ZIKV, the long-term impacts of this framing intervention on behavior need to be investigated further. It is unknown whether this type of intervention will promote longitudinal behavioral changes. Consideration of the frequency and timing of this type of tailored messaging likely also influences sustained behavior change. Indeed, other scholars (Nisbet & Scheufele, 2009) have emphasized the need for this type of research to further effective communication between scientists and members of the public. Our research brings new insight to practitioners seeking to address complex ecological problems in communities and comes at a critical time

when we need to establish effective best practices in communication and public engagement in all realms of science.

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Table 1. Survey respondents (N=60) ranked their perceived seriousness and likelihood of getting of following illnesses within the next year, 1 being most serious/likely and 4 being least serious/likely. Scores below represent the mean rank and the standard deviation.

Illness	**Serious** Mean (std.dev.)	**Likely** Mean (std.dev.)
Zika Virus	1.5 (0.84)	3.0 (0.77)
Common Cold	2.9 (1.10)	2.7 (0.99)
Flu	2.1 (0.98)	2.9 (0.84)
Food Poisoning	2.0 (0.99)	2.9 (0.87)
Strep Throat	2.1 (0.94)	3.0 (0.77)

Table 2. Frame elements and variables in current Zika virus communication put forth by CDC and other governmental organizations. The “personal safety” frame.

Frame Elements	*Variables*
Topic/Theme	Mosquito control
	Individual action for individual prevention- personal safety
Actor	Individuals
Benefit	Reduced Zika virus for self
Benefit Attribution	Reduced mosquito populations lead to reduced Zika load
Risk	Spread of Zika virus
Risk Attribution	Lack of current effective mosquito control in urbanized areas
Solution	Individual protection and reduce mosquito populations
Proponent	Center for Disease Control and other Governmental agencies
Treatment	Neutral/ Negative

Table 3. Frame elements and variables in our re-frame of Zika virus communication. The "collective action" frame.

Frame Elements	*Variables*
Topic/Theme	Individual action for group benefit- public wellbeing
	" Breaking transmission cycle"
Actor	Local community organizations Individuals
Benefit	Reduced Zika virus in the community
Benefit Attribution	Breaking the transmission cycle
Risk	Spread of Zika virus
Risk Attribution	Individuals in community may be infected with Zika virus but are unaware
Solution	Collective action to protect vulnerable populations against Zika virus and in mosquito control
Proponent	Academia (at current)
	CDC and other governmental organizations
Treatment	Positive

Table 4. A comparison of the two frames as was presented to survey participants. Highlights the key areas of emphasis that differed between.

Individual Action Frame	Collective Action Frame
-Current communication frame.	-Proposed communication frame.
-Individual preventative behaviors benefit self.	-Individual preventative behaviors benefit others.
-Focus on illness and effects of Zika on the individual.	-Focus on illness and effects of Zika on pregnant women and unborn babies.
-Reducing mosquito populations will reduce Zika virus load in communities.	-Breaking transmission cycle will reduce Zika virus load in communities.

Establishing Community Perceptions of ZIKV SURVEY

(Part of a larger survey published elsewhere).

Script: Assent for adults who participate (no name or identifying information is collected). You are being asked to participate in a research project. The purpose of our research is to find out about what you know about mosquitoes and science. The data you collect will be used as part of a Baltimore Area Mosquito Assessment Survey. Your participation will include receiving an anonymous code to be used on your pre-post survey about your beliefs (these are not right or wrong questions). Anonymous means that no personal identifying information is collected for the research. There are no risks or near-term benefits to your participation. In the long term, we hope to develop a mosquito control program. You can stop your participation at any time. You will receive monetary compensation for your data sheets, which will be handed to you as cash when you return your data. Do you understand what I am saying and are you willing participate in our project?

Q1. Things to make note of:

- Gender (1)
- Ethnicity/Race (2)
- Children (3)
- Age (4)

Now we would like to understand your impressions related to a few issues regarding trash and pest control.

The issues of trash and pest control highlighted above relate to the potential for zika virus spread. We will now ask questions specifically about zika virus.

Q2. What do you know about the following illnesses (focus on zika)? Listen and then score.

	Knowledgeable (1)	Moderately knowledgeable (2)	Knows a little (3)	Knows nothing (4)
A common cold (1)	❍	❍	❍	❍
The flu (2)	❍	❍	❍	❍
Food poisoning (3)	❍	❍	❍	❍
Zika virus (5)	❍	❍	❍	❍
Strep throat (6)	❍	❍	❍	❍

Q3. How serious would it be if you came down with one of the following illnesses.

	Very Serious (1)	Serious (2)	Not very serious (3)	Nothing to worry about (4)
A common cold (1)	❍	❍	❍	❍
The flu (2)	❍	❍	❍	❍
Food poisoning (3)	❍	❍	❍	❍
Zika virus (5)	❍	❍	❍	❍
Strep throat (6)	❍	❍	❍	❍

Q4. How likely is it that you would come down with one of the following illnesses.

	Very likely (1)	Likely (2)	Not very likely (3)	No chance at all. (4)
A common cold (1)	❍	❍	❍	❍
The flu (2)	❍	❍	❍	❍
Food poisoning (3)	❍	❍	❍	❍
Zika virus (5)	❍	❍	❍	❍
Strep throat (6)	❍	❍	❍	❍

Q5. How likely is it that people can take action against the following illnesses?

	Very likely (1)	Likely (2)	Not very likely (3)	No chance at all. (4)
A common cold (1)	❍	❍	❍	❍
The flu (2)	❍	❍	❍	❍
Food poisoning (3)	❍	❍	❍	❍
Zika virus (5)	❍	❍	❍	❍
Strep throat (6)	❍	❍	❍	❍

Q6. How likely is it that the government can take action against the following illnesses?

	Very likely (1)	Likely (2)	Not very likely (3)	No chance at all. (4)
A common cold (1)	❍	❍	❍	❍
The flu (2)	❍	❍	❍	❍
Food poisoning (3)	❍	❍	❍	❍
Zika virus (5)	❍	❍	❍	❍
Strep throat (6)	❍	❍	❍	❍

Q7. How likely is it that you will take action against the following illnesses?

	Very likely (1)	Likely (2)	Not very likely (3)	No chance at all. (4)
A common cold (1)	❍	❍	❍	❍
The flu (2)	❍	❍	❍	❍
Food poisoning (3)	❍	❍	❍	❍
Zika virus (5)	❍	❍	❍	❍
Strep throat (6)	❍	❍	❍	❍

Q8. Where do you get your information about preventing illnesses (ask about internet sources)

	Very often (1)	often (2)	Not very often (3)	Never (4)
Newspapers (1)	❍	❍	❍	❍
Television (2)	❍	❍	❍	❍
Radio (3)	❍	❍	❍	❍
Internet (4)	❍	❍	❍	❍
Your doctor (5)	❍	❍	❍	❍
Other people (6)	❍	❍	❍	❍
Other (7)	❍	❍	❍	❍

Q9. Where do you get your information about zika (ask about internet sources)

	Very often (1)	often (2)	Not very often (3)	Never (4)
Newspapers (1)	❍	❍	❍	❍
Television (2)	❍	❍	❍	❍
Radio (3)	❍	❍	❍	❍
Internet (4)	❍	❍	❍	❍
Your doctor (5)	❍	❍	❍	❍
Other people (6)	❍	❍	❍	❍
Other (7)	❍	❍	❍	❍

Q10. Do you plan on changing any of your behavior because of the zika virus threat?

- ❍ Definitely yes (1)
- ❍ Probably yes (2)
- ❍ Might or might not (3)
- ❍ Probably not (4)
- ❍ Definitely not (5)

Q11. If yes, what?

New ZIKV Frames MATERIALS

Script: Assent for adults who participate (no name or identifying information is collected). You are being asked to participate in a research project. The purpose of our research is to find out about what you know about mosquitoes and Zika virus. Your participation will include receiving an anonymous code (these are not right or wrong questions). Anonymous means that no personal identifying information is collected for the research. There are no risks or near-term benefits to your participation. In the long term, we hope to develop a mosquito control program. You can stop your participation at any time. You will receive monetary compensation for your responses at the end of the survey. Do you understand what I am saying and are you willing participate in our project?

Q1. Have you heard of zika virus?

YES_____ NO_____

Zika virus is likely to be introduced to this region of the United States and the Asian Tiger mosquito are able to transmit the virus to people if they become infected.

Q2. Are you currently doing anything to avoid the virus?

YES_____ NO_____

Zika is a serious threat. While many people with the virus will not fall ill, those that do may experience a rash/fever. It is because people often don't show symptoms that makes Zika hard to control. To avoid the spread of the virus, people should use mosquito repellent (as directed); especially when traveling to countries where Zika is being spread by mosquitoes. Those who are pregnant need to take extra precautions as there is greater risk to the unborn baby. All people need to work together to help protect pregnant people and unborn babies from the zika virus.

Q3. Knowing this, might you take action to avoid virus?

YES_____ NO_____

Please keep in mind that while zika is serious, reports of mosquitoes carrying zika in the Baltimore area have not been made. An infectious person would have to be exposed to a large population of mosquitoes that then survive long enough to bite a second person. This means that the risk is currently low, real-but not something people need to panic about. Certainly, pregnant women should take extra precautions to avoid mosquito bites. Zika is not spread casually from person to person (it can be sexually transmitted).

Q4. How does your taking care to avoid the virus help those who are pregnant?

PLEASE EXPLAIN:

Public interest statement: How science is communicated, particularly what elements of the science is emphasized (known as framing), to community members can impact how individuals respond to the implications of this science. In the context of invasive, disease carrying mosquitoes, cooperation and action on the part of scientists and community members is needed to mitigate the impacts of these mosquitoes. In our study, we found that shifting the emphasis of a scientific message from protecting yourself from mosquitoes as an individual choice to highlighting the impact individual action has on a commonly held value (e.g., protecting unborn babies) leads to a higher proportion of individuals willing to take action against mosquitoes.

About the author: Amanda Sorensen, PhD in Human Ecology, is a postdoctoral research associate at the University of Nebraska Lincoln researching the role of identity, framing conservation and environmental values, and natural resource usership on public valuation of protected species such as swift fox.