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## Mosquito Control Practices and Zika Knowledge Among Outdoor Construction Workers in Miami-Dade County, Florida

### To the Editor:

Mosquito-borne diseases such as Zika virus pose a health and safety risk to outdoor workers such as those employed in the construction industry. Mosquito-borne diseases such as dengue fever,<sup>1</sup> malaria,<sup>2</sup> and chikungunya fever<sup>3</sup> have been previously associated with construction worker populations. Rapidly emerging as an epidemic over the past year, Zika virus has been associated with significant birth defects such as microcephaly<sup>4</sup> as well as adult complication such as Guillain-Barre syndrome.<sup>5</sup> While the majority of Zika transmission occurs via mosquitoes, Zika virus has the potential to spread via sexual transmission,<sup>6</sup> blood transfusions,<sup>7</sup> and non-sexual transmission.<sup>8</sup>

With the recent outbreaks of Zika virus across South America, the Caribbean, and South Florida, USA, there is a growing need to assess the occupational exposure of Zika virus and other mosquito-borne diseases particularly among worker populations

who spend a disproportionate amount of their job working outdoors. Zika virus is transmitted by *Aedes* species mosquitoes that exhibit increased biting activity during the day when outdoor construction workers are most vulnerable.<sup>9,10</sup> In April 2016, the Occupational Safety and Health Administration (OSHA) issued guidelines for construction worker protection from Zika virus.<sup>11</sup>

The aim of this rapid pilot study was to assess the attitudes and concerns of construction worker employees in Miami-Dade County, Florida on mosquito-borne diseases with a specific focus on Zika virus. We also examine construction company mosquito control policies and preventive measures. Characterization of the attitudes and concerns of construction industry employees help to identify gaps in awareness and opportunities to develop prevention strategies appropriate for outdoor construction workers.

### METHODS

This study used a cross-sectional study design with a one-time paper-based anonymous survey administered in a convenience sample of construction industry employees in May 2016. All present members (adults age 18 years and older) were invited to participate in the voluntary survey. In total, 49 surveys were distributed and 44 were returned completed (44/49 = 89.8% response rate).

The 16-item survey featured questions on sociodemographics, occupational history, and company-wide statistics (ie, number of employees at construction firm, number of construction workers at the firm who work outdoors). The survey also included questions on occupational safety policies and protocols at the worker's construction company. In terms of mosquito-borne disease, respondents answered questions regarding company mosquito-control at the worksite and specific methods of mosquito controls.

### RESULTS

Table 1 displays the sociodemographic characteristics of the 44 survey participants. Among the participants, the majority were men ( $n = 33$ ; 75.0%) and construction safety officers ( $n = 29$ ; 74.4%). The average years of experience in the construction industry was 13 years (standard deviation = 10 years). The average number of company employees was 251 employees (standard deviation = 288 employees), and the average proportion of outdoor workers was 56%.

In terms of mosquito control practices, 22% of survey respondents reported mosquito control activities at their worksite. In terms of specific mosquito control and prevention activities, the most common was personal repellent spray (90.0%). Measures such as standing water treatment, source reduction (clear ditches, tires), and full-coverage uniform encouragement among workers were reported by 20.0% of respondents. No construction employees reported permethrin-treated uniforms or gear (0.0%) as a means of mosquito-control at their company. The vast majority reported that these mosquito control activities were primarily to control nuisance mosquitoes (90.0%).

Figure 1 features employee and personal attitudes and concerns surrounding mosquito-borne illness and Zika virus. A minority of construction employees reported that company employees had concerns about worksite mosquitoes in the last year (37.5%). Similarly, 34.2% of construction employees noted employee concerns about Zika.

A majority of respondents considered mosquitoes a problem to some degree at their worksite (76.6%). Twenty-three percent of survey participants reported feeling moderately or extremely concerned about personally contracting Zika virus, while 12.5% of respondents reported no concerns at all. Over 54% of workers surveyed were not aware of the US Centers for Disease Control and Prevention (CDC) and the Occupational Safety and Health Administration (OSHA) guidance for protecting workers from occupational exposure to Zika virus.

### DISCUSSION

We present the results of a rapid cross-sectional survey characterizing the mosquito control practices and employee attitudes towards mosquito-borne diseases and Zika virus in Miami-Dade County, Florida. This pilot study shows that there are limited mosquito control measures at construction worksites in Miami-Dade, Florida. In addition, the primary motivation among outdoor workers at a construction site for mosquito control is to prevent nuisance mosquitoes rather than preventing mosquito-borne diseases. The majority of participants considered mosquitoes at least a minor problem at their specific worksite. However, personal concerns about infection with a mosquito-borne disease were not common or of major concern for these outdoor workers.

The strength of this rapid analysis is the study worker population and study

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Ethics Committee Approval: This study has been approved by the University of Miami Institutional Review Board (IRB ID: 20160748).

The authors report no conflicts of interest.

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**TABLE 1.** Socio-Demographic Characteristics of Construction Employees Participating in a Mosquito Control and Zika Virus Knowledge Survey, May 2016 (n = 44)

Characteristics	n*	%
Gender		
Male	33	75.0
Female	11	25.0
Construction safety officer		
Yes	29	74.4
No	10	25.6
	<b>Mean</b>	<b>Standard Deviation</b>
Years of experience in construction (yrs)	13	10
Number of company employees	251	288
Number of outside workers	141	189
Proportion of outside workers (%)	56%	34%

\*Differences in groups and sub-groups attributed to non-response or item missing.

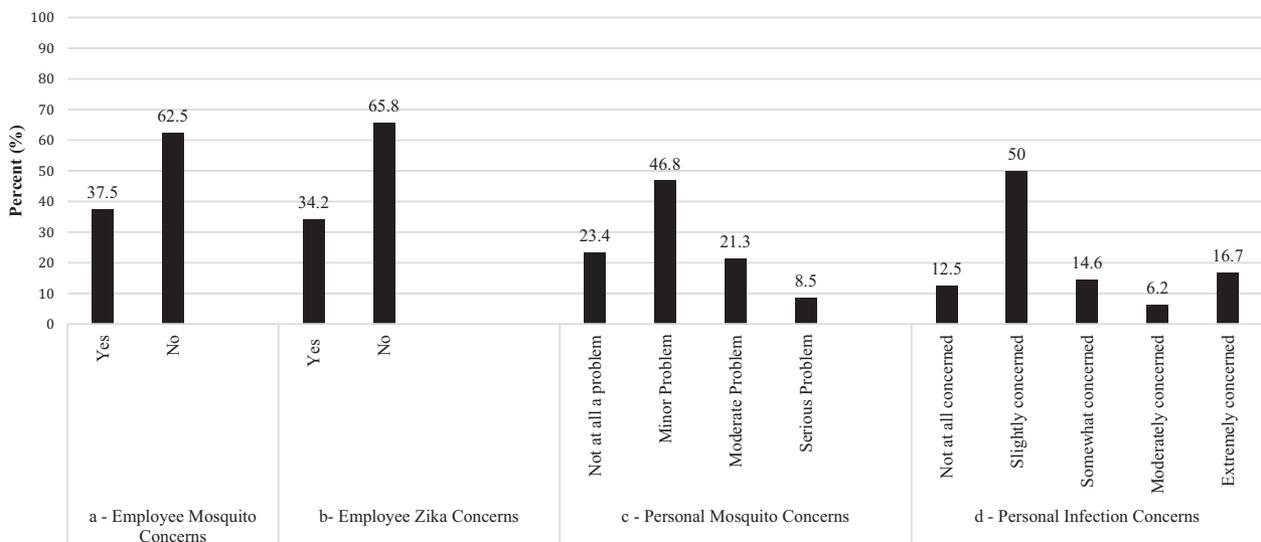
timing. Florida is one of two states with confirmed locally acquired Zika infection, and the epicenter of locally acquired infections is Miami-Dade County.<sup>12</sup> Limitations to this study include the cross-sectional and self-reported nature. The study includes construction employees from South Florida, which limits the generalizability of the study to practices by other construction firms or outdoor workers (ie, restaurant workers). Another study limitation is the relatively small sample size of construction firms.

The most common mosquito control method was personal repellent spray (90.0%). This mosquito prevention method places the protection burden on the individual worker instead of implementing company-wide changes and infrastructure adjustments to protect workers. It is important to interpret these survey findings in the context of the minimal reported employee concerns for mosquito-borne diseases and Zika virus. A minority of construction employees reported concerns of both mosquito-borne diseases and

Zika virus—low rates of concern may lead to low rates of adherence for using the personal repellent spray. Studies on malaria protective measures have demonstrated awareness and knowledge to predict adherence with protective measures.<sup>13</sup> Future studies should assess construction worker Zika and mosquito-borne awareness and knowledge in the context of protective measure adherence.

Low rates of employee concerns may be attributable to minimal knowledge regarding Zika virus and mosquito-borne diseases as only 54% of our sample was aware of existing OSHA and CDC guidance on protecting workers from occupational exposure to Zika virus.<sup>14</sup> Another explanation for the minimal worker concerns is a belief that there is sufficient worksite protection already or protective measures are unnecessary. Furthermore, construction workers may avoid expressing concern due to the hyper masculine culture of the construction industry. This oppressive work culture may push construction industry employees to minimize their concerns for potential occupational exposures.<sup>15,16</sup>

The most publicized complication of Zika infection is microcephaly secondary to perinatal infection. As a result, men workers may view Zika virus as an insignificant issue, and the majority of survey respondents were men. However, recent studies have shown both sexual and non-sexual transmission of Zika virus.<sup>6,8</sup> Men construction workers with Zika infection



- <sup>a</sup> Have your company employees raised concerns about mosquitoes at your worksite in the last 12 months?
- <sup>b</sup> Have your company employees raised concerns about Zika at your worksite in the last 12 months?
- <sup>c</sup> How much of a problem do you personally think mosquitoes are where you work?
- <sup>d</sup> How concerned are you about catching a mosquito-borne disease?

**FIGURE 1.** Mosquito and Zika virus attitudes and concerns among construction workers in Miami-Dade County, Florida, USA in May 2016.

pose a threat for viral spread in the local community. Studies should seek to understand construction worker estimate of Zika virus contagiousness and risk.

With the rise in Zika virus in Miami-Dade County, construction workers are at increased risk for exposure and infection. Given the increased risk due to outdoor work and the construction work environment, construction companies should implement company-wide protective measures to prevent mosquito-borne diseases. Among Miami-Dade County construction workers, high occupational risk combined with low levels of protection or concern serve as a potential catalyst for further infection and outbreak.

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