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ORIGINAL RESEARCH

Dengue Awareness in Latin American Populations: A Questionnaire Study

Elsa Sarti · Helen Cox · Sandra Besada-Lombana · Laura Tapia-Maruri

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ABSTRACT

Introduction: Dengue is an escalating public health concern in Latin American Countries with a dramatic increase of cases reported during the past decade. The objectives of this study were to identify and provide insights into current management and attitudes toward dengue and to understand attitudes to vaccination and current behaviors to prevent dengue in Mexico and Colombia.

Methods: This was a community-based, cross-sectional, descriptive study conducted in urban and rural areas in endemic and non-endemic regions. The interviews were conducted face-to-face using a structured questionnaire containing 58 questions. A quota sampling approach was used to obtain a nationally representative sample of the adult population. All data were weighted to correct for differences between the samples surveyed in each country relative to their general population.

Results: A total of 1978 participants completed the survey. Two percent and 10% of participants in Mexico and Colombia, respectively, had experienced dengue fever, with just under one-third of adults and almost two-thirds of their children hospitalized as a result of the illness. Awareness of dengue was similar in Colombia (76%) and Mexico (68%), with awareness higher in endemic regions than in non-endemic regions. Colombia had a higher proportion of participants (84%) who considered dengue to be a common disease in their country, compared with Mexico (56%). In Mexico and Colombia, 55% and 54% in endemic areas, and 28% and 46% in non-endemic areas believed that everyone was at risk of contracting dengue. In both countries, the most common action undertaken by

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E. Sarti (✉)
Sanofi Pasteur, AV. Universidad 1738, Col. Coyoacán, Mexico, D.F. 04000, Mexico
e-mail: elsa.sarti@sanofipasteur.com

H. Cox
IPSOS Healthcare, London, UK

S. Besada-Lombana
Sanofi Pasteur, Transversal 23 No. 97-73. Piso 9, Bogota, Colombia

L. Tapia-Maruri
Mexican Society of Public Health, Hershel 109 Col. Anzures, México, D.F. 11590, Mexico

participants to prevent dengue infection was removal of standing water. At least 70% of participants believe their government could do more to prevent dengue in their country.

Conclusions: Dengue was identified as a severe and common disease in Mexico and Colombia. Most participants recognized the need to reduce the risk of dengue infection by removal of standing water. Awareness was similar in Colombia and Mexico.

Keywords: Awareness; Attitude; Dengue; Latin America

INTRODUCTION

Dengue is a common mosquito-borne viral disease of major international, public health concern [1]. The disease is caused by four virus serotypes, DENV-1, DENV-2, DENV-3 and DENV-4, and is transmitted to humans by infected mosquitos [2]. The primary vector responsible for dengue virus transmission is *Aedes aegypti*. However, dengue outbreaks have also been attributed to several other species of mosquito [3]. Infection may not be apparent or may cause a variety of clinical manifestations from mild dengue fever to potentially more severe dengue characterized by plasma leakage and hemorrhage [3]. Severe dengue is usually more often associated with a second heterologous dengue infection, which can be fatal in some cases [4–6].

Current dengue control measures, including the use of insecticides and water management, target the mosquito vector, but are of limited effectiveness [3]. There are no effective antiviral treatments for dengue, and management of the disease is limited to supportive therapy. At present, there are no licensed vaccines for the prevention of dengue disease; however, a number of dengue vaccines are currently in development [7].

The disease is endemic in more than 100 countries in tropical and subtropical regions of the world [3]. An estimated 50–100 million dengue infections occur annually, and in 2010, these resulted in over 2.2 million cases of disease and approximately 20,000 deaths globally [3]. Although the main burden of dengue has historically fallen on Asia and the Western pacific regions [8], a dramatic increase of dengue cases has been reported in the Americas during the past decade [8, 9]. In 2013, there were over 2.3 million cases of dengue informed to the World Health Organization in the Americas sub-region alone [10]. Between 2000 and 2011, the annual number of non-severe dengue disease cases reported in Colombia surveillance data ranged between 22,775 (in 2000) and 147,670 (in 2010), with a case fatality rate among patients with severe dengue disease of 0.1–5.3% recorded during 2000–2010 [11]. In Mexico, the annual number of uncomplicated dengue cases reported increased from 1714 in 2000 to 15,424 in 2011 with a mortality rate of up to 1.2% among patients with dengue hemorrhagic fever [12]. The escalating public health concern with dengue in Latin America has been attributed to a combination of factors that include radical growth of urban populations, migration flow, and insufficient financial resources, compounded by climate change, poor sanitation and poverty [13].

Given the increasing public health concern with dengue in Latin America, it has become paramount that the general population are aware of the disease and undertake necessary precautions and practices to minimize the risk of infection. We therefore undertook this study to assess awareness, knowledge [e.g., about signs and symptoms of dengue disease, preventative

measures/risk reduction and practices undertaken to prevent dengue (by government and individuals)], as well as attitudes toward vaccination in two Latin American countries.

METHODS

Study Design and Participants

This was a community-based, cross-sectional, descriptive study conducted in three countries: Brazil, Mexico and Colombia. The main survey was conducted in 2012 between March and May for the three countries. Additional interviews were conducted in Mexico and Colombia in July and August 2012 to get a representative sample. The most common interview technique used in each country was selected to attain a general population sample. In Mexico and Colombia, interviews were conducted in the participants' homes, whereas in Brazil, interviews were conducted in the street. Due to different methodology used to collect the data in Brazil, the Brazilian data are provided in the supplementary appendix.

Adults aged 18 years or older were eligible for inclusion in the survey. A quota sampling approach was used to obtain a nationally representative sample. Census data from each country was used to set quota, with non-interlocking quotas set by age (age groups 18–24, 25–34, 35–44, 45–54, 55–64 years and ≥65 years in Mexico, and 18–25, 26–35, 36–40, 41–45, 46–50 and ≥51 years in Colombia), gender, socioeconomic classification and region (including endemic vs non-endemic regions for countries with mixed dengue endemicity, i.e., Mexico and Colombia). An endemic region was defined as a region where dengue cases are reported, the vector exists and environmental conditions allow transmission. Quotas were also set to ensure a representative split in terms of urban/rural areas in Mexico and Colombia. The definition of rural was 'those communities with less than 2500 inhabitants' (defined by National Institute of Statistics) [14].

Twenty-nine cities were included in the survey conducted in Mexico, nine in non-endemic regions (Aguascalientes, Chihuahua, Coahuila, Federal District, Durango, Estado de México, Guanajuato, Hidalgo and Querétaro) and 20 in endemic regions (Baja California Sur, Campeche, Chiapas, Colima, Guerrero, Jalisco, Michoacán, Morelos, Nayarit, Nuevo León, Oaxaca, Puebla, Quintana Roo, San Luis Potosí, Sinaloa, Sonora, Tabasco, Tamaulipas, Veracruz and Yucatán). All regions in Mexico included rural areas. In Colombia, the Bogotá region was included as a non-endemic area whereas the Caribe, Oriental, Ori/Amazonia, Sur Oriental, Central and Pacifica regions were included as endemic areas. Twenty cities were included in the survey conducted in Colombia with 19 in endemic areas (Arauca, Barranquilla, Boyacá, Cali, Cartagena, Cartago, Casanare, Caucasia, Cundinamarca, Guainía, Guaviare, Huila, Quindío, Magangue, Malambo, Medellin, Putumayo, Risaralda, Santander) and one in a non-endemic area (Bogota D.C).

Survey Questionnaire and Interviews

The survey questionnaire was drafted in English and then translated in Spanish. A pretest (or survey validation) of the questionnaire was undertaken with four participants (two in each country) within the same target population to assess the suitability and test for any possible vagueness in the questions formulated. The questionnaire comprised 58 questions, taking an average of 25 min to complete. It was divided into eight sections (see supplementary appendix): (1) demographics; (2) health profile, perceptions and behavior in seeking

health advice; (3) general knowledge of infectious diseases; (4) perceptions of dengue disease; (5) personal experience with dengue; (6) family experience with dengue; (7) attitudes toward vaccinations; and (8) perceptions of dengue vaccination. The current manuscript focuses on the first seven sections of the survey only because the questions in Section 8 are purely hypothetical at present as there is currently no licensed dengue vaccine available.

The interviews (one per household) were conducted with residents of households in their homes. The first house was randomly selected according to the geographical localization followed by a systematic selection (i.e., skipping a set number of houses to identify the next household) of remaining houses within the localization. Participation in the study was voluntary and no incentives were provided.

Country-specific profiling questions were included to enable the interviewer to determine the socioeconomic level of the participants to ensure that the correct quota of participants was recruited to attain a general population sample. Social–economic class was categorized according to official national data [15, 16]. In Mexico, this was based on the National Association of Market Research criteria, which used characteristics of the household (number of rooms, bathrooms, lighting and education level). Utility usage was the basis for socioeconomic classification in Colombia.

Data Analysis

No formal statistical power calculation was used in this descriptive study; the sample size in each country was chosen to include at least 800 participants. The survey results were analyzed using Latent Gold version 4.5 (Boston, USA). Participant responses to each question were expressed as relative percentages.

All data were weighted according to age, gender and region to correct for differences between the demographic profiles of the samples surveyed in each country relative to their general adult population. This was done to ensure that the results would be broadly representative of the adult population in each country.

This article does not contain any new studies with human or animal subjects performed by any of the authors.

RESULTS

Participant Population

A total of 1978 participants completed the survey (Mexico, $n = 886$; Colombia, $n = 1092$). Characteristics of participants in both countries are summarized in Table 1. The proportion of participants that lived in urban areas was 30% in Mexico and 79% in Colombia.

Impact of Dengue

More participants in Colombia (10%) reported that they have experienced dengue compared with Mexico (2%). Of those who had experienced the disease, 73% in Colombia and 84% in Mexico described it as severe or very severe (scores from 6–10 on severity scale). The proportions of participants with at least one child who had experienced dengue were 7% in Colombia and 1% in Mexico. The proportion of participants and their children hospitalized as a result of the illness varied considerably by country; however, it should be noted that the base size was small in Mexico ($n = 22$) (Fig. 1).

Table 1 Participant characteristics

	Mexico (*n* = 886)		**Colombia (*n* = 1092)**	
Sex *n* (%)				
Male	432 (49)		534 (48)	
Female	454 (51)		558 (52)	
Age, median	35		40	
	Range (years)	***n* (%)**	**Range (years)**	***n* (%)**
	18–24	230 (26)	18–25	203 (17)
	25–34	195 (22)	26–35	250 (22)
	35–44	170 (20)	36–40	133 (11)
	45–54	123 (14)	41–45	116 (9)
	55–64	80 (9)	46–50	118 (10)
	65+	88 (10)	51+	272 (30)
Residence				
Endemic, *n* (%)	532 (60.0)		906 (83.0)	
Urban, *n* (%)	158 (17.8)		678 (62.1)	
Rural, *n* (%)	374 (42.2)		228 (20.9)	
Non-endemic, *n* (%)	354 (40.0)		186 (17.0)	
Urban, *n* (%)	107 (12.1)		186 (17.0)	
Rural, *n* (%)	247 (27.9)		0 (–)	
Social economic classification	**Class**	***n* (%)**	**Class**	***n* (%)**
	AB	62 (7)	AB	10 (2)
	C+	118 (14)	C1	20 (4)
	C	157 (17)	C2	44 (7)
	C−	153 (17)	D1	183 (22)
	D+	170 (20)	D2	295 (26)
	D	182 (21)	E	202 (18)
	E	44 (5)		

Socioeconomic class categorization varied between countries according to official national data and is beyond the scope of this article [15, 16]

Mexican classification was based on the Asociación Mexicana de Inteligencia de Mercado y Opinión Pública (AMAI) criteria (number of rooms, bathrooms, lighting and education level) [15]: *A/B* it is the segment with the highest standard of living in the country. This segment has covered all welfare needs and is the only level that has the resources to invest and plan for the future, *C+* it is the second layer with the highest standard of living in the country. Like its predecessor, this segment has covered all the needs of quality of life, however, has limitations to invest and save for the future, *C* this segment is characterized by having reached a level of practical life and with certain amenities. It has a basic infrastructure in entertainment and technology, *C−* this segment is characterized by having reached a level of practical life and with certain amenities. It has a basic infrastructure in entertainment and technology, *D+* this segment has covered the minimum sanitary infrastructure of their home, *D* it is the second segment with lower quality of life. It is characterized by having achieved a property, but lacks most of the services and goods satisfactions, *E* this is the segment with lower quality of life and wellbeing. Lacks all the services and goods satisfactions

Colombia classification is defined as follows: *A* higher managerial, administrative, professional, e.g., Chief executive, senior civil servant, surgeon, *B* intermediate managerial, administrative, professional, e.g., bank manager, teacher *C1* supervisory, clerical, junior managerial, e.g., shop floor supervisor, bank clerk, sales person, *C2* skilled manual workers, e.g., electrician, carpenter, *D* semi-skilled and unskilled manual workers, e.g., assembly line worker, refuse collector, messenger, *E* casual laborers, pensioners, unemployed, e.g., pensioners without private pensions

In Colombia, one-third of adults who experienced dengue were hospitalized as a result of the illness, rising to two-thirds of their children.

Awareness and Understanding of Dengue

In Mexico and Colombia, 68% and 76% of participants, respectively, were aware of dengue

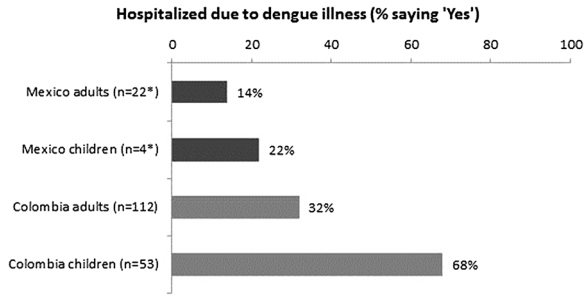

Fig. 1 Proportion of participants and their children who experienced dengue and were hospitalized in Mexico and Colombia. *Asterisk* sample size was small in Mexico. Question 38: Were you hospitalized as a result of the infection. Question 43: Was your child hospitalized?

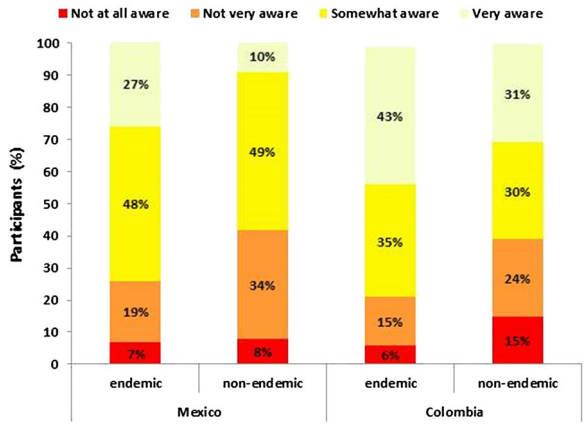

Fig. 2 Awareness of dengue in Mexico and Colombia in endemic and non-endemic areas

but with wide variation within countries (Fig. 2). In Mexico, awareness was higher in endemic regions (74%) than non-endemic regions (58%). Likewise, in Colombia, awareness was also higher in endemic regions (78%) compared with non-endemic regions (61%).

Dengue was considered a common disease by 84% of participants in Colombia and 56% of participants in Mexico. In Mexico, higher proportions of participants considered influenza (75%) and pneumonia (67%) to be common compared with dengue. In Colombia, dengue was considered more common than influenza, meningitis, pneumonia, malaria and whooping cough. Interestingly, much lower proportions of participants considered dengue to be common in their own area. In Mexico and Colombia, 14% and 31% considered dengue to be common in their region, respectively. In Mexico and Colombia, higher proportions of participants living in endemic areas compared with non-endemic areas considered dengue to be common in their region (20% vs 7% in Mexico and 33% vs 18% in Colombia).

The proportion of participants reporting various infectious diseases as life threatening or very severe in endemic and non-endemic regions of each country is shown in Table 2. Dengue was considered a severe disease by more participants than any other disease rated in endemic regions of Colombia. However, in non-endemic regions of Colombia, more participants considered pneumonia or malaria to be severe. In endemic areas of Mexico, more participants considered influenza or pneumonia to be severe and in non-endemic areas of Mexico, more participants considered influenza, pneumonia and whooping cough to be severe.

In Mexico and Colombia, only 44% and 53% of those surveyed, respectively, believed that everyone was at risk of contracting dengue; however, the proportions were higher in endemic regions of Mexico and Colombia compared with non-endemic regions (55% vs 28% in Mexico and 53% vs 46% in Colombia) (Fig. 3). In addition, many believed that those living near water or in a poorer area were at risk of contracting dengue, particularly participants living in non-endemic areas in Mexico and Colombia (Fig. 3).

Table 2 The proportion of participants in Mexico and Colombia reporting various infectious diseases as life threatening or very severe

Ranking	Mexico		Colombia	
	Endemic	Non-endemic	Endemic	Non-endemic
1st	Influenza 51.7%	Influenza 49.5%	Dengue fever 66.8%	Pneumonia 61.3%
2nd	Pneumonia 51.2%	Pneumonia 49.4%	Pneumonia 60.7%	Malaria 50.0%
3rd	Dengue fever 46.5%	Whooping cough 33.8%	Malaria 49.0%	Dengue fever 48.8%
4th	Whooping cough 31.8%	Dengue fever 26.8%	Meningitis 44.0%	Meningitis 32.5%
5th	Malaria 29.0%	Malaria 23.8%	Influenza 42.4%	Influenza 28.8%
6th	Meningitis 21.5%	Meningitis 12.1%	Whooping cough 38.8%	Whooping cough 22.5%

Question 18: Looking at this list of infectious diseases, please indicate how severe these diseases are using a scale of 1–5? *NA* not applicable

Action Taken to Prevent Dengue

A slightly higher proportion of participants in Colombia (68%) than Mexico (61%) believed that controlling dengue was a government responsibility (i.e., proportion with high agreement (scores from 8–10) that controlling dengue was the responsibility of the government). In Mexico and Colombia, 68% and 48% of participants, respectively, believed that their government had undertaken action(s) to prevent dengue infection in the past 6 months. However, 7 out of 10 Mexicans, and 8 out of 10 Colombians believed their government could do more to prevent dengue. Some participants believed that nothing had been done by their government to control dengue in the past 6 months (17% and 27% in Mexico and Colombia, respectively).

When asked to choose the three most informative sources on dengue fever from a list, 45% and 42% of participants in Mexico and Colombia, respectively, selected the government (including central and local government) as a good source of information. The media (including newspapers, TV, radio, flyers, websites, etc.) were considered to be a good source of information by 86% in Mexico and 83% in Colombia, with TV advertisements cited by 36% and 19% in Mexico and Colombia, respectively, and TV news cited by 45% and 49% in Mexico and Colombia, respectively. Only 36–38% of participants in both countries considered their local medical clinic a good source of information.

The top three actions undertaken by participants to prevent dengue infection in each country are displayed in Fig. 4. The most common action to prevent dengue infection in both countries was removal of standing water (69% and 60% of participants in Mexico and Colombia, respectively). Approximately 14% and 5% of Mexicans and Colombians did not undertake any action to prevent dengue as they assumed that their government took care of this. The proportion of participants who took various action(s) to prevent dengue differed depending on whether they lived in a dengue-endemic or non-endemic region (Fig. 5). In Mexico, more participants in endemic areas than in non-endemic areas used mosquito repellent, mosquito nets and took action to reduce the number of mosquito breeding sites; however, overall, respondents in non-endemic

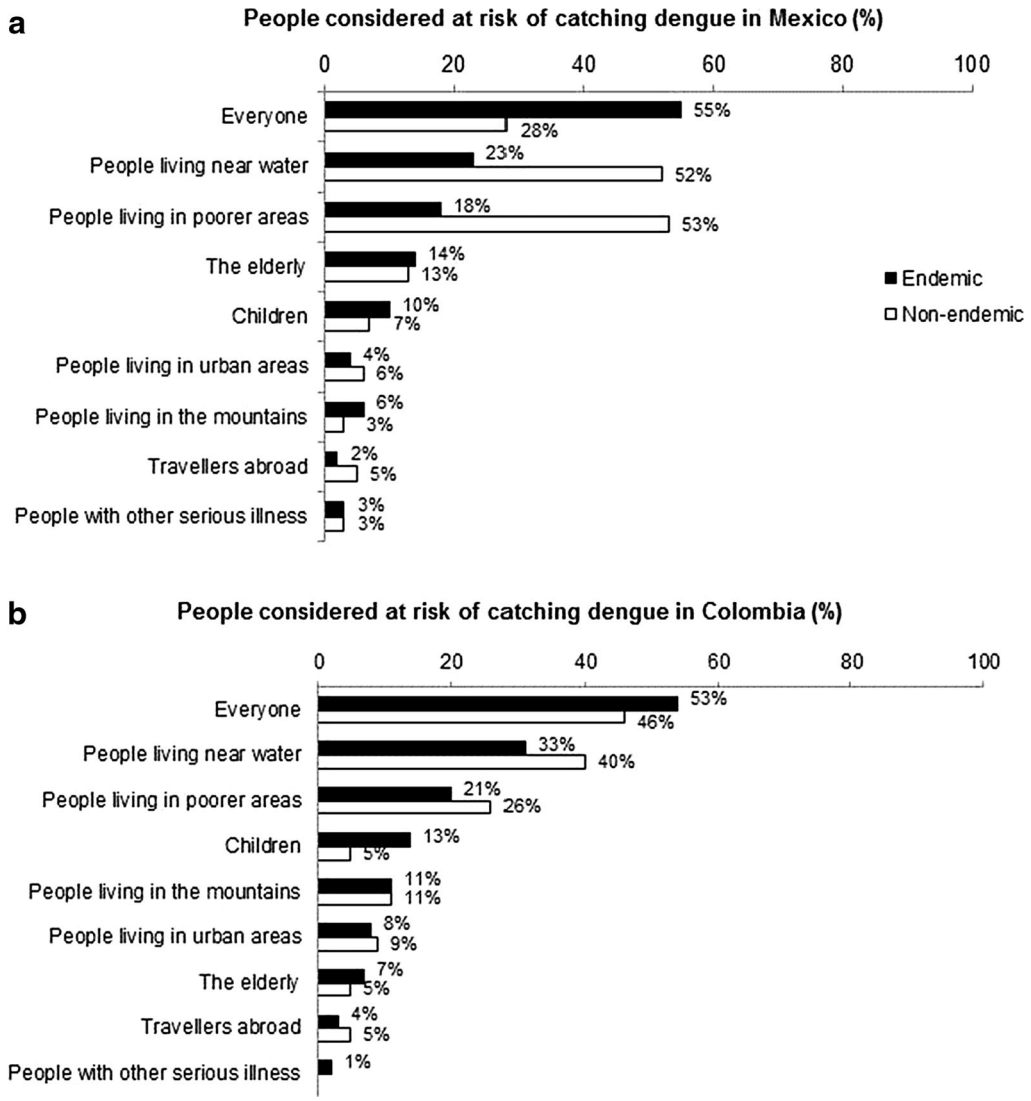

Fig. 3 Participants living in endemic and non-endemic areas considered at risk of contracting dengue in **a** Mexico and **b** Colombia. Question 20: Who do you think is at risk of catching dengue fever in your country?

areas took more actions to prevent dengue than in endemic areas. In Colombia, more people in endemic areas used mosquito nets, took action to reduce the number of mosquito breeding sites and regularly cleared or removed standing water than in non-endemic areas.

Attitudes Toward Vaccinations

There was high uptake of childhood vaccines in all countries (90–95%) as reported by the participants. There was a higher rate of adult vaccination (in the last two years) in Mexico (72%) than Colombia (59%). The vast majority of participants (83%, and 91% in Mexico and Colombia, respectively) had a high level of trust (high agreement score of 8–10) in vaccines to prevent infectious diseases. Only a small proportion of participants in Mexico and Colombia considered that they did not need vaccines because they are never ill (8% and 6%, respectively).

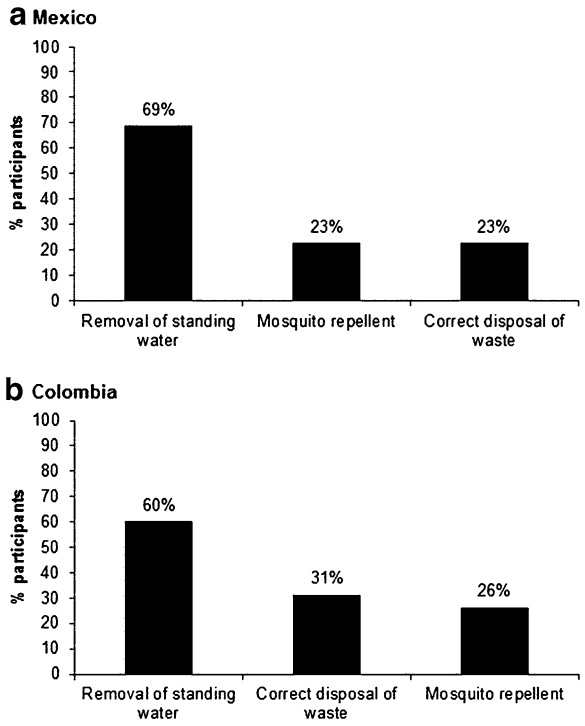

Fig. 4 Top three actions taken by participants to prevent dengue per country in **a** Mexico and **b** Colombia. Question 25: What actions do you personally take to prevent dengue fever?

DISCUSSION

To the best of our knowledge, this is one of the largest surveys concerning dengue involving just under 2000 participants in two Latin American countries. More participants in Colombia (10%) reported that they have experienced dengue compared with Mexico (2%). Of those who had experienced the disease, 73% in Colombia and 84% in Mexico described it as severe or very severe; however, it should be noted that the sample size in Mexico was small ($n = 22$). Approximately one-third of adults who reported they have experienced dengue in the current study were hospitalized as a result of the illness, rising to almost two-thirds of their children. This observation is consistent with the greater burden of illness in children [17, 18].

Awareness of dengue was high in the Latin American countries surveyed (68–76%), but appears lower than awareness of dengue in "classic" endemic regions of Asia (90–99%) [19–21]. Wide variations in dengue awareness have also been reported in the Indian sub-continent, from as high as 90% [22, 23] in some areas to as low as 35% in others [24]. The reasons for the within-country regional variations in dengue awareness may be related to a number of different factors. Studies conducted in Jamaica, Pakistan and Malaysia have reported that dengue awareness was greatest among participants with higher levels of education and in those with higher incomes [20, 23, 25]. One study in Malaysia reported better knowledge among respondents less than 40 years of age [20]. In our study, as expected, awareness was higher in endemic areas compared with non-endemic areas.

The lower incidence of dengue in Mexico compared with Colombia in the 10 years prior to this study may explain the different perceptions of how common dengue is in Mexico (60% perceive dengue to be common) compared to Colombia (>80% perceive dengue to be common) [10]. Given the mass media coverage of the H1N1 influenza pandemic that occurred in Mexico between 2009 and 2012, it is not surprising that influenza was considered more common than dengue by about 20% of Mexicans [26, 27]. As expected, a greater proportion of participants in endemic areas considered dengue to be common in their own area compared with those living in non-endemic areas; however, it should be noted that migration within Mexico is high, at around 22% [28].

The media appeared to be the main source of information on dengue for a high proportion of participants. This is consistent with findings from other studies conducted in Malaysia, Jamaica,

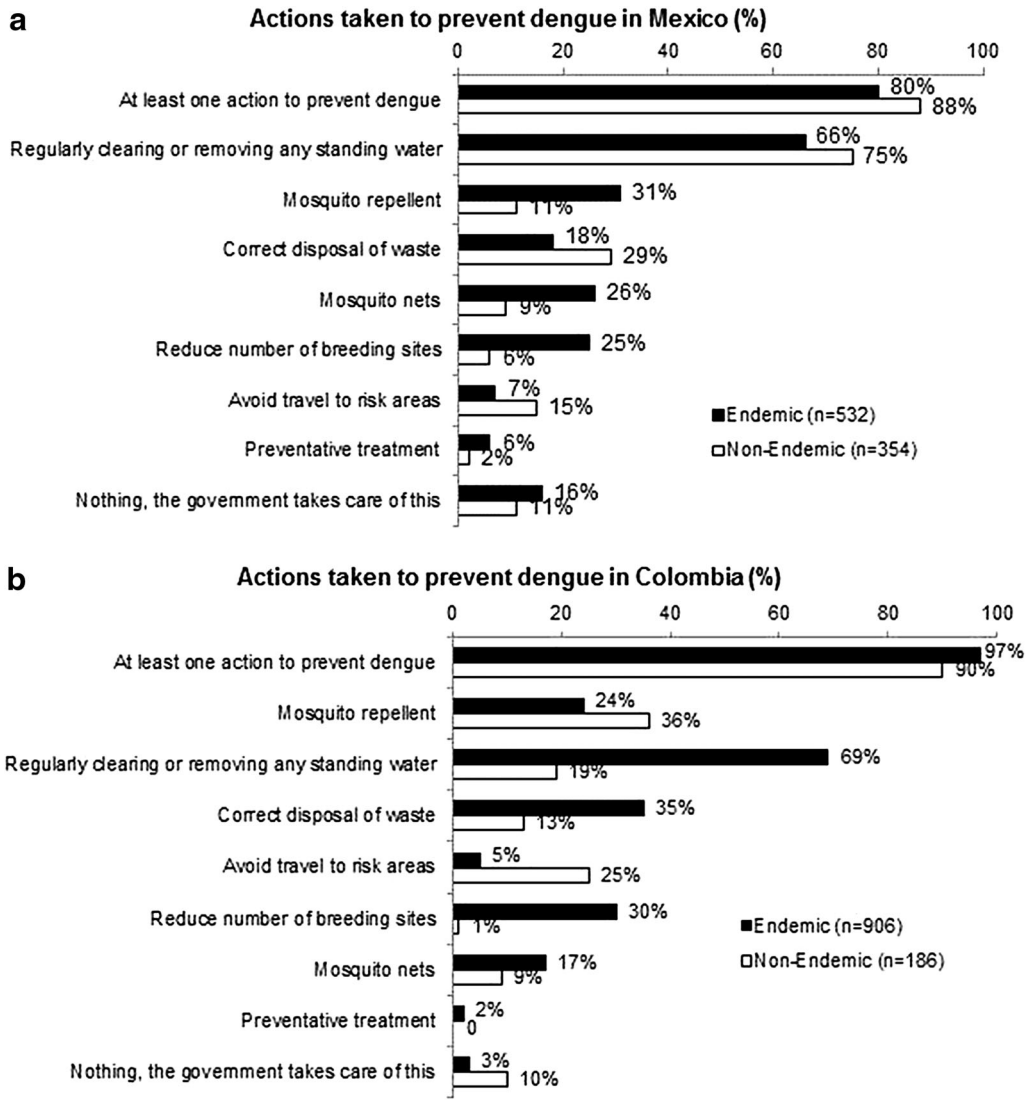

Fig. 5 Actions taken by participants to prevent dengue in **a** Mexico and **b** Colombia in endemic and non-endemic areas. Question 25: What actions do you personally take to prevent dengue fever?

Pakistan and India [19, 20, 22, 23, 25, 29]. In contrast, close personal contacts (friends, family, or neighbors) were found to be the main source of information in one small study of migrant women in Thailand and in another study conducted in Laos [30, 31]. As over 90% of households in Mexico and Colombia have television, it is not surprising that study participants reported the media, and in particular television, as the major source of information on dengue [32, 33]. Television should therefore be considered as an important tool to disseminate information on dengue. However, as the number of independent channel operators increases, there is potentially an increasing risk of misinformation [33].

The main action undertaken by the majority of participants to reduce the risk of dengue was to remove standing water from their locality. Studies conducted in Asia have also shown that

most people generally recognize that the breeding site for the mosquito responsible for dengue is standing/stagnant water [19, 23, 31, 34, 35]; however, they tend to focus on the prevention of mosquito bites, i.e., use of mosquito repellents, rather than eradication of the mosquito population [20, 22, 23, 31, 35]. Across Mexico and Colombia, 14% and 5% of participants, respectively, took no action to prevent dengue infection. In non-endemic areas of Mexico and Colombia, 11% and 7% of participants took no action to prevent dengue infection compared with 16% and 4% in endemic areas. These proportions are similar to those from studies in other countries where approximately 8–16.5% of people said they took no preventative action against dengue [20, 25, 35]. The higher number of participants that took no action to prevent dengue in Mexico, compared with Colombia, is consistent with the lower perception of dengue as a common disease in Mexico.

This study has a number of limitations and caution must be exercised when making generalizations beyond the sample assessed. There is a possibility of interviewer bias combined with the drawbacks of convenience sampling (i.e., a self-selecting cohort willing to participate with the survey). There were also differences in the classification of social demographics between countries, as well as in sampling of endemic and non-endemic cities and urban and rural areas which may hinder direct comparability of the results across the countries assessed. Nonetheless, the strength of this study lies in its large sample size, and comprised a diverse demographic background selected to closely resemble the general population in the respective countries. The data collected here add to the limited literature available in Latin America.

CONCLUSION

Dengue was identified as a severe and common disease, and most participants recognized the need to reduce risk through removal of standing water. Awareness was high in Colombia, but much lower in Mexico. The lower awareness in Mexico could be attributed to the lower incidence of dengue compared with Colombia, and in addition, greater concerns about influenza in Mexico due to the recent H1N1 influenza pandemic.

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Conflict of interest. Elsa Sarti and Sandra Besada-Lombana are employees of Sanofi Pasteur. Helen Cox is an employee of IPSOS Healthcare, funded by Sanofi Pasteur to develop, conduct and report on the survey used in this study. Laura Tapia-Maruri does not have any conflict of interest.

Compliance with ethics guidelines. This article does not contain any new studies with human or animal subjects performed by any of the authors.

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