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Knowledge, attitudes and practices regarding dengue infection in Westmoreland, Jamaica

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Abstract

Background—Dengue virus infection causes significant morbidity and mortality in most tropical and sub-tropical countries of the world. Dengue fever is endemic in Jamaica and continues to be a public health concern. There is a paucity of information on knowledge, attitudes, and practices (KAP) of Jamaicans regarding dengue infection.

Objective—To describe dengue related knowledge, attitudes and practices (KAP) of residents of Westmoreland, Jamaica.

Methods—A cross-sectional questionnaire survey of 192 parents attending child health clinics in the Parish of Westmoreland was conducted.

Results—More than half of the parents (54%) had good knowledge about signs, symptoms, and modes of transmission of dengue. Approximately 47% considered dengue to be a serious but preventable disease to which they are vulnerable. Nevertheless, a majority (77%) did not use effective dengue preventive methods such as screening of homes and 51% did not use bed nets. Educational attainment (OR, 2.98; CI, 1.23–7.23) was positively associated with knowledge of dengue. There was no correlation between knowledge about dengue and preventive practices (p=0.34). Radio and TV were the predominant sources of information about dengue fever.

Conclusion—Our findings suggest that the good knowledge about dengue fever among residents of Westmoreland did not translate to adoption of preventive measures. Health program planners and practitioners need to identify and facilitate removal of barriers to behavior change related to control of dengue fever among the population. Future campaigns should focus on educating and encouraging individuals and families to adopt such simple, inexpensive preventive actions, such as, use of insecticide treated bed nets and screening of homes.

Keywords

Dengue fever; dengue knowledge; attitudes and practices; Westmoreland; Jamaica

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Introduction

Dengue fever is caused by a mosquito-borne human viral pathogen that belongs to the genus Flavivirus of the family Flaviviridae (single-strand, non-segmented RNA viruses). There are four dengue serotypes (DEN-1, DEN-2, DEN-3, and DEN-4).(1) Dengue fever predominantly occurs in Southeast Asia, the Americas, Africa and the Caribbean Islands. There has been a gradual global upsurge in the number of dengue cases in the last decade.(2) Dengue is transmitted in humans by two species of *Aedes* mosquitoes namely, *Aedes aegypti* (principal vector) and *Aedes aldopictus*. Although infection with one dengue serotype confers lifetime immunity against reinfection by the same serotype, there is no evidence of cross immunity.(1) Therefore, it is possible for one to be infected with dengue fever several times during one's lifetime. There are two main forms of dengue disease, dengue fever and the more severe dengue hemorrhagic fever (DHF). Infection with any of the four serotypes can produce a broad range of clinical manifestations including asymptomatic infection, mild flu-like symptoms, and the more severe hemorrhagic fever.(3) The hemorrhagic fever usually results when someone who had prior infection with a particular dengue serotype becomes infected with a different serotype. The cross reaction of antibodies to the dengue antigens is thought to result in this disease.(4) In severe cases, patients may suddenly deteriorate, develop hypothermia and go into circulatory shock, a condition known as dengue shock syndrome.(5) This syndrome is associated with 40–50% fatality if untreated or mistreated. When properly treated, the case fatality can be reduced to 5% or less.(6) Every year, there are more than 100 million cases of dengue worldwide and of these, 2000–3000 cases (mostly children) result in death.(7) In tropical areas where dengue fever is endemic, dengue hemorrhagic fever is confined to children younger than 15 years of age.(8) However, in the Caribbean and Latin America, all ages are affected with highest incidence among those under 15 years old.(9) Treatment for dengue fever entails mainly supportive therapy. Because there is no vaccine to protect against this disease, great emphasis is placed on control and preventive measures.

Dengue fever is thought to have circulated in the Caribbean for more than 200 years, but it was not until 1950s that virological evidence for this was available.(10) By 1953–54, Den-2 was isolated in Trinidad and Tobago while Den-3 was isolated in the 1960s from the Greater and Lesser Antilles.(10) Den-1 was first isolated from Jamaica in 1977 during an epidemic in which 60,000 cases were reported. About 4 years afterwards, Den-4 was isolated and was partly responsible for the massive outbreak of dengue which affected nearly half the population of Cuba in 1981. All four serotypes of dengue currently circulate in Jamaica. More recently, in 1998, there were 1,551 cases of dengue fever caused by the DEN-1 and DEN-3 strains. Forty-two of these cases were DHF while 37 were a combination of dengue and DHF. (9) In 2006, there were 71 confirmed cases of dengue fever in Jamaica (11), and there have been recent large outbreaks of the disease in neighboring Cuba.(12)

Tropical areas such as Jamaica provide a climate that is conducive to breeding of dengue transmitting mosquitoes. Thus, seasonal variations in temperature and rainfall correlate with the levels of dengue infections. Increased numbers of dengue cases are associated with elevated levels of rainfall and temperatures.(13) Given that dengue is a vector borne disease, many initial attempts at curbing the disease were directed at vector elimination using insecticides. However, chemical vector control programs have limited feasibility due to insect resistance and the cost of personnel required to maintain the programs.(9, 14) The WHO and Centers for Disease Control and Prevention recommends limited reliance on insecticidal control and emphasis on community educational campaigns that emphasize residents' responsibility in reducing vector breeding sites.(15, 16) This view is supported by prior research showing that community education can be more effective in reducing dengue vector breeding sites than chemicals alone.(17) The Jamaican Ministry of health classifies

dengue fever as a class 2 disease. Therefore it is given less priority than a class 1 disease such as HIV/AIDS. This prioritization is partly because of budgetary cut backs and resource constraints.(10) Dengue diagnosis is further hampered by availability of only one poorly equipped laboratory in the Island.(10) Thus, samples have to be taken to Trinidad and Tobago for analysis even during epidemics. This underscores the reactionary approach towards dengue control in Jamaica.(10) Nevertheless, Jamaica has a well organized primary health care system which integrates community based health education about environmental control of vector with different levels of care. Attempts have also been made in the past to achieve vector control over limited geographical areas. These attempts were however limited by the lack of sufficient funds.(10) To date, only two published studies have been conducted in the Caribbean to assess Knowledge, Attitudes and Practices (KAP) related to dengue fever and neither of these studies was conducted in Jamaica. One survey study conducted in Grenada (18) in 1996 found that many people had adequate knowledge of dengue fever and mosquitoes, but that knowledge of the important relationships among mosquitoes, human behavior, and disease transmission was sub-optimal. The other study conducted in Puerto Rico, was a qualitative assessment of community beliefs and practices about dengue. Some of the participants had suffered from dengue fever and were identified through the surveillance system. The investigators found that participants with previous dengue diagnosis were more concerned about risk of the disease, had better knowledge about disease prevention and recommended the use of insect repellants more than participants who had never been diagnosed with dengue.(19)

Recent outbreaks of dengue in Jamaica and the paucity of relevant studies on knowledge, attitudes and practices regarding dengue transmission and infection necessitated development of the study. Further, although investments have been made in media campaigns to increase awareness about dengue by government, non-governmental and private institutions in Jamaica, no assessment has been conducted to determine the impact of such interventions or to identify gaps in knowledge and practice regarding dengue infection.

Methods

Study setting

The study was conducted in the parish of Westmoreland which is located on the western end of the island. Westmoreland has an area of 807 square kilometers, and is the 8th largest of the fourteen parishes. Based on the 2001 census, the parish has a population of 138,947. Agriculture, mainly sugarcane cultivation, is the predominant means of livelihood for residents.(20) In 2006, there were 18 suspected cases of dengue in the parish (9 were confirmed). Most of the cases occurred in the Bethel Town, Darliston and Savanna la mar Health Districts.(11)

Study design and participants

A descriptive cross-sectional study was conducted between June and August 2007. From a list of all 21 health centers in the parish, 10 (Darliston, Bethel Town, White House, Savanna la mar, Grange Hill, Negril, Little London, Peters Field, Lambs River, Bluefield) were randomly selected for the study. The Accident and Emergency unit at the Savanna la mar General Hospital was also included. Figure 1 is a map of Westmoreland showing all 21 health centers. Parents attending Child Health Clinics with their children were the target group. Parents of every other child seen at the health facilities were asked to take part in the study. The protocol for the study was reviewed and approved by the Institutional Review Board (IRB) of the University of Alabama at Birmingham, the Advisory Panel of Ethics and Medico-Legal Affairs in the Jamaican Ministry of Health, and the Western Regional Health Authority, Jamaica. Written informed consent was obtained from participants. Participation

in the study was voluntary and no incentives were provided. There is a paucity of data regarding dengue knowledge, attitudes and practices in this area. Therefore, we assumed the most statistically conservative response distribution possible: 50 %. To capture a representative sample of the population of the parish (138,947) with 80% confidence and a 5% margin of error, we estimated that a total of 165 persons were required (Raosoft Inc sample size calculator).

Study instruments and data collection

Following enrollment in the study, data were collected on participants' knowledge, attitudes and practices regarding dengue using an interviewer-administered questionnaire. The study instrument was developed following an extensive review of the literature. Three Delphi review rounds were completed to identify and clarify pertinent questions, verify the purpose of the questionnaire, and discuss appropriate responses.(21) The questionnaire was pretested among two separate groups of 14 residents in Westmoreland who were excluded from the main study. The questionnaire covered the following areas: (1) demographic information (district, sex, age, occupation, and education); (2) health information relating to whether the respondent had had dengue disease or not; (3) knowledge about dengue symptoms, signs, and transmission modes; (4) attitude towards dengue; (5) preventive practices against dengue e.g. methods used to reduce breeding sites, and reduce potential human-mosquito contact (repellents, bed nets, and window screens). Data were collected from a total of 192 respondents.

Data Analysis

The data were analyzed using SAS software package version 9.1 (Statistical Analytical System, Gary, NC). Four men who were interviewed were excluded from the analysis because they may have viewpoints which differ essentially from the women. Simple frequency tables were prepared for the socio-demographic variables and for knowledge, attitudes and preventive practices. Responses to questions were coded such that correct answers were scored 1 and incorrect answers were scored 0. These were added to arrive at a single value out of a possible total score of 29 for knowledge, 3 for attitude, and 12 for practice. Knowledge was assessed based on 29 questions grouped under the following three categories: 1) Knowledge of the symptoms of dengue 2) Knowledge of dengue transmission 3) Knowledge of dengue management. These are shown in Table 2. Respondents were considered to have adequate knowledge if they correctly answered 80% of the questions.

Similarly, a positive attitude was assessed based on the ability of participants to give correct answers to the following 3 questions: 1) Dengue is a serious illness; 2) You are at risk of getting Dengue; 3) Dengue can be prevented; (Table 4). Respondents were regarded as having an appropriate attitude towards dengue if they scored 80% of the questions.

Preventive practices were assessed based on 12 questions grouped into the following two categories: 1) Preventing mosquito-man contact and 2) Eliminating breeding sites of mosquitoes around the household (Table 5).

Participants were deemed to have adequate preventive practices if they answered 80% of the questions correctly. Odds Ratios (OR) and associated 95% confidence intervals (95% CI) for the association between KAP and socio-demographic variables were calculated by logistic regression. For adjusted models, a backward-selection process was performed, with socio-demographic variables known to be associated with dengue knowledge, attitude and practice entered into the model.

Results

As shown in Table 1, the mean age for the 192 respondents was 31±8.5 years. We excluded the 4 males in the sample since they constituted a small proportion of the participants. Excluding them did not meaningfully change the results. The literacy level was high with 45.5% of the respondents having completed high school education. Approximately 44% of the participants were in *a common-law union (living with a partner)* compared to 42.7% who were single, divorced or widowed and 13.4% who were married. A substantial proportion (41.7%) of the respondents was unemployed.

Knowledge about dengue fever

Low percentages of respondents were able to correctly identify typical symptoms of dengue such as fever (49.5%), rashes (34.0%), joint pains (32.5%,) and muscle pain (2.1%) (Table 2). On the other hand, most participants were aware that flies and ticks do not transmit dengue fever (66.5% and 71.8% respectively). When asked about available measures to prevent contact with mosquitoes, many respondents (58.0%) were aware that screening windows and using bed nets reduced contact with mosquitoes. Many (68.1%) cited use of insecticide sprays as a means of destroying mosquitoes while 62.2% felt that covering water containers reduce mosquito breeding. Many participants felt it was necessary to remove standing water (68.6%), use mosquito repellants (47.9%), cut bushes (68.1%) and pour chemicals on standing water (66.5%) to prevent mosquito breeding and contact with mosquitoes. With respect to management of dengue, 29.8% said they would not take aspirin for dengue illness while 66.5% said they would; 3.7% were unsure. About three-quarters (72.3%) of the participants said they would get plenty of rest if they had dengue; 22.3% would not while 5.3 were unsure. Regarding sources of information on dengue fever (Table 3), most participants reported that they had heard of dengue through the TV/radio (97.3%). Participants also obtained information from brochures (94.6%), neighbors (94.6%), and schools (88.7%), newspapers (76.3%) and health workers (54.8%).

Attitudes and practices regarding dengue disease

Table 4 shows that most participants strongly agreed (63.8%) and agreed (23.4%) that dengue is a serious illness. Thus, 87.2% of participants effectively appreciated the serious nature of the disease. Also, about 80% of participants strongly agreed (40.9%) or agreed (39.4%) agreed that the disease is preventable. Only 21.2% of the respondents thought they were at risk of contracting dengue fever (5.8% strongly agreed and 15.4% agreed). Some participants undertook preventive activities to avoid contact with mosquitoes (Table 5). For instance, 61.7% used insecticide sprays; 56.4% employed professional pest control services, 22.9% screened their windows from mosquitoes and 4.8% used bed nets during the night.

With regards to KAP scores, 54.4% of participants achieved at least 80% on the knowledge score, 46.6% obtained at least 80% on the attitude score and 28.5% obtained 80% on the preventive practices scale.

In the univariate analysis of the associations between dengue knowledge, attitudes, practices and socio-demographic characteristics of the study group, we found increased odds of having correct knowledge about dengue if one has completed secondary education (Odds ratio (OR), 2.00; 95% Confidence Interval (CI), 1.04–3.85) or completed technical training, college or post college studies (OR, 2.98; 95% CI, 1.23–7.23). No significant association was found between preventive practices and socio-demographic characteristics of the participants.

There was no correlation between knowledge about dengue and preventive practices (p=0.34).

Discussion

Our study sought to assess public knowledge, attitudes and practices related to dengue infection in Westmoreland, Jamaica. Our findings suggest a good level of knowledge which is not commensurate with attitudes and practices directed at reducing the prevalence of the disease. The literacy rate of 99.4% (based on use of completed primary education as a surrogate) is above the national average of 86%.(22) This could be due to confounding element of health seeking behavior among the more the educated members of society.

The knowledge level on dengue fever reported in this study is comparable to findings in similar KAP studies conducted in Grenada(23) and Thailand.(24) Most respondents were not able to correctly relate the symptoms of dengue apart from a few who identified fever, an obvious symptom. Fever was also the most frequently recalled symptom in a similar study conducted in India.(25) Almost half the respondents rejected pain behind the ears (which is often due to swollen lymph glands) as a plausible symptom. This could be because pain behind the ears is not a commonly described symptom(6) or perhaps because participants had not personally experienced the disease, nor witnessed a case from a close relative or friend. The poor knowledge of the spectrum of symptoms associated with dengue means it may be confused with most other causes of fever such as the flu. The implication of this is that presentation to the clinic may be delayed until complications arise.

Knowledge of means of dengue transmission was equivocal with respect to possible transmission through blood transfusion and needle stick injury: approximately 45% of the participants thought the disease could be contracted through blood transfusion or needle stick injury. However, it is noteworthy that it is in rare instances (during the acute stage of the disease) that the virus may be passed in blood or organ transplant.(26) While 40% of participants were aware that person to person contact cannot lead to acquisition of dengue, there still remained an appreciable 60% of respondents who needed to be educated appropriately in order to ensure that they have correct information.

The A*edes aegypti* mosquito is known to bite mostly during several hours after dawn and before dusk.(27) Interestingly, only about 3% of respondents were aware of this unique behavior of the vector. Bridging this gap in knowledge is essential in the design of programs to educate residents on personal protection against mosquitoes. Most respondents were aware of measures to protect themselves against contact with mosquitoes through window screening, use of bed nets, covering standing water, removal of standing water, cutting bushes and spraying with chemicals. Yet, a smaller proportion considered the use of repellants. It is possible that the cost of purchasing these repellants may be responsible for their low use. More than three-quarters were aware that avoiding standing water and use of window screens are beneficial.

Knowledge of management strategies for the disease was high among respondents. However, 67% reported they would take Aspirin if they had dengue disease. Aspirin is known to increase the bleeding tendencies in patients with dengue fever and is therefore contraindicated. Aspirin is a drug that is frequently taken to reduce fevers. Taking this drug without a proper diagnosis of dengue fever could tip the patient into bleeding diastases. Though participants agreed they would get plenty of rest if they had dengue (72%) and drink lots of water (67%), it is possible that these are the usual remedies they would take if they were ill from any other disease. Respondents indicated that Radio and Television were the predominant sources of information regarding dengue. Secondly, only about half of

participants obtained information about dengue disease from health workers. Thus, information, education and communication (IEC) intervention programs may need to be reviewed so that health workers can maximize the opportunity of clinic visits, to communicate effective ways of preventing dengue disease.

Almost 80% of residents do not use effective preventive methods such as mosquito screening of homes while 95.2% do not use bed nets. This may be because unlike other tropical places where malaria is prevalent, until recently, malaria was not common in Jamaica. Thus, people do not take measures known to protect against mosquito borne diseases. It may also be that the cost of employing these strategies is too high for some participants given competing demands for scarce household financial resources. Thus, contact between vectors and humans persist.

From the foregoing, it is apparent that most people (54.4%) had fair knowledge of dengue fever, but this was associated with appropriate attitudes in only 46.6% of participants. Furthermore, only 28.5% of respondents were engaged in positive preventive practices. This is in consonance with findings in other studies where knowledge about dengue fever did not necessarily translate to positive attitudes and improved preventive measures.(24, 28) On the other hand, our findings run contrary to findings in a study done in a rural area of Sao Paulo, Brazil(29) where strong positive attitude was associated with knowledge about dengue fever. The associations we found between educational level and knowledge about dengue have been shown in another study,(30) and could be a general indication of access to more information about diseases as a result of higher literacy level. Poignantly, the fair knowledge and average positive attitude about dengue did not translate into high levels of preventive practices. Indeed, there was no correlation between both variables, a finding that has been reported in other studies.(31) (32)

Our findings must be interpreted in the light of several potential limitations the most apparent of which may be the fact that a cross-sectional survey assesses relationships based on one point in time and it does not account for the dynamics of relationships between variables evaluated. Besides, it is possible that since the survey was interviewer based use of questionnaires, some participants would provide socially desirable responses to some questions.(33). Thirdly, the small sample size may have limited our ability to detect associations that were small and moderate in magnitude and yielded estimates that lacked precision. Furthermore, we excluded males from the study; this has implications for the genaralizability of our results to the whole populace of Westmoreland. However, since most women in Westmoreland use the clinics from which the women were randomly sampled, the results have external validity to women in Westmoreland, Jamaica.

In conclusion, we submit that in spite of our study limitations our findings highlight the need for further information, education and communication programs to identify barriers to action and to seek ways to translate population knowledge about dengue into positive preventive practices that would ultimately reduce the transmission of dengue in this parish and other parishes in Jamaica.

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Table 1

Socio-demographic characteristics of study participants, Westmoreland, Jamaica, 2007

Variable	Number (N=188)	Percent
Gender		
Female	188	100
Age group (years)		
<20	13	6.8
20–24	39	20.3
25–29	38	19.8
30–34	37	19.3
35–39	31	16.2
≥40	34	17.7
Education		
Some Primary, completed primary or some secondary	69	35.9
Completed secondary	88	45.8
Technical training, college or post college	35	18.2
Marital Status		
Single, Divorced or widowed	80	42.8
Married/Common-law union*	107	57.2
Occupation		
Unemployed	78	40.8
Unskilled or vendor	26	13.6
Semi-skilled, skilled or lower management	87	45.6

Mean age ± Standard deviation = 31 ± 8.5 years

*Living with a partner, this has legal status in Jamaica.

Sum of N for some variables may not equal total N due to missing responses

Table 2

Knowledge about Dengue fever among 188 residents of Westmoreland, Jamaica, 2007

Variable	Number (percent) YES	Number (percent) NO
Knowledge of symptoms		
Is fever a symptom of dengue	93 (49.5)	95 (50.5)
Is headache a symptom of dengue fever	78 (41.5)	110 (58.5)
Is joint pains a symptom of dengue fever	61 (32.5)	127 (67.6)
Is muscle pain a symptom of dengue fever	4 (2.1)	184 (97.9)
Is pain behind the eyes a symptom of dengue fever	105 (55.9)	83 (44.1)
Is rash a symptom of dengue fever	64 (34.0)	124 (66.0)
Is abdominal pain a symptom of dengue fever	103(54.8)	85 (45.2)
Knowledge of transmission		
Do flies transmit Dengue fever?	63 (33.5)	125 (66.5)
Do ticks transmit Dengue fever?	53 (28.1)	135 (71.8)
Do all types of mosquitoes transmit Dengue fever?	68 (36.2)	120 (63.8)
Does the *Aedes* mosquito transmit Dengue Fever?	117 (62.6)	70 (37.4)
Does person to person contact transmit Dengue fever?	74 (39.4)	114 (60.6)
Can Dengue fever be transmitted by a blood transfusion?	88 (46.8)	100 (53.2)
Can Dengue fever be transmitted by a needle stick?	85 (45.2)	103 (54.8)
Can Dengue fever be transmitted by sexual intercourse?	0 (0)	188 (100)
	Number	**Percent**
When are the Dengue mosquitoes likely to feed/bite?		
Night time	98	52.1
Day time	5	2.7
Both day and night	70	37.2
Don’t know	15	8.0
Mosquitoes breed in standing water		
Yes	137	72.9
No	45	23.9
Don’t know	6	3.2
Window screens and bed nets reduce mosquitoes		
Yes	109	58.0
No	75	39.9
Don’t know	4	2.1
Insecticide sprays reduce mosquitoes and prevent Dengue		
Yes	128	68.1
No	58	30.9
Don’t know	2	1.1
Covering water containers reduce mosquitoes		
Yes	117	62.2
No	67	35.6

Variable	Number (percent) YES	Number (percent) NO
Don't know	4	2.1
Removal of standing water can prevent mosquito Breeding		
Yes	129	68.6
No	53	28.2
Don't know	6	3.2
Mosquito repellants prevent mosquitoes		
Yes	90	47.9
No	75	39.9
Don't know	23	12.2
Cutting down bushes can reduce mosquitoes and Dengue		
Yes	128	68.1
No	54	28.7
Don't know	6	3.2
Pouring chemicals in standing water can kill mosquito Larvae		
Yes	125	66.5
No	51	27.1
Don't know	12	6.4
Knowledge of management		
Would you take Aspirin for Dengue?		
Yes	125	66.5
No	56	29.8
Don't know	7	3.7
Would you get plenty of rest for Dengue fever?		
Yes	136	72.3
No	42	22.3
Don't know	10	5.3
Would you drink plenty of water for Dengue fever?		
Yes	126	67.0
No	51	27.1
Don't know	11	5.9
Would you consult a physician for dengue fever?		
Yes	185	98.4
No	3	1.6
Is there a treatment for dengue fever?		
Yes	136	72.7
No	7	3.7
Don't know	44	23.5

Note: Sum of N for some variables may not equal total N due to missing responses

Table 3

Sources of information on dengue fever (N=186)

Sources of information	Number (percent)	Number (percent)
	Yes	No
TV/Radio	181(97.3)	5 (2.7)
School	165 (88.7)	21 (11.3)
Health workers	102 (54.8)	84 (45.2)
Mass meetings	0 (0)	186 (100)
Loud speaker	92 (49.5)	94 (51.5)
Brochures	176(94.6)	10 (5.4)
Newspaper	142 (76.3)	44 (23.7)
Neighbors	176(94.6)	10 (5.4)
Child	0(0)	186 (100)

Table 4

Attitude towards dengue fever among 188 residents of Westmoreland, Jamaica, 2007

Variable	N=188	
	Number	Percent
Dengue is a serious illness?		
Strongly agree	120	63.8
Agree	44	23.4
Disagree	7	3.7
Strongly Disagree	4	2.1
Not sure	13	6.9
You are at risk of getting Dengue		
Strongly agree	11	5.9
Agree	29	15.4
Disagree	25	13.3
Strongly Disagree	11	5.9
Not sure	112	59.6
Dengue Fever can be prevented		
Strongly agree	77	41.0
Agree	74	39.4
Disagree	11	5.9
Strongly Disagree	7	3.7
Not sure	19	10.1

Sum of N for some variables may not equal total N due to missing responses

Table 5

Preventive practices against dengue fever among 188 residents of Westmoreland, Jamaica, 2007.

Variable	Number (percent)	Number (percent)
Preventing mosquito-man contact	**Yes**	**No**
Use insecticide sprays to reduce mosquitoes	116 (61.7)	72 (38.2)
Use professional pest control to reduce mosquitoes	106 (56.4)	82 (43.6)
Use screen windows to reduce mosquitoes	43 (22.9)	145(77.1)
Use fans to reduce mosquitoes	52 (27.7)	136 (72.3)
Use bed nets to reduce mosquitoes	9 (4.8)	179 (95.2)
Eliminate standing water around the house to reduce mosquitoes	106 (56.4)	82 (43.6)
Cut down bushes in the yard to reduce mosquitoes	97 (51.6)	91 (48.4)
Use mosquito eating fish to reduce mosquitoes	3 (1.6)	189(98.4)
Use mosquito coils to reduce mosquitoes	149 (79.3)	39 (20.7)
Does nothing to reduce mosquitoes	31 (16.5)	157 (83.5)
Eliminating mosquito breeding sites		
Covered water containers in the home	148 (80.4)	36 (19.6)
Frequency of cleaning water filled containers and ditches around the house.		
Always	65 (43.6)	
Often	53 (35.6)	
Sometimes	29 (19.5)	
Never	2 (1.3)	

Sum of N for some variables may not equal total N due to missing responses