

# BREAK YOUR BONES

Mortality and Morbidity Associated with Haiti's  
Chikungunya Epidemic

Athena R. Kolbe, Augusta Herman and Robert Muggah



*photo by Smuay*

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### Mortality and Morbidity Associated with Haiti's Chikungunya Epidemic

Athena R. Kolbe<sup>1</sup>, Augusta Herman<sup>2</sup> and Robert Muggah<sup>3</sup>

In December 2013, chikungunya, a debilitating dengue-like virus spread by mosquitos, was first diagnosed in the Americas on the island of St. Martin. The disease quickly spread to neighboring islands and on May 7 the Haitian Ministry of Health confirmed 14 cases.<sup>4</sup> A week later that number had increased to more than 1,500. Within two weeks of its purported arrival, it had risen to more than 5,500 cases. Epidemiologists report that chikungunya is likely to keep spreading.<sup>5</sup>

Although most Caribbean nations were able to control and respond to the outbreak, chikungunya has been merciless in Haiti. Lack of basic infrastructure, poor mosquito control measures, and deep social and economic disparities hampered prevention and treatment efforts. Shortly after the outbreak was announced, an Igarapé Institute-led research team was dispatched to conduct a nationwide survey to determine the risks and protective factors for infection with chikungunya. The Institute has coordinated similar assessments of spread of cholera and food security in the wake of natural disasters, as well as violence and victimization.

Between 19-30 May 2014, a total of 2,807 randomly sampled households (accounting for 13,760 individuals) from all ten geographic departments were interviewed, as were 446 randomly sampled tourists departing the Port-au-Prince airport. An additional survey of market conditions was conducted in Port-au-Prince and the seaside town of Jacmel. A qualitative component to the study included five focus groups (ten participants in each group) and 27 in-depth interviews. The qualitative interviews and focus groups were conducted in Jacmel and the greater Port-au-Prince area.

#### Key findings include:

- **There are clear signs of therapid and uncontrolled spread of chikungunya.** The virus had infected 9.2% of individuals in the study, affecting 14.3% of households (n=402).
- **Both children and adults are susceptible to the virus;** 493 adults (8.6% of all adults) and 767 children (9.6% of all children) registered symptoms of chikungunya.
- **There are several statistically significant risk factors associated with the virus.** These include having a household member with chikungunya, living in a displaced persons camp, a past diagnosis of dengue fever in the household, and rice farming.

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<sup>4</sup> Jamaica Observer (May 7, 2014).

<sup>5</sup> Haiti Libre (May 13, 2014); Herriman (2014); Roos (2014).

- **Some evidence-based practices to prevent chikungunya are not being regularly applied.** Although treated nets are a relatively affordable and effective method of preventing mosquito-borne diseases they were seldom used by surveyed households. Open water containers – in which mosquitos can breed - were found outside of most rural homes and half of all urban and peri-urban homes.
- **Most Haitians resort opt for traditional means to treat chikungunya.** More than three quarters of ill individuals (n=971; 77.1%) were treated using traditional medicine, either at home or by a traditional medicine practitioner. For chikungunya, traditional medicine is often used in conjunction with biomedical treatments.
- **There is a high level of resignation among the population that they will contract the virus.** More than half of the survey respondents (n= 1466; 52.2%) either agreed or strongly agreed with the statement, “even if I spend a lot of money and time trying to prevent it, I will still get chikungunya.”

## BACKGROUND

Chikungunya is spreading fast across the Caribbean, and Haiti in particular. Since first detecting the virus in late 2013, the Caribbean Public Health Agency reported more than 135,000 confirmed cases by June 2014, with signs also of infections in the United States.<sup>6</sup> The World Health Organization (WHO) predicts that these numbers will escalate, especially in Haiti where chikungunya was first detected in May, owing to the large numbers of people exposed to open water containers.<sup>7</sup>

Over the past decade chikungunya has reemerged as a public health threat across Africa and Asia.<sup>8</sup> An enzootic virus transmitted by the *Aedes* mosquito, it was, until recently, confined to parts of South Asia and the tropical and subtropical regions of Sub-Saharan Africa. The WHO reports that since 2004, the virus has spread to parts of Western Europe and the Caribbean.<sup>9</sup> Like dengue, another mosquito-borne virus, the disease causes severe morbidity and, occasionally, death.

The word chikungunya is derived from the Makonde phrase “kun qunwala” which means “that which is contorted” or “that which bends up”. This is in reference to the way victims of the virus twist in pain. Chikungunya symptoms including high fever and rash are similar to those associated with dengue fever, which is spread by the same mosquito. But the distinguishing feature of the chikungunya virus is excruciating pain in the joints which can persist for months or even years after the febrile stage of the disease.<sup>10</sup>

Though chikungunya is generally not fatal in healthy adults, it has nevertheless emerged as a serious public health concern.<sup>11</sup> The virus can cause long-term and even permanent arthritis symptoms in the elderly, but also individuals with pre-existing medical conditions, and even in pregnant women and newborns. In children and infants, high fevers as well as accompanying seizures and dehydration can lead to serious complications or worse.<sup>12</sup>

<sup>6</sup> Fox News, 2014.

<sup>7</sup> Baron & Fieser, 2014.

<sup>8</sup> Burt, et al, 2012.

<sup>9</sup> WHO, 2014.

<sup>10</sup> Soumahoro, et al, 2011.

<sup>11</sup> Burt, et al, 2012.

<sup>12</sup> Anish, et al, 2011; Gopalan & Das, 2009.

The virus has a short incubation period and spreads quickly, often infecting several members of a single household. Furthermore, chikungunya is complicated by health problems common in the developing world and among African people and people of African descent.<sup>13</sup> Diabetes and pre-existing hypertension, in particular, have been associated with more severe symptoms and death among chikungunya patients. The current recommended biomedical treatment is over-the-counter doses of acetaminophen to reduce fever, pain and joint inflammation. There is no cure for chikungunya and vaccines are still in the early stages of development.

## METHODS

### Household survey

The Igarapé Institute-led team has administered a range of survey-based assessments in Haiti since 2010. Household surveys are a valuable tool for gathering information about vulnerable segments of Haiti's population, particularly since many of them are not registered in formal administrative data collection systems.<sup>14</sup> The present assessment was rapidly administered by an experienced team of Haitian and international researchers including 32 national enumerators. Fielding of the survey started on May 19 and was completed on May 31, 2014.

In order to survey a large enough sample of the population to generate generalizable findings, the team applied Random GPS Coordinate Sampling (RGCS) to identify and interview a total of 2,807 households throughout the country. The number of households chosen per commune was based on the population of the commune as reported by the national statistics office.<sup>15</sup> The response rate for this survey was 82.5% which is similar to previous household surveys in Haiti.<sup>16</sup>

A two-member research team visited selected homes and randomly selected an adult over the age of 18 to interview. The adult was asked to provide information about themselves and all other household members during a 35-minute interview. Responses were recorded by the enumerators using an android tablet survey application.<sup>17</sup> Respondents received no remuneration for participation in the study though were provided with basic health care advice, a package of mosquito repellent coils, and written information on chikungunya at the conclusion of the interview.<sup>18</sup>

<sup>13</sup> Cooper, et al, 2005; Lloyd-Jones, Adams, & Brown, et al., 2010.

<sup>14</sup> Using a standardized approach to sampling and data collection allows researchers to compare population groups including specific vulnerable populations as well as to examine the differences across geographic regions. See Kolbe and Muggah (2010) and Shannon et al, 2012.

<sup>15</sup> The population figures provided by the national statistics office are projections based on a 2003 census and may not reflect the current reality on the ground. Yet no other reliable national population statistics by commune are publically available.

<sup>16</sup> A total of 3,400 households were approached to participate in the survey. Each household was visited up to four times until an adult living in the home could be found to consent for the survey. A randomly chosen household member over the age of 18 was then invited to complete the survey. In 226 locations, no adult was located during the four visits. In 46 households the adult chosen was ineligible to participate due to disability (cognitive impairment, dementia, deaf and did not communicate orally or in writing, etc.). The remaining 321 households refused to participate in the study. The most common reasons for refusing to participate were lack of time (n= 152; 47.3% of refusals) and suspicions about the tablets used for data collection or the motivations of the survey team (n=60; 18.6% of refusals).

<sup>17</sup> Android tablets with the isurveysoft application were used to collect data. The survey took 25-30 minutes to complete. When responding to sensitive questions the respondent was asked to press an icon on the tablet screen to record their answer in order to ensure their anonymity and preserve the confidentiality of their responses. The study protocols were reviewed and approved by the Ethical Research Committee of the Institute of Social Work and Social Science (Ensititi Travay Sosyal ak Syans Sosyal) in Petionville, Haiti.

<sup>18</sup> Trained research team members provided basic medical advice about the virus. "Trained research team members" included medical, public health, and nursing students who completed a 12-hour public health training on chikungunya prior to fielding. Written materials were produced in low-literacy Haitian Creole and French with extensive pictorial aids. These handouts included information from the Ministry of Public Health and focused on mosquito control, home care treatment, and treatment options using a biomedical approach.

## SURVEY OF TOURISTS

Whilst media reports indicate that the chikungunya outbreak has not yet affected tourism in the Caribbean,<sup>19</sup> this Strategic Note assesses the short-term impacts of the chikungunya outbreak on Haiti's emerging tourism industry. The current administration has identified tourism as a priority in improving Haiti's economy.<sup>20</sup> Significant funding for the Ministry of Tourism has been devoted to positioning Haiti as tourist destination with support devoted to training in tourism and business, planning and promotion of tourist areas, improving the transport sector, and the introduction of performance standards and legal frameworks in related projects. Foreign direct investment in tourism has exploded in recent years with new upscale hotels operated by American and European firms opening in the capital area.

Most of Haiti's tourists enter and leave the country via the Toussaint L'Ouverture International Airport (Mais Gate), located on the outskirts of Port-au-Prince. Drawing on methods applied in a study of tourists by the Igarape Institute in 2013, a random selection of tourists departing the airport were identified and invited to respond to an orally administered survey.<sup>21</sup> The team applied random sampling methods to tourists departing the airport with every nth individual approaching an airport entryway being selected and screened to determine their status as a departing tourist.<sup>22</sup> Study inclusion criteria included being aged 18 or older, entering Haiti on a tourist visa, staying in Haiti for less than 90 days, and not engaging in income-generating activities while in Haiti.<sup>23</sup>



*The area surrounding slow moving rivers, streams, and reservoirs, like this one in Jacmel, provide an ideal habitat for infected mosquitoes.*

*Photo by Augusta Herman*

<sup>19</sup> Lopez, 2014; TravelMail, 2014.

<sup>20</sup> See previous Igarape Institute assessments of tourism in Haiti at <http://pt.igarape.org.br/is-tourism-haitis-magic-bullet-an-empirical-treatment-of-haitis-tourism-potential/>.

<sup>21</sup> [http://igarape.org.br/wp-content/uploads/2013/06/NE\\_9\\_Is-Tourism-Haiti%E2%80%99s-Magic-Bullet\\_\\_7jun.pdf](http://igarape.org.br/wp-content/uploads/2013/06/NE_9_Is-Tourism-Haiti%E2%80%99s-Magic-Bullet__7jun.pdf).

<sup>22</sup> Surveys were conducted by interview pairs who chose every nth person to interview randomly based on a Kish number table. So, if the random number for that enumerator for that hour was 5, every fifth person was approached. Everyone who looked to be over the age of 14 was approached, even those who appeared to be Haitian nationals, and were asked a series of screening questions to determine if they were a tourist and eligible for the study. Survey consent was obtained orally and then the team completed an eight minute survey with the respondent.

<sup>23</sup> Survey interviews with tourists were conducted in English, French, Creole, and Spanish and data was entered on to a tablet-based survey application. Portuguese, Italian, German, Korean, Vietnamese and Tagalog surveys were available for respondents to complete in hard copy if they did feel comfortable completing their interview in one of the languages spoken by the research team. The survey of tourists was administered over a ten-day period ending May 31, 2014. Of the 530 tourists invited to participate in the study, 446 agreed to do so, giving a response rate of 84.1%. The most common reason for declining to participate was lack of time (n=61; 72.6% of refusals).

## MARKET SURVEY

One concern expressed by the Ministry of Public Health (MSPP) early in the epidemic was of predatory price increases by medication providers.<sup>24</sup> During a May 20 press briefing the MSPP warned pharmacies against such actions and recommended that the population purchase medication only from licensed vendors.<sup>25</sup>

To determine how the chikungunya epidemic has impacted cost of prevention and treatment items, research team members visited 100 randomly selected pharmaceutical providers (80 in Port-au-Prince and 20 in Jacmel) and 50 randomly chosen vendors carrying a particular common brand of mosquito repellent (40 in Port-au-Prince and 10 in Jacmel). Sites were chosen through RGCS with the first vendor due north of GPS coordinate being chosen. Half of the pharmaceutical providers sampled were MSPP approved.<sup>26</sup>

At each site a research team member purchased an adult dose of paracetamol (acetaminophen) or a particular, commonly found brand of mosquito repellent coils. The cost of each item was recorded by the purchaser and his/her research team partner after leaving the site. The owner or salesperson was not informed of the study prior to or after the interaction. The cost of these items was compared to prices for the same items purchased in Port-au-Prince and Jacmel on April 15 and 22 respectively.<sup>27</sup> The average (mean) price of each item on each day was then calculated.



Haitian marketplace - Saint-Marc

photo by McIninch

<sup>24</sup> See *Haiti Libre* (May 25, 2014).

<sup>25</sup> The MSPP press release states: "Souhaitons que le MSPP, demande à la population d'acheter des médicaments uniquement dans les pharmacies autorisées et met en garde l'industrie pharmaceutique contre toute forme d'augmentation de prix sans justification dans la vente de leurs produits." It can be found online at <http://www.mspp.gouv.ht/site/downloads/CHIKUNGUNYA%20GAGNE%20ENCORE%20DU%20TERRAIN%20.pdf>.

<sup>26</sup> The research team continued randomly sampling until half of the vendors visited that day were MSPP-approved pharmaceutical providers. At that point, only providers who were not MSPP-approved were included in the sample. This enabled us to compare those pharmacies which have submitted to Ministry approval guidelines with providers which have no government oversight. MSPP approved vendors were identified by a current blue MSPP certificate displayed in the pharmacy.

<sup>27</sup> Since 2004, researchers currently associated with the Igarape Institute and Enstiti Travay Sosyal ak Syans Sosyal have been tracking the cost of 250 household items (including a range of items from bullets, mangos, and dry milk to diapers, medications, and insect repellent). The price of each item in randomly chosen locations throughout the country is recorded on a quarterly basis. The data from that study was used to find the mean cost of each item in April 2014 for this report.

## QUALITATIVE COMPONENT

The focus of the qualitative component was on increasing understanding of indigenous responses to the epidemic including treatment approaches, knowledge about disease transmission and opinions about the risks and protective factors associated with chikungunya. Qualitative interviews and focus groups were conducted by a team that included four Haitian graduate students studying anthropology and social work, two undergraduate social work students, and an American medical anthropology student. Participant recruitment was administered using snowball sampling by approaching community members and seeking others, through respondents, who have been impacted by chikungunya.

Interviews were continued until information saturation was reached and no new information was provided by participants. In all, five focus groups (with ten participants in each group) and 27 in-depth interviews were completed. The qualitative interviews and focus groups were conducted in Jacmel and the greater Port-au-Prince area beginning May 15 and concluding on May 30, 2014. Interview and focus group notes and transcripts were analyzed using a grounded theory approach as this best suited the research question and the skills of the research team.

## DEMOGRAPHIC PROFILES

The demographic profiles of survey participants were analogous to other household surveys conducted in Haiti by the authors and others.<sup>28</sup> The average reported household size was 4.89 individuals (SD= 2.7 individuals). The average reported age of adult respondents was 28.6 years (SD= 9.8 years). As in previous assessments, slightly more women (n=1429; 50.9%) than men (n= 1378; 49.1%) participated in the survey, which is similar to the percentage of females in the general population. In rural areas the most common occupations were farming, charcoal production, and being a merchant. In urban areas the most common occupations were skilled manual labor, family service-oriented business, and being a merchant.

The 2,807 households accounted for 13,760 individuals in total; of these, 8,003 (58.2%) were children under the age of 18. Slightly less than half of all households included children (n=1,252; 44.6%), though these children were sometimes not the biological children of the head of household. Households included several generations of extended family members as well as girlfriends/boyfriends, common-law and polygamous marriages, as well as adopted, fostered, and *restavek* children.<sup>29</sup> Rural households had more children on average than urban and suburban households. Rural households were also largest on average, followed by suburban households, and then urban households. Households residing in camps for Internally Displaced Persons (IDPs) were smallest with an average household size of only 4.11 individuals.

Meanwhile, the demographics of tourists who responded to the survey were similar to a previous Igarape-led survey of tourists to Haiti.<sup>30</sup> Slightly more than half were male (n=228; 51.1%). The mean age was 32.9 years (SD: 12.0 years). Two thirds traveled outside the Port-au-Prince metropolitan area (n=279; 62.5%). Half traveled to Haiti alone rather than with family members, friends or a group (n=214; 47.9%). Slightly less than half were of Haitian descent (n=219; 49.1%).

<sup>28</sup> See <http://pt.igarape.org.br/after-the-storm-haitis-coming-food-crisis/> and <http://pt.igarape.org.br/the-economic-costs-of-violent-crime-in-urban-haiti/>.

<sup>29</sup> A *restavek* is a child who works for another household as a domestic servant in exchange for room, board, and (sometimes) schooling. *Restaveks* generally range from 6-16 years of age; most are female. Household surveys conducted by other researchers sometimes exclude *restaveks*, however we include them as household members in this study as they reside only with the family with whom they work.

<sup>30</sup> [http://igarape.org.br/wp-content/uploads/2013/06/NE\\_9\\_Is-Tourism-Haiti%E2%80%99s-Magic-Bullet\\_\\_7jun.pdf](http://igarape.org.br/wp-content/uploads/2013/06/NE_9_Is-Tourism-Haiti%E2%80%99s-Magic-Bullet__7jun.pdf).

## THE EXPERIENCE OF CHIKUNGUNYA

Chikungunya was present in 14.3 percent of surveyed households (n=402). In total 493 adults (8.6% of all adults) and 767 children (9.6% of all children) reported symptoms indicative of chikungunya; this accounted for 9.2% of the entire study population.<sup>31</sup> Of those reported to have chikungunya, 22 died during the study period: 6 children and 16 adults (1.7% of those with those with chikungunya). All of the deaths were individuals with preexisting medical conditions, most commonly heart problems or diabetes, and who also lived in households that were in the lowest 25 percentile of income. The mortality rate was higher than that found in other geographic areas (1 death/1000 cases)<sup>32</sup> though the reason for this is unknown and it is not clear if this will change over the life of the epidemic as increased resources are devoted to identification, treatment and prevention.

Chikungunya was detected in all ten of Haiti's geographic departments (see figure 1). The highest numbers of cases were registered in the Ouest, or Western Department. This department also features the highest population of all ten departments. When looking at the percentage of individuals in the study who reported symptoms of the virus, it is clear that individuals in the Sud-Est or South-East were most likely to have reported chikungunya, followed by those in the Centre, the Nord-Est, and the Artibonite.



*Funeral for a 32-year-old mother of two from Port-au-Prince who died of chikungunya in May 2014.*

*photo by Vilius Yvon*

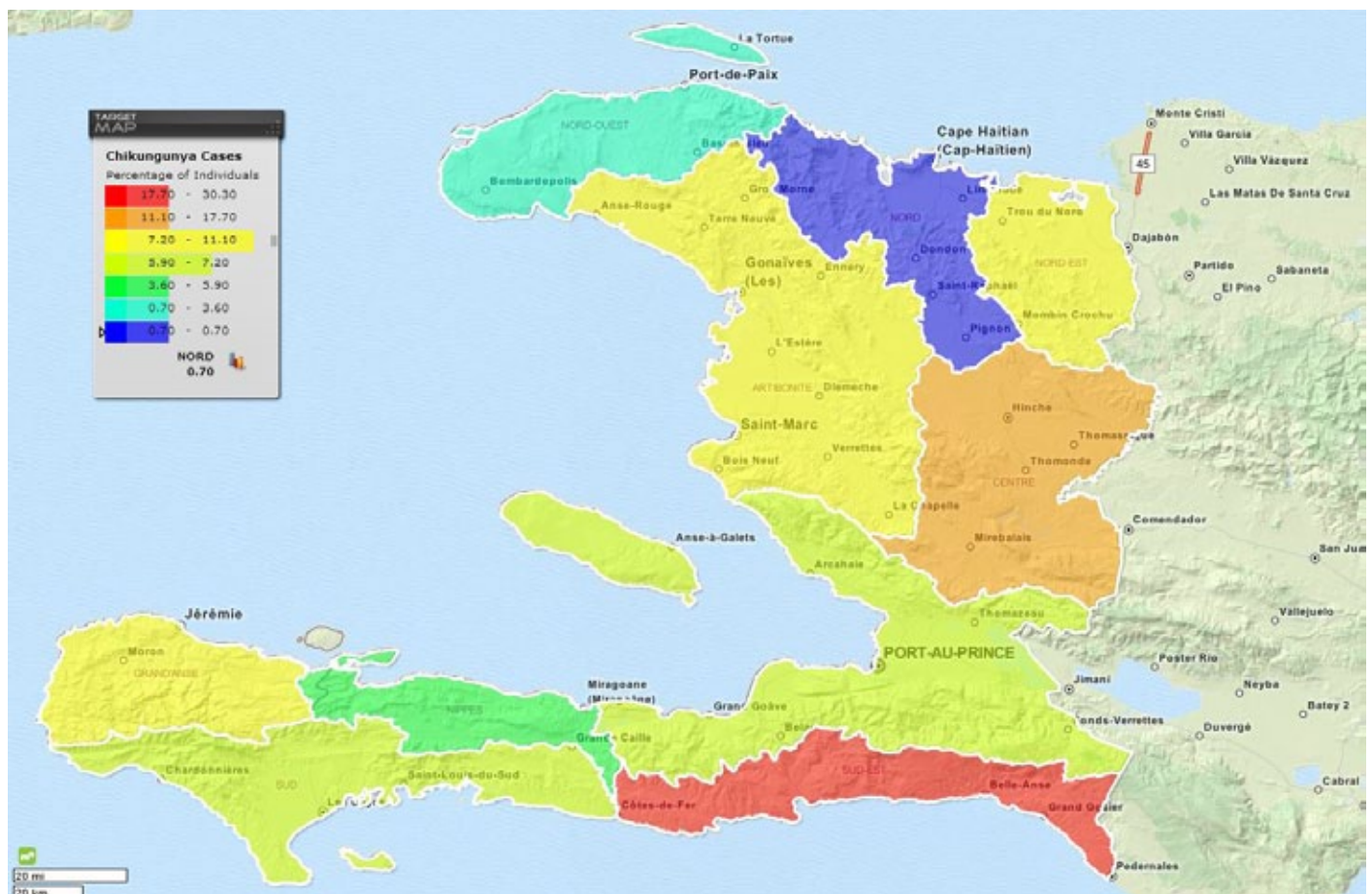
<sup>31</sup> Most ill individuals had not seen a doctor and been diagnosed; therefore only those who exhibited joint pain, bone pain or joint inflammation with a rash were included in these figures. Individuals who had a rash but no joint pain, bone pain or inflammation were assumed to have dengue fever and are not included in these figures. Therefore, this may be an underestimation of the true number of chikungunya cases thus far.

<sup>32</sup> Mavalankar, et al, 2008.



**Figure 1. Chikungunya Cases by Department**

Department	Number of households surveyed	Number of chikungunya cases	Percentage of department study population <sup>33</sup>
Ouest	1,036	365	7.2
Sud-Est	163	242	30.3
Nord	275	10	0.7
Nord-Est	101	55	11.1
Artibonite	444	235	10.8
Centre	190	165	17.7
Sud	199	70	7.1
Grande-Anse	121	59	10.0
Nord-Ouest	188	33	3.6
Nippes	90	26	5.9



Source: Created with study data using Target Map software.

<sup>33</sup> Number of chikungunya cases divided by number of individuals in the household survey from that department.

## RISKS AND PROTECTIVE FACTORS

There was disagreement among study participants as to who is most at risk of contracting chikungunya. Some believe that those living in highly dense neighborhoods or rice farming areas are most at risk, while others attribute risk to particular behaviors including sleeping without a sheet covering one's face or eating outside in the evening. But in general, most study participants felt resigned to eventually acquiring chikungunya at some point if they were not already infected. As one young man in a Port-au-Prince focus group put it, "if you're alive, you're at risk."

There are several statistically significant risk factors for the virus revealed in this study. These include having another household member with chikungunya, living in an IDP camp, a past diagnosis of dengue fever in the household in the previous 24 months, having four or more uncovered water containers within 10 meters of the living space, having "fetch buckets of water" as a daily chore, and being a rice farmer.

Likewise, statistically significant protective factors include being in the upper 25 percentile of household income<sup>34</sup>, using treated bed nets, taking recent action to remove/cover/treat open water containers near home, living in an arid or high mountain climate, having a home with piped water and a covered cistern, and using repellent techniques on a daily basis for the 10 days prior to completing the survey.

A 2012 study commissioned by the MSPP and funded by the United States Agency for International Development found that just 19 percent of households surveyed reported using an insecticide-treated bed net.<sup>35</sup> Though treated nets are a relatively affordable and effective method of preventing mosquito-borne diseases, they are reportedly seldom used by respondents. Furthermore, nets (both treated and untreated) were frequently in disrepair with holes or tears that allowed mosquitos to enter the covered sleeping area.

Shared bed space also hampered the effectiveness of bed nets as those sleeping against the net are sometimes bitten through the material while it rests against their skin. One qualitative participant took off his shirt during the interview to show his left arm was covered with dozens of mosquito bites. Sharing a bed with his brother and cousin left the participant with his left arm flush against the mosquito net. He was exposed despite the fact that the net was treated. He explained that mosquitos were invulnerable to the insecticide:

*In Haiti we have a stronger type of mosquito than the mosquitos found in other countries. You can burn leaves or coils, you can spray them [with commercial repellent], and you can slap them between your hands. The mosquitos are zombies! They return from the dead and bite again and again. With a curse it is possible that a person can send mosquitos to torture you. You cannot rid your home of them as much as you try to do so! The Haitian mosquito will survive even death.*

Though the presence of zombie mosquitos was not supported by this study, the frustration that many respondents expressed with ridding their homes of mosquitos was well supported by surveys and qualitative interviews. Mosquitos appeared to be resistant to some locally produced products designed to kill or repel insects. During one focus group a research assistant sprayed the room with an aerosol product purchased in Haiti and produced in the Dominican

<sup>34</sup> It should be noted that "taking action to remove/cover/treat open water containers" and "having piped water and a covered cistern" were both strongly correlated with being in the upper 25 percentile of household income.

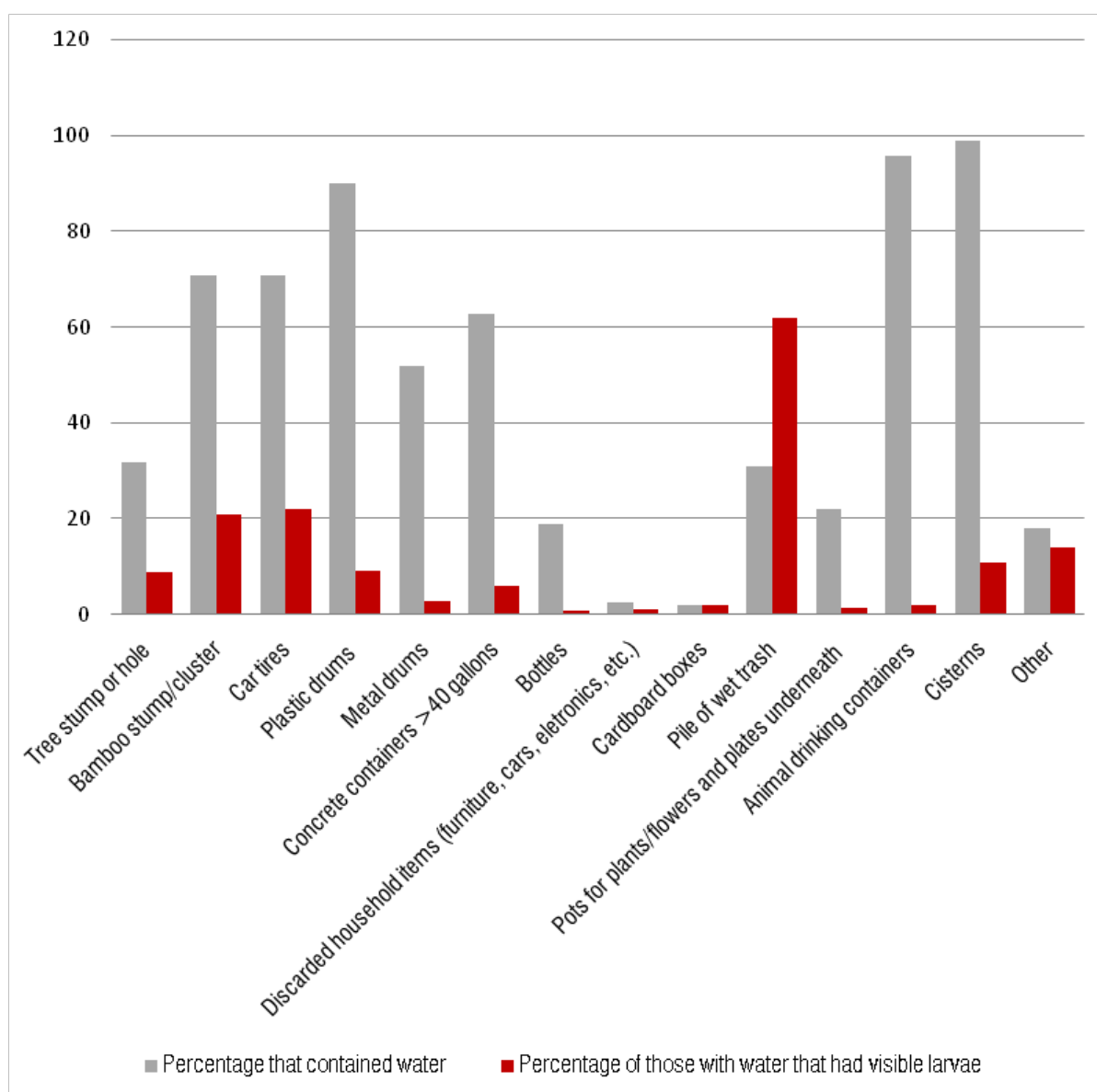
<sup>35</sup> MSPP & USAID, 2012.

<sup>36</sup> Similar stories were reported by focus group participants using a particular Haitian-made aerosol spray.

Republic. Within minutes the mosquitos that had fallen to the ground during the spraying began twitching and moving. Within thirty minutes the “stunned” mosquitos were up and flying again. It is possible that some products do not contain the insecticide they claim to contain or have lower amounts than specified on the packaging.<sup>36</sup>

In addition to bed nets, controlling open water access can reduce the presence of mosquito larvae. The space surrounding the dwelling place of survey respondents was examined for water catchment areas including uncovered wells, open water storage containers, animal watering troughs and the like (see figure 2). Water catchment areas were found outside of most rural homes and roughly half of all urban and peri-urban homes. The presence of four or more water catchment containers within 10 meters of the home was positively correlated with both a history of dengue fever in the household and with symptoms of chikungunya.<sup>37</sup> Water catchment areas were visually inspected for mosquito larvae.<sup>38</sup>

Figure 2. Water Containers Near Home (With and Without Visible Mosquito Larvae)



<sup>37</sup> Dengue fever and chikungunya are spread by the same type of mosquito.

<sup>38</sup> At every 20th site with larvae, up to 10 larvae were collected per sample using a plastic pipette. These were placed in vials of 70% alcohol and retained for future testing.

## EXPERIENCE OF THE ILLNESS

Fever, achiness, pain in the joints, fatigue, and rash were the most commonly reported symptoms in both children and adults (see figures 3 and 4). Headaches, experienced by 5.1% of adults and 19.2% of children and adolescents, were intermittent and typically not localized.<sup>39</sup> Pains in the neck, back, and extremities were commonly reported as was pain “in the bones”. This last symptom gave rise to the virus’s Haitian Creole nickname “kaze le zo” (or “kraze zo” which translates to “breaking your bones” or “breaking bones”). The bone pain was described by focus group participants and interview respondents as “screeching”, “breaking”, or “cracking.”

Participants in the qualitative component of the study agreed that an early sign of chikungunya is a rash or bumps that appear on various parts of the body, including the chest, arms, and legs. Joint and bone pain then followed quickly after.<sup>40</sup> Swollen and painful lymph nodes were widely reported by individuals who also reported having diarrhea in the 30 days prior to experiencing symptoms of chikungunya. After the febrile stage of the illness concluded, chikungunya patients reported dry and flaking skin, continued rashes and bumps, and small knots on their scalp. Joint pain lasting several weeks or more was also reported as was continued fatigue which many respondents attributed to the body’s tardiness in expelling the “bad blood” caused by the virus.

**Figure 3. Symptoms Present in Adults (n=493)**

Symptom	Number Reporting	Percentage
Achiness/pain all over	465	94.3
Bone pain	392	79.5
Conjunctivitis	20	4.1
Cough	141	28.6
Dizziness	108	21.9
Dry/flaking skin	75	15.2
Fatigue	426	86.4
Fever	480	97.4
Headache	123	24.9
Hypertension <sup>41</sup>	25	5.1
Inflammation of joints	368	74.6
Inflammation of muscles	102	20.7
Itchiness	191	38.7
Joint pain	473	95.9
Joint stiffness	217	44.0
Knots/bumps on scalp	26	5.3
Loss of appetite	176	35.7
Loss of taste	30	6.1
Mouth ulcers/lesions	27	5.5
Muscle pain	128	26.0
Muscle weakness	250	50.7
Nausea/stomach “churning”	44	8.9
Night terrors/bad dreams	16	3.2
Other sleep disturbances	35	7.1
Profuse sweating	132	26.8
Rash/skin lesions	431	87.4
Seizures	6	1.2
Sore throat	56	11.4
Stomach ache	66	13.4
Swollen/painful lymph nodes	189	38.3
Unable to walk	88	17.8
Vomiting	29	5.9

<sup>39</sup> No chikungunya sufferers reported a headache that was primarily “pain behind the eyes,” which is associated with dengue. Headaches were most commonly reported in adolescents.

<sup>40</sup> With some patients, the pain seems to locate itself at points of previous injuries while rashes were often localized on healing or recent injuries or tattoos. Though tattoos are rare in Haiti, all individuals in the study who had a tattoo and got chikungunya reported that the rash was worse at their tattoo site or that it was localized on tattoo sites. This was true even for individuals who had not recently been tattoo (one patient was tattooed more than 15 years prior and the rash only occurred on tattoo sites: back left shoulder, right upper arm, left forearm and the back of the right leg).

<sup>41</sup> Among individuals with no history of hypertension.

**Figure 4. Symptoms Present in Children (n=767)**

Symptom	Number Reporting	Percentage
Acts/looks "strange"	222	29.9
Achiness all over	740	96.5
Bedwetting/soiling self <sup>42</sup>	69	9.0
Bone pain	473	61.7
Conjunctivitis	38	5.0
Cough	230	30.0
Dizziness	240	31.3
Dry/flaking skin	170	22.2
Fatigue/excessive sleeping	613	80.0
Fever	742	96.7
Headache	147	19.2
Inflammation of joints	528	68.8
Inflammation of muscles	184	24.0
Irritable/fussy	475	61.9
Itchiness/scratches self	341	44.5
Joint Pain	697	90.9
Knots/bumps on scalp	39	5.1
Lacks interest in play & normal activities/listless	656	85.5
Loss of appetite/refuses to suckle breast or bottle	407	53.1
Loss of taste	31	4.0
Mouth ulcers/lesions	42	5.5
Muscle pain	228	29.7
Muscle weakness	366	47.7
Nausea/stomach "churning"	116	15.1
Night terrors/bad dreams	98	12.8
Other sleep disturbances	104	13.6
Profuse sweating	235	30.6
Rash/skin lesions	699	91.1
Seizures	55	7.2
Sore throat	61	8.0
Stomach ache	182	23.7
Swollen/painful Lymph nodes	310	40.4
Unable to walk	64	8.3
Vomiting	94	12.3

Only 31 adults (6.3%) and 52 children (6.8%) were taken to see a medical professional for their illness. Among those who had visited a doctor or clinic, a third were tested including blood draws, stool samples and urine samples. Half of those who visited the doctor or a clinic described being physically examined by a medical professional including having their blood pressure, weight/height or temperature measured, having someone listen to their heart or lungs using a stethoscope, or the medical professional touching or examining their body (stomach area, rash sites, inside of mouth/throat, and joints were the most commonly examined parts of the body). In the other cases, the medical professional diagnosed them only by asking questions. Blood tests were only reported by patients who saw a doctor within a week of developing symptoms.

More than three quarters of ill individuals (n=971; 77.1%) were treated using traditional medicine, either at home or by a traditional medicine practitioner. Home treatments included changes in diet, rest, drinking a lot of water, bathing several times each day, herbal remedies (see figure 5), and bundling (wrapping the feverish person in layers of sheets, blankets, and clothing). Bathing in medicinal herbs three or four times a day was believed to treat the

<sup>42</sup> Excludes children who have not yet been toilet trained.

rash or prevent it from spreading. Bathing was done with or without traditional medicine additions to the bath water. Individuals who bathed in three or more times a day were more likely than other chikungunya patients to say that their fever lasted fewer than four days.

Bundling was reported with nearly all of the children under age 5 with chikungunya; it is a common practice in Haitian culture for the treatment of fevers in babies and children. Medical professionals frequently advise against this practice, telling caregivers to bath the child instead or to loosely cover them with light clothing or sheets. One female focus group participant in Jacmel explained, “this [bundling] is how we treat fevers; since it works I will do it even though the nurse [at the clinic that treated by child] told me not to do it. When you can’t afford medication, you do what you can to help your baby get well.”

Traditional medicines were widely used by both household survey respondents and participants in the qualitative component of the study. Asosi tea is notable as it was used to both prevent chikungunya as well as to treat the symptoms of weakness, malaise, fatigue and to remove impurities from the blood. Cleansing of the blood was a common theme in both qualitative interviews and in survey responses. Both specific herbal teas and intravenous (IV) medication or fluids (called “serum”) are believed to remove impurities from the blood, which respondents say is an essential part of healing from the virus.

The “hierarchy of resort” refers to the sequence of options, in order of preference, which individuals will use when treating an illness.<sup>43</sup> For chikungunya, Haitians preferred to use traditional medicine (generally teas to cleanse the blood) in combination with biomedical approaches including paracetamol or intravenous (IV) fluids as their first option.<sup>44</sup> Intensive or more expensive or extreme options for traditional medicine are then instituted if biomedical treatments fail. The order of preference for biomedical treatment was IV medication followed by injections, capsules and tablets. It is worth noting that the most common local brand of acetaminophen (paracetamol) comes in a tablet form. The importance of the form of medication administration rather than the actual medication given was emphasized in both open-ended responses to survey questions as well as in qualitative interviews and focus groups. IV fluids (called “serum”) were commonly understood by respondents to be a biomedical technique for removing impurities from the blood.



*In Cite Soleil, a man gives his neighbor acetaminophen to relieve her joint pain.*

*Photo by Vilnius Yvon*

<sup>43</sup> Schwartz, 1969.

<sup>44</sup> Interestingly, with other common illnesses, including dengue fever, the hierarchy of resort usually starts with home care and teas, followed by paracetamol in conjunction with herbal remedies, and then clinic treatment. The intensive public information campaign surrounding chikungunya, which includes messages from the MSPP to treat with paracetamol, may be part of the reason that biomedical approaches are sought first in conjunction with traditional remedies at home.

**Figure 5. Traditional Treatments Used for Chikungunya**

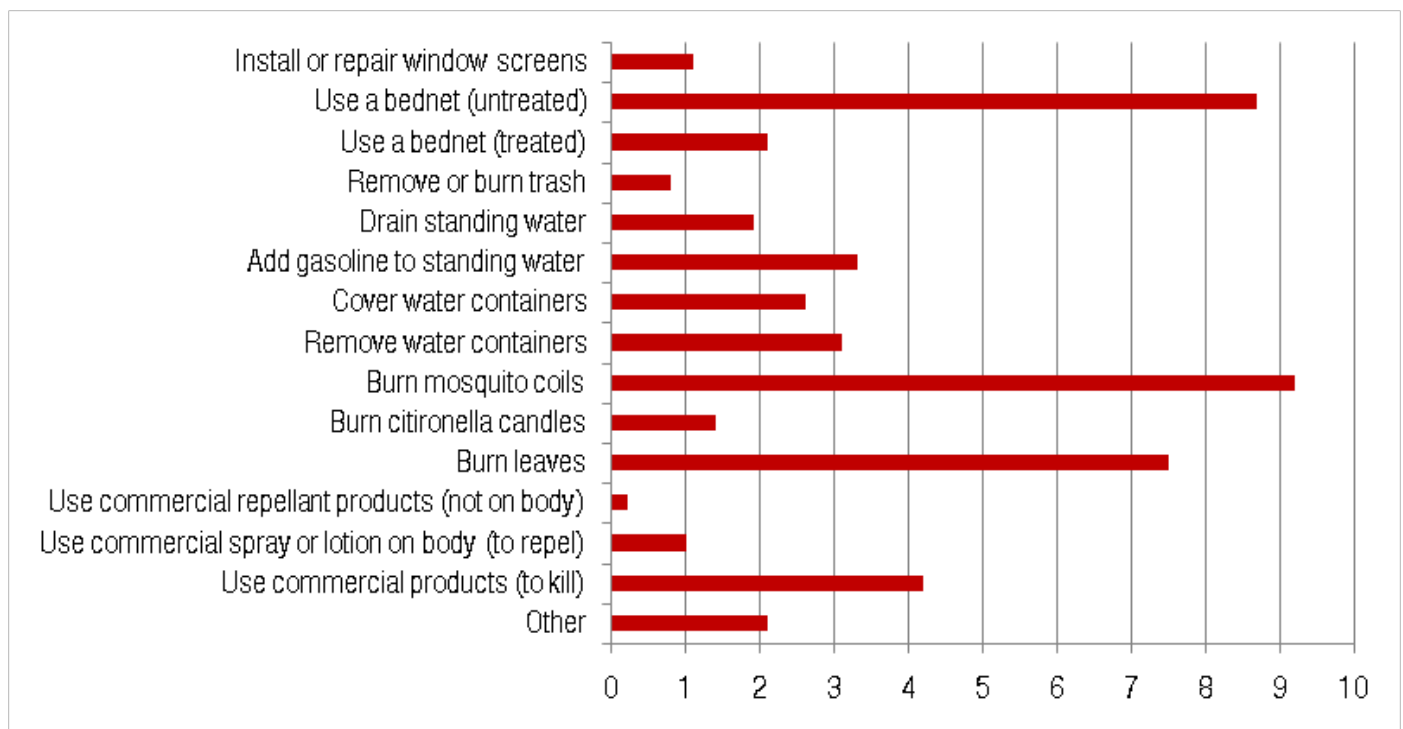
Plant/Tree	Method	Targeted Symptom
Aloe (leaves)	Tea made of leaf sap	Fatigue, inflammation
Aloe (leaves)	Leaf sap on skin	Itching, rash, skin irritation from scratching
Asosi/asorosi/cerasse (leaves)	Tea	Weakness, headache, general malaise, remove impurities from the blood, prevention of chikungunya
Bay rum tree (leaves and seeds)	Decoction in bath or poultice on skin	Inflammation, joint pain
Beet (root)	Cooked, added to food	Weakness, fatigue, general malaise in children, remove impurities from the blood
Chapantye (leaves)	Tea	Joint inflammation
Cinnamon (bark)	Tea	Nausea, vomiting
Citron (fruit)	Juice or tea with honey	Swollen and painful lymph nodes
Cloves (flower bud)	Tea, added to food	Stomach ache from taking pain-killers
Fey lang chat/catnip (leaves)	Tea, infusion	Fever, nausea, malaise in babies and small children, remove impurities from the blood
Fey lang chat/catnip (leaves)	Tincture	Seizures
Fey lang chat/catnip (leaves)	Bath, paste of crushed leaves	Infected or irritated rash
Flèjalouzi, henna (leaves, flower)	Decoction in bath or poultice on skin	Headache, aching feet, rash, skin irritation from scratching
Flour (white) with white rum (klarín)	Paste	Itching, skin irritation
Garlic ("paper" <sup>45</sup> )	Tea	Hypertension, fever, swollen and painful lymph nodes, joint inflammation Nausea, vomiting
Ginger (root)	Tea	Fever, inflammation, joint pain, general malaise, remove impurities from the blood
Goat weed (leaves)	Tea	Stomach ache from taking pain-killers, nausea, remove impurities from the blood
Guava (leaves)	Tea (with salt)	Gargled for sore throat, added to hot water and drunk for hypertension or fever
Kenip tree (leaves)	Decoction	Stomach ache from taking pain-killers, remove impurities from the blood
Kenip tree (seeds)	Powder of roasted seeds	Sleep disturbance, hypertension Joint pain
Kowosòl/ Soursop (leaves)	Tea	Fever, headache, inflammation, joint pain, rash
Lignum vitae (leaves)	Poultice on skin	Headaches
Mascreti/Castor (seeds)	Oil on skin	Stomach ache from taking pain-killers, Sleep disturbance
Melis (leaves)	Tea	Itching, skin irritation
Mint (leaves)	Tea	Headache
Oatmeal	Bath	Inflammation and pain at joints
Salt	Place in hair and wrap head with cloth	Headache, fever, skin irritation from scratching
Salty cornmeal	Hot poultice	Joint pain
Sandbox tree (leaves)	Compress	Stomach ache from taking pain-killers
Sarsaparilla (root)	Tea	Joint inflammation, aches in joint areas
Silk cotton tree (gum)	Chew the gum	Joint inflammation
Silk cotton tree (leaves)	Bath, compress of wet leaves, poultice	Inflammation
Silk cotton tree (roots)	Decoction on skin	
Sour orange (fruit)	Mix with castor oil and apply to compress Macerated and eaten	Fever Joint inflammation
Tamarind (fruit)	Poultice of young leaves on skin	Sore throat, aches, irritability in sick children
Tamarind (leaves)	Tea (with salt)	Inflammation
Tamarind (leaves)	Decoction in bath or poultice on skin	Inflammation, pain, skin irritation
Tua-tua (leaves)	Extracted oil on skin	Loss of appetite, headaches, fever, irritability in sick children
Tua-tua (seeds)	Tea	Fever, aches
West Indian cedar (bark)	Decoction in bath	Inflammation, joint pain
West Indian cedar (bark, twigs)	Paste from powdered bark resin on skin	Fever, remove impurities from the blood
West Indian locust tree (bark)	Tea (with salt)	Loss of appetite
West Indian mahogany tree (bark)	Decoction given orally	Fever, remove impurities from the blood
West Indian mahogany tree (bark)	Tea (with salt)	
West Indian mahogany tree (leaves)		

<sup>45</sup> The papery thin covering of the garlic clove and head.

## PREVENTION TECHNIQUES

Prevention techniques fell into two general categories: 1) killing or repelling mosquitos; and 2) preventative medication or traditional treatments. Few survey respondents reported taking steps to deter mosquitos by removing or treating breeding habitats in response to the chikungunya outbreak (figure 6). Repelling mosquitos was more common. This involved the burning of leaves (commonly citron or eucalyptus) or the use of a commercial product such as burning mosquito repellent coils or using an aerosol spray. Some respondents also used herbal bathes (in particularly catnip and silk cotton tree leaves), with household members who had chikungunya in order to prevent the individual from being bitten again and then thus spreading the virus to others.

Figure 6. Percentage of Households Using Mosquito Control or Prevention Techniques



Preventative medicine and traditional treatments to prevent chikungunya included taking high doses of paracetamol, taking vitamins, and drinking herbals teas. Some individuals incorrectly believed that the MSPP had recommended paracetamol as a prophylactic for chikungunya, though in fact Ministry officials have only advised people to take medication if they exhibit symptoms of the virus. Stomach pains, nausea, vomiting and diarrhea were widely reported by those taking paracetamol prophylactically. In general, vitamins in a tablet or effervescent form were preferred rather than diet changes to increase vitamin intake (such as consuming more citrus fruit to increase vitamin C consumption or eating more green leafy vegetables for the micronutrient benefit).

When asked where chikungunya came from and how it is spread, most survey respondents acknowledged that it was spread by mosquitos. However, in an response to an open-ended question at a later point in the survey (which said, "Please explain to me what chikungunya is and how it came to Haiti") Haitian citizens often blamed fate, God, the sinfulness of community members, businessmen, and MINUSTAH (the United Nations Mission in Haiti) for the disease. Nearly one in five respondents believed that chikungunya was intentionally brought to Haiti to make money for businessmen and/or as a form of social and political control. It is likely that the ongoing cholera epidemic, which

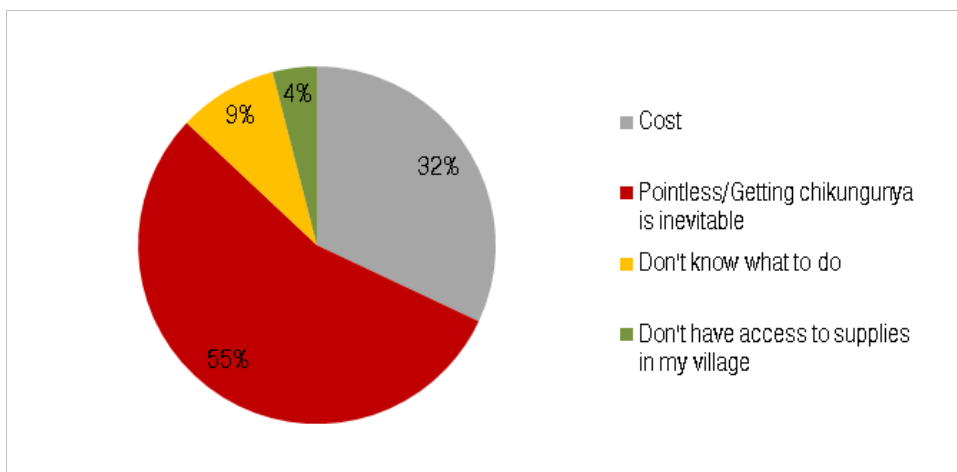


was brought to Haiti (unintentionally) by Nepalese peacekeepers associated with MINUSTAH, is in part responsible for this belief.

Survey respondents and focus group participants often expressed frustration that “bad things keep happening” to Haiti and that chikungunya is one more crisis in a long string of disasters. As one elderly woman put it, “if it’s bad and it hasn’t happened here yet, it will soon.” Similar to responses registered following the 2010 earthquake <sup>46</sup>, the sinfulness of oneself and ones neighbors was also blamed for the chikungunya epidemic. “God is punishing us physically,” one focus group participant explained. “He knows our hearts and thoughts and responds to our evil with illness.” Nearly a quarter said that it was “up to God” whether or not a person gets chikungunya.

The extent of resignation among the Haitian population to the prospect of contracting chikungunya is astonishing. More than half of the survey respondents (n= 1466; 52.2%) either agreed or strongly agreed with the statement, “even if I spend a lot of money and time trying to prevent it, I will still get chikungunya.” Similarly, when survey respondents who did not report engaging in mosquito vector control and bite prevention techniques were asked the main reason why this was so, more than half stated that to do so was pointless as infection with chikungunya is “inevitable” (see figure 7). This fatalistic attitude and the ineffective products marketed locally to repel or kill mosquitos may seriously hamper prevention efforts.

**Figure 7. What is the main reason you haven’t engaged in mosquito control or bite prevention?**



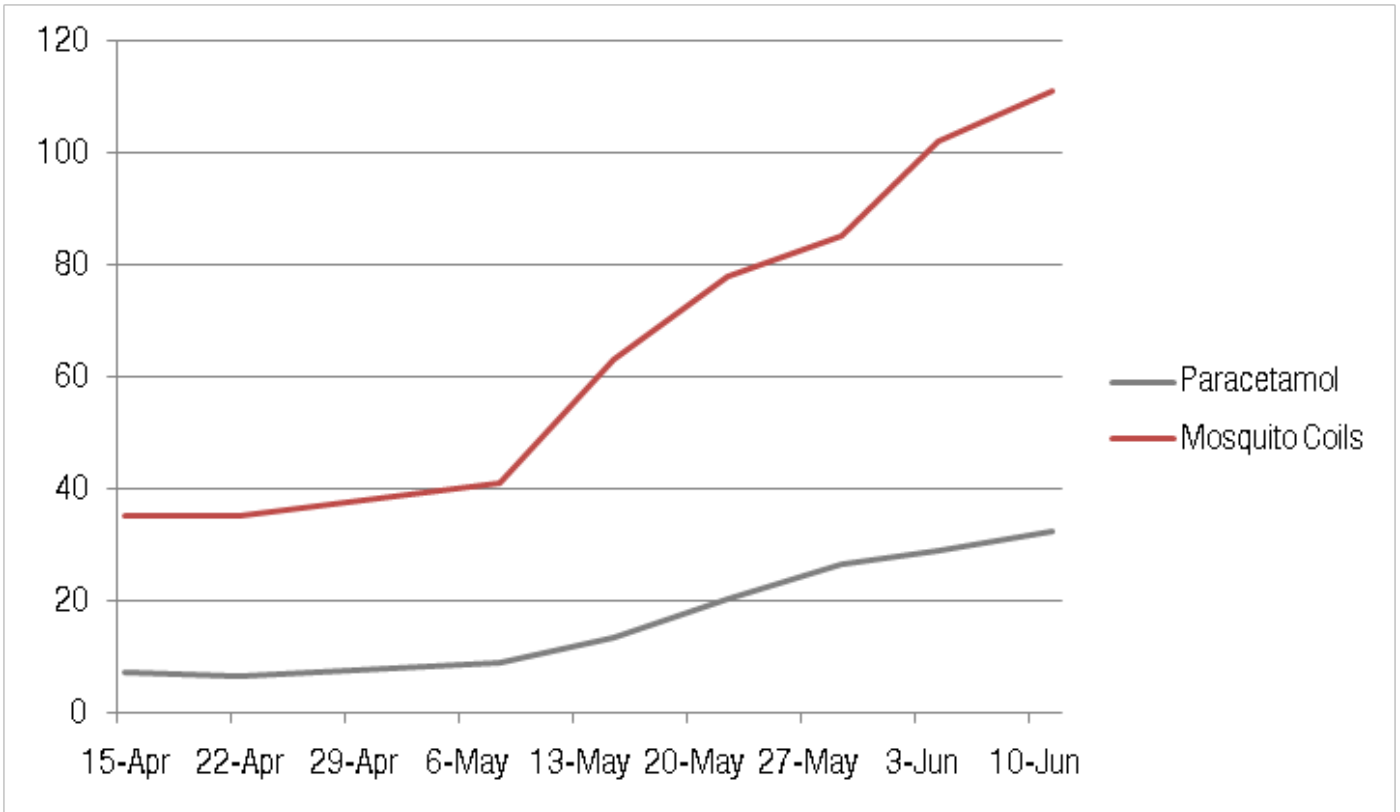
## THE COST OF PREVENTION AND TREATMENT

During qualitative interviews and focus groups, respondents often focused on the financial costs of controlling mosquitos. Many reported that the cost of insecticide had increased considerably since the outbreak was first publicized on May 6. The price of window screens, pump sprayers, and other household items related to mosquito control were also reported to have increased substantially. The Igarapé team tracked the costs of two items: a common brand of repellent and a single dose blister pack of acetaminophen from the month before the public announcement of the chikungunya outbreak through June 11, 2014. Figure 8 demonstrates that the mean price of both items rose dramatically from April to June 2014. Out-of-pocket costs during a chikungunya outbreak, such as these, are disproportionately burdensome for vulnerable members of society.<sup>47</sup>

<sup>46</sup> Kolbe et al., 2010.

<sup>47</sup> Vijayakumar, et al., 2013.

**Figure 8.** Average Price (in Haitian Gourdes) of Paracetamol and a Common Brand of Mosquito Repellent Coils in Jacmel and Port-au-Prince during the Months of April, May, and June

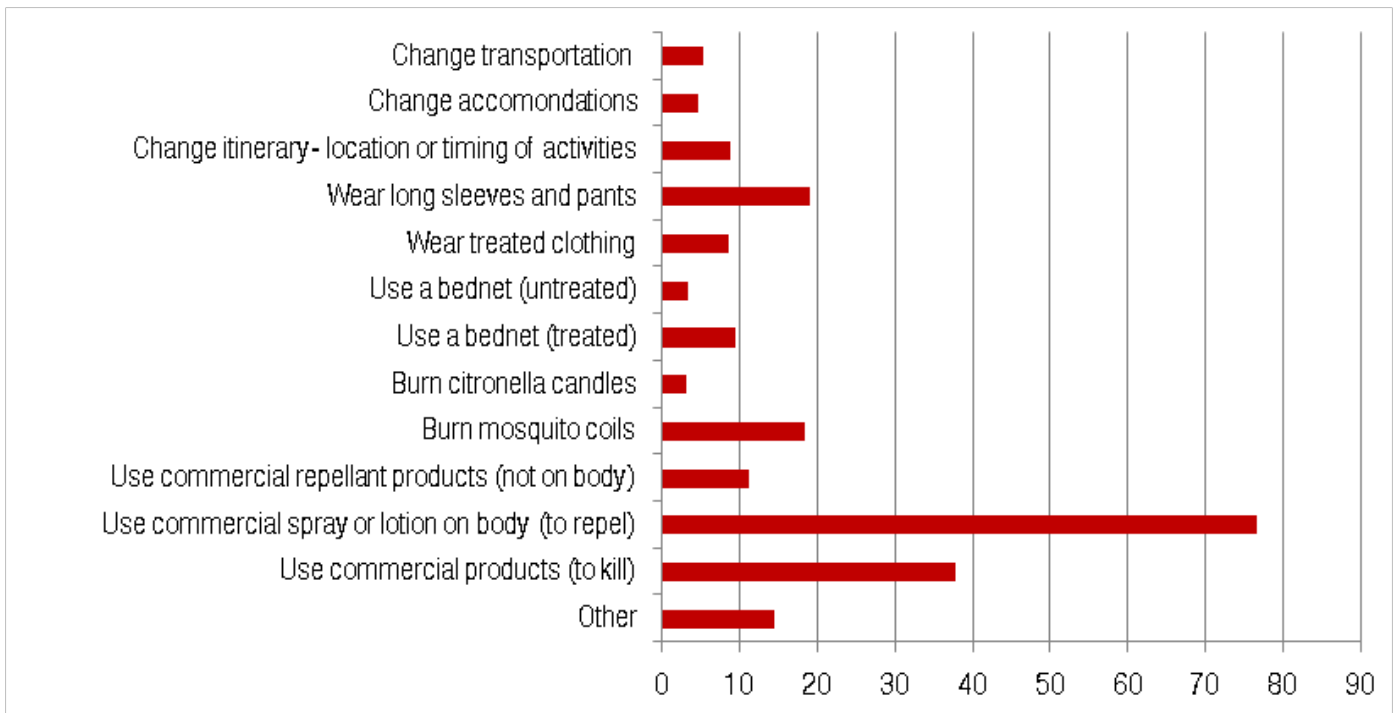


## IMPACT ON TOURISTS

Of the 446 tourists interviewed, almost all had heard of chikungunya. Virtually all of them also engaged in prevention techniques including using repellent, sleeping under bed nets, avoiding mosquito prone areas, sleeping in rooms with fans, and wearing long sleeves and pants (see figure 9). Only 27 tourists were diagnosed with chikungunya or had the characteristic symptoms of fever with rash and joint pain or swelling. Of those 10 said their symptoms were mild and resolved within four days or fewer. Twenty of the 27 had traveled in the countryside, notably the areas of Thomazeau, Fond Parisien, Jacmel, and Cabaret.



*A rash covers the arms and face of an 18-year-old American tourist.*

**Figure 9. Percentage of Tourists Using Prevention Techniques**

Most tourists expressed concerns about the virus but said that they had not significantly altered their trip plans overall because of the outbreak. Fewer than ten percent of tourists changed their accommodations (often opting for hotels with window screens or fans), transportation (choosing enclosed vehicles with air conditioning over open taptaps or trucks), or altering the location and timing of their activities to avoid mosquito prone areas. People over the age of 60 were 2.4 times more likely than tourists under age 60 to report that they made alternations in their trip plans because of the chikungunya outbreak. More than half reported that they plan to visit Haiti again whether or not the virus is still prevalent at the time of their next trip.

## CONCLUDING THOUGHTS

Mosquito borne illnesses – notably dengue fever and malaria – have long been a serious public health problem in Haiti. Vulnerable and impoverished segments of society are particularly at risk for diseases that are spread by mosquitos; mosquito vector control techniques are cost-prohibitive for the impoverished majority in Haiti. Yet it is these citizens who are bear a disproportionate burden of both illnesses and deaths from mosquito-borne illnesses. This study shows that a proper identification of risks and protective factors, as well as the implementation of effective prevention measures, can make a difference. It is critical that public authorities advocate proven remedies in the short-term, and that health professionals and policy makers invest in interventions with a demonstrated track record when responding to the epidemic.

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