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Epidemiological Characteristics of Clinically-Confirmed Cases of Chikungunya in Teculutan, Guatemala

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Chikungunya and Zika at the Front Door

The very first time I heard of chikungunya virus was when my grandmother contracted it. My families from both parents live in Guatemala. It was March of 2015 when my father received a call from my aunt, crying and telling him my grandmother had fainted. She is one of the chikungunya cases that present severe symptoms of abdominal and joint pain, and high fevers. Due to the severity of the pain in her joints, she is now unable to walk or sit straight; chikungunya means “to be contorted.” From there, many more family members contracted the virus, though their symptoms were not as severe as my grandmother’s. I did worry about them, but only a limited amount, since I knew they would recover. I certainly did not consider chikungunya a threat to my health. That is, until I traveled to Guatemala for winter vacation.

I was traveling to our home town of Teculutan, a municipality in the Guatemalan department of Zacapa. Before departing, my family warned my parents of the recent epidemic of the chikungunya virus. During the months of October, November and December, there had been an increase in the cases of CHKV, and many of my family members were just recovering from this virus. Therefore, I bought several bottles of insect repellent, and made sure I took long-sleeve shirts with me, and light long pants to wear during the day. The chikungunya virus is transmitted by a mosquito known as the “Yellow fever mosquito”, or Aedes aegypti by its species name. Such mosquito only bites during the day. So, upon my arrival, I felt prepared against the female mosquito and its bites, with my repellents and long-sleeve shirts; however, the weather made it impossible. Temperatures were in the high 100-105°F, and all I wanted to do was run to the nearest river and jump in the cold water. The heat irritated my skin and the repellent only made this worse so I ultimately decided to skip it. Despite my efforts, I got bitten by mosquitoes several times during the day. I felt vulnerable. Not only could I contract chikungunya, but by then the pandemic of Zika was sweeping through Guatemala. While I was there, my cousin contracted Zika.

At first, I couldn’t understand why this virus was spreading so fast. I came up with the idea of conducting my senior honors project on chikungunya virus, and, since they are transmitted by the same mosquito, indirectly also the Zika virus. I contacted the coordinator of the local health center, which is a free clinic open to the public, and ran by the Guatemalan Department of Health. For several days, I worked with the epidemiological sheets of diagnosed CHKV cases, with aims of discovering any trend on the symptoms, age, location, gender, and occupation. Also, I interviewed the doctor and two nurses to learn about their experiences and perspectives of dealing with the chikungunya virus, and more recently the Zika virus. Interestingly enough, the doctor and nurses shared what they thought was needed in order to control and manage the high incidences of these viruses, educating the community. The doctor mentioned that it is inevitable to avoid the environmental conditions that make it ideal for the mosquito to breed faster, but there are many factors within the cultural lifestyles that could help control the epidemic of vector-borne viruses such as dengue, chikungunya, and Zika.
In order to understand how a virus is transmitted in municipalities like Teculutan, it is crucial to consider the cultural lifestyles. In Teculutan, like in many other municipalities across Guatemala, the majority of leisure time is spent outdoors. For the most part, the area where Zacapa is located is the warmest all year around, except for cooler weather during the last three months of the year. Due to the hot weather, families typically have an outdoor area to rest, and spend time with family. In many instances, it isn’t a choice, but a necessity. Teculutan is a relatively poor community, where many homes lack windows, and a roof in the kitchen and resting areas.

Grandparent’s home resting areas.

Also, in the lines of discussing kitchen areas, most families own an outdoor sink to wash the dishes, clothing, and it is the main water container at home. These outdoor sinks, also called “pilas” are one of the most common breeding habitats for mosquitoes. It is water that is stagnant, it is not flowing, and it is not cleaned often. The doctor of the clinic mentioned that, through a survey conducted in town with purposes of assessing and tracking mosquito breeding habits, families were asked about their knowledge on mosquito egg and larvae; many of them did not believe a larva would later turn into a mosquito.

After analyzing the data collected through exploratory data visualization, I compared the demographics of suspected and confirmed CHKV cases to the population of Teculutan as a whole. I found that women in the household are particularly at risk for chikungunya in Teculutan. I also found that there were hot spots of mosquito abundance in poor residential areas.
These results combined with information obtained from the interviews conducted all pointed to a critical need to assess the average citizens’ knowledge, attitudes and preventive practices toward mosquito-borne diseases and mosquito prevention. As part of my honors project, I developed a Knowledge, Attitudes, and Practices Survey (KAP), which is a tool for assessing the general and specific knowledge on the mosquito, the virus, and the diseases of chikungunya and Zika. I provided this tool to the clinic to use moving forward as it continues on the front line of these epidemics.

**KAP Survey – CHKV and Teculutan**

**Knowledge**

**Symptoms**

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1.</td>
<td>Is fever a symptom of CHKV?</td>
</tr>
<tr>
<td>2.</td>
<td>Is arthritis (joint pain) a symptom of CHKV?</td>
</tr>
<tr>
<td>3.</td>
<td>Are allergies a symptom of CHKV?</td>
</tr>
<tr>
<td>4.</td>
<td>Is headache a symptom of CHKV?</td>
</tr>
<tr>
<td>5.</td>
<td>Is back pain a symptom of CHKV?</td>
</tr>
<tr>
<td>6.</td>
<td>Is nausea a symptom of CHKV?</td>
</tr>
<tr>
<td>7.</td>
<td>Is mucosal hemorrhage a symptom of CHKV?</td>
</tr>
<tr>
<td>8.</td>
<td>Is vomit a symptom of CHKV?</td>
</tr>
<tr>
<td>9.</td>
<td>Is rash a symptom of CHKV?</td>
</tr>
</tbody>
</table>

**Transmission**

1. Is CHKV in the air?
2. Is CHKV in the water?
3. Do mosquitoes transmit CHKV?
4. Can CHKV be transmitted from one person to another?
5. Can CHKV be transmitted by blood transfusion?
6. Can CHKV be transmitted by sexual intercourse?

**Mosquito**

1. Where do mosquitoes come from?
   - Egg in the water
   - Egg outside the water
Egg in trees
I Don’t Know

2. When are the CHKV mosquitoes likely to bite/feed?
   - Night time
   - Day time
   - All day
   - Not sure

3. Do mosquitoes breed in stagnant water?
   - Yes
   - No
   - Not sure

4. All types of mosquitoes transmit CHKV
   - Yes
   - No
   - Not sure

5. *Aedes aegypti* likes to linger indoors
   - Yes
   - No
   - Not sure

6. Insect repellents reduce mosquito bites and prevent CHKV?
   - Yes
   - No
   - Not sure

7. Covering water containers reduces mosquitoes?
   - Yes
   - No
   - Not sure

8. Does removal of stagnant water prevent mosquito breeding?
   - Yes
   - No
9. Insecticide spray reduces mosquito and prevents CHKV
   Yes
   No
   Not sure

10. Cleaning backyards can prevent mosquito breeding and prevent CHKV
    Yes
    No
    Not sure

11. Covering outdoor sinks can reduce mosquito breeding and prevent CHKV
    Yes
    No
    Not sure

12. Using window screens during the day can prevent mosquitoes indoors
    Yes
    No
    Not sure

13. Pouring chemicals in stagnant water can kill mosquito larvae?
    Yes
    No
    Not sure

14. Pouring chemicals in outdoor sinks is safe
    Yes
    No
    Not sure

Knowledge of Management

1. Would you take acetaminophen for CHKV?
   Yes
   No
   Not sure
2. Would you drink plenty of fluids for CHKV?
   Yes
   No
   Not sure

3. Would you get plenty of rest for CHKV?
   Yes
   No
   Not sure

4. Would you seek medical attention for CHKV?
   Yes
   No
   Not sure

5. Is there treatment/cure for CHKV?
   Yes
   No
   Not sure

How did you (hear, learn, find out) about CHKV?
- TV/Radio
- School
- Work
- Health providers
- Family/friend
- Newspaper
- Social media
- Neighbors
- Child
- Publicity

**Attitudes**

1. CHKV is a punishment from God
   Strongly agree
   Agree
   Disagree
   Strongly disagree
2. CHKV is a serious illness?
   Strongly agree
   Agree
   Disagree
   Strongly disagree
   Not sure

3. You are susceptible to CHKV
   Strongly agree
   Agree
   Disagree
   Strongly disagree
   Not sure

4. CHKV can be prevented
   Strongly agree
   Agree
   Disagree
   Strongly disagree
   Not sure

5. CHKV is a deadly illness
   Strongly agree
   Agree
   Disagree
   Strongly disagree
   Not sure

6. Are you worried about you or your family of getting CHKV?
   Strongly agree
   Agree
   Disagree
   Strongly disagree
   Not sure

7. If you had CHKV before, you can/will get it again
   Strongly agree
   Agree
   Disagree
8. If sick, you would go to the local public clinic
   - Strongly agree
   - Agree
   - Disagree
   - Strongly disagree
   - Not sure

9. CHKV is a community problem
   - Strongly agree
   - Agree
   - Disagree
   - Strongly disagree
   - Not sure

10. CHKV is an environmental problem
    - Strongly agree
    - Agree
    - Disagree
    - Strongly disagree
    - Not sure

11. Everyone is susceptible of getting CHKV
    - Strongly agree
    - Agree
    - Disagree
    - Strongly disagree
    - Not sure

12. The government is doing everything to help control CHKV outbreak
    - Strongly agree
    - Agree
    - Disagree
    - Strongly disagree
    - Not sure

**Practices**
Preventing mosquito-human contact   YESNO
1. Use insecticide sprays to reduce mosquitoes
2. Seek professional pest control to reduce mosquitoes
3. Use window screens to reduce mosquitoes
4. Use bed nets to reduce mosquitoes
5. Use ventilators to reduce mosquitoes
6. Cover standing water containers to reduce mosquitoes
7. Cover outdoor sink tanks to reduce mosquitoes
8. Clean backyards to reduce mosquitoes
9. Dispose garbage to reduce mosquitoes
10. Use mosquito eating fish to reduce mosquitoes
11. Close doors to prevent mosquitoes indoors
12. Use long-sleeve shirts and long pants to prevent mosquito bite
13. Use disc insect repellent at night time to reduce mosquito indoors
14. Use body repellent when going outdoors to reduce mosquito bite
15. Does nothing to reduce mosquitoes

**Eliminating mosquito breeding sites**

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cover water contains in the home</td>
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</tbody>
</table>

Frequency of cleaning water filled containers around the house
- Always
- Often
- Sometimes
- Rarely
- Never

Frequency of emptying and brushing outdoor sink water tank
- Always
- Often
- Sometimes
- Rarely
- Never
Epidemiological characteristics of clinically-confirmed cases of Chikungunya in Teculutan, Guatemala

Introduction

Why Chikungunya?
- 3,327,000 cases in Central America since 2013
- Current outbreaks of CHIK, Zika, and Dengue in Teculutan, all transmitted by the same mosquito
- Recently emerged in Central America in 2013

- Transmission by mosquitoes in the genus Aedes
- Vector is Aedes aegypti
- Human experience living in Guatemala, where mosquitoes are around all year long
- Family members infected with CHIK & Zika known
- Standard housing provides mosquito breeding areas, adult resting areas, and opportunities for biting

Methods

- Small Clinic
  - Volunteers in Cocks at School in January 2013
  - Collected 180 samples, CHIK cases (13% clinically confirmed)
  - Holocaust workers in sub data into Excel
  - Conducted epidemiological data analysis
  - Conducted in-depth interviews with clinic’s director and nurses

- Mosquito Data
  - Incident 1: Biosecurity, insecticid al sprays in 90% of homes
  - Incident 2: DDT fumigations in 10% of homes
  - Result: 3,200 residents vs 10 neighborhoods

- Developing an Educational Health Campaign
  - Created a survey to evaluate the educational needs of residents for mosquito-borne diseases
  - Workshops: Community knowledge on disease transmission, symptoms, prevention, and treatment
  - Grassroots education through the media and community meetings
  - Focus on the importance of mosquito control

- Surveillance:
  - Completed 180 reports for CHIK and Zika
  - Review of clinical cases in Teculutan

- Mosquito surveillance
  - Increase in mosquito incidence in recent weeks
  - Increased mosquito occurrence in recent weeks

- Summary
  - CHIK cases are on the rise
  - Education and awareness are crucial for prevention

Results

- Age distribution among clinically-confirmed cases vs. general population
  - Children and adults up to age 50 common majority of cases
  - Largest peak of general population is ages 25-60

- Occupation distribution among clinically-confirmed cases vs. general population
  - Clinically confirmed cases
    - Private sector
    - Public sector
    - Agriculture
    - Student
    - Housewives
  - Occupation distribution among the general population
  - Transmissions young adults or over 60
  - Risk of population is overcrowded and agriculture is the predominant industry

Discussion

- Interview Questions
  - Bystanders have critical misconceptions regarding mosquito-borne diseases
  - Fear of exposure to people and rapid educational outreach programs on disease outbreaks
  - Majority of residents have received treatment and minimal attention to preventive practices

- Survey tool is based on response to interview discussion, and direct knowledge, attitudes, and preventive practices

- "Yes or No" response questions from survey
  - Knowledge of mosquito-borne diseases
  - Attitude towards CHIK
  - Preventive practices like insecticide sprays to reduce mosquito densities

- Epidemiological characteristics allow for identification of at-risk populations
  - Younger children and young adults at most risk
  - Unemployed population may be at high-risk

- Summary of most reported symptoms allow for awareness of disease and early identification

- Focus on local area mosquito propagators to reduce CHIK cases

- Limitations
  - Only clinically-confirmed CHIK cases
  - Limited time frame
  - No generalizability
  - Data from one clinic

Conclusions

- Recommendations
  - Use insect repellent and protective clothing when outdoors
  - Window screens to reduce mosquito entering indoors
  - Controlling water containers

- Major hygiene clean ups are needed to reduce mosquito breeding

- Recommend indoor insecticides to reduce risk of house with adult mosquito population not being cleared

- "No, but..." The mosquito net is mosquito-borne

- Many countries have adapted the " meshes on terraces" technique that would eliminate breeding in outdoor sites

Acknowledgments

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