



Epidemiological Description of Chikungunya Virus Outbreak in Dire Dawa Administrative City, Eastern Ethiopia, 2019

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Abstract: Chikungunya virus (CHIKV) is an arbovirus transmitted to humans by *Aedes* mosquitoes. It is one of the epidemic vector-borne diseases which has recently re-emerged, mainly in Asian and African continents and has led to a significant global public health problem in these countries. In Ethiopia the Chikungunya outbreak was reported from Dire Dawa Administrative City on July 2019. Therefore this paper is to document and highlight the epidemiology of chikungunya outbreak in Dire Dawa Administrative City. The Data was analyzed from line list collected by Regional Health Bureau from different public and private health sectors during the course of the outbreak, July 29, 2019 to October 20, 2019. Accordingly, the total of 41162 suspected cases of Chikungunya with 16 laboratory confirmed cases were reported from the City Administration. All of the suspected cases fulfill the standard case definition of Chikungunya. The outbreak starts at one kebeles and finally affected whole part of the city. The median age of the patient is 25 years. The overall attack rate of the outbreak was 12.3% with zero case fatality rate. The outbreak affected all age groups and both sexes. However, females are more affected than males with an attack rate of 12.32% and 6.19% for female and male respectively. Higher attack rate was reported from 15 to 44 age group (AR=50.35%). Fever (99.9%), headache (99.4%), joint pain (99.3%) and back pain (87.7%) are the major clinical symptoms observed during the outbreak.

Keywords: Chikungunya, Outbreak, Dire Dawa, Ethiopia

1. Introduction

Chikungunya virus (CHIKV) is an arbovirus transmitted to humans by *Aedes* mosquitoes. The virus was first described in 1952 during a febrile illness outbreak in Makonde, a province in southern Tanzania [1]. It is one of the epidemic vector-borne diseases which has recently re-emerged, mainly in Asian and African continents and has led to a significant global public health problem in these countries [3, 4]. *Aedes aegypti* and *Aedes albopictus* are the two *Aedes* species commonly responsible for transmission [3, 5, 6].

In Africa, the virus is maintained in a sylvatic transmission cycle between non-human primates, small mammals (eg, bats

and monkeys), and *Aedes* mosquitoes [8]. Outbreak of CHIKV is usually associated with heavy rainfall and subsequent spillover of the virus from an enzootic forest cycle to an epizootic savannah or woodland cycle. Rural outbreaks occur when mosquito populations increase in areas where populations of non-immune people are present [11].

Chikungunya infection typically causes fever and severe and persistent joint pain [7]. Other additional symptoms include nausea, vomiting, chills, headaches and rashes. It is rarely a life threatening infection and treatment is mainly symptomatic. Clinical manifestations of CHIKV fever show some overlap with, and must be distinguished from dengue fever, as well as juvenile rheumatoid arthritis, rubella, and

several other febrile diseases [9].

Chikungunya infection is diagnosed on the basis of clinical, epidemiological, and laboratory criteria. An acute onset of fever and severe arthralgia or arthritis that is not explained by other medical disorders is considered as a possible CHIKV case. The case becomes probable if the patient has lived in or visited epidemic areas [10, 11, 25].

Eastern Ethiopia has been recurrently affected by Dengue fever since September 2013 especially during the rainy season. Vector survey conducted in this area also identified the abundance of *Aedes aegypti*, the vector responsible for both Dengue Fever and Chikungunya Fever transmission [12-14]. At the end of July 2019, local authorities from Dire Dawa Administrative city, the Eastern part of Ethiopia reported unknown febrile illness with joint pain. In response to this, Ethiopian Public Health Institute deployed investigation team to the area to conduct epidemiologic investigation. Consequently, 12 samples tested positive for chikungunya by reverse-transcriptase polymerase chain reaction (RT-PCR) at national laboratory. Total of 41162 suspected cases of Chikungunya with 16 laboratory confirmed cases were reported from Dire Dawa Town from July 29, 2019 to October 20, 2019. Therefore this paper documents the outbreak of Chikungunya reported in Dire Dawa Administrative City, Easter Ethiopia highlighting the epidemiology of the outbreak. With this junction, the objective of this analysis is to describe the outbreak, identify the at-risk population and monitor the trend of the outbreak.

2. Material and Methods

The study was conducted at Dire Dawa Administrative city which is located in the Eastern of Addis Ababa at Latitude 9031'N and Longitude 410 52' E. It is about 515 Km far from capital city of Ethiopia, Addis Ababa which is surrounded by Ethio-somali and Oromia region. The area of the city administration is 1,213 Km², with annual temperature of is 25.9°C. The health service coverage of the city is 100%.

Data was obtained from line list collected by Dire Dawa Administrative City Health Bureau from different public and private health sectors during the course of the outbreak. The outbreak period was from 29 July 2019 to 20 October 2019. All suspected cases fulfilling the standard case definition of Chikungunya were included in this analysis.

Suspected cases: is a person with acute onset of fever and severe arthralgia or arthritis not explained by other medical conditions, and who resides or has visited epidemic or

endemic areas within 2 weeks before the onset of symptoms.

Probable case: is a patient meeting both the clinical and epidemiological criteria
Confirmed case: a patient meeting the laboratory criteria, irrespective of the clinical presentation.

Data was cleaned by Microsoft Excel and exported to SPSS 23 statistical software for analysis. Further it is described based on person, place and time. Descriptive analysis was applied to calculate Rate, ratio and proportion for interested parameters.

3. Result

3.1. Epidemiologic Investigation

Dire Dawa City is endemic for AFI like malaria. The city had been affected by recurrent Dengue Fever outbreak starting from 2013 especially during the rainy season (July to September). At the end of July 2019 unknown AFI like illness with fever and joint pains was reported from kebeles 6 (local smallest administrative unit) to Dire-Dawa administrative city health Bureau. Soon after, experts from Ethiopian Public Health Institute (EPHI) deployed to the area to conduct epidemiologic investigation to the affected area. Subsequently, 12 samples tested positive for chikungunya by reverse-transcriptase polymerase chain reaction (RT-PCR). Therefore, the total of 41162 suspected cases of Chikungunia with 16 laboratory confirmed cases were reported from Dire Dawa Town during the outbreak. All suspected cases have fulfilled the case national definition of Chikungunia.

3.2. Epidemiology and Clinical Description of the Case

All of the suspected cases used for this analysis fulfill the standard case definition of Chikungunya. The median age of the patient is 25 years (with age range from 1 month to 98 years) and standard deviation of 16. A total of 41 cases have preexisting comorbidity, 23 Diabetes and 18 hypertensive patients. Only five pregnant women have visited health facility for chikungunya during the outbreak period. Almost all cases were treated at public health facilities, 40242 (97.76%) and 920 (2.34%) were treated at private health facilities. The mean date of onset of the first symptoms and seeking the medical care is 1 day with standard deviation of 1.64. As most of the Chikungunya illness is self-limiting illness and less fatal, almost all of the patients are treated at OPD level. Only 563 (1.63%) of the cases are admitted to receive inpatient treatment (Table 1). Age group of 15 to 44 is the most affected part of the population with an attack rate of 50.35 in percent.

Table 1. Characteristics of Chikungunia cases and attack rate of suspected Chikungunia during the outbreak in Dire Dawa city.

| Characteristics | Categories | Case (%) n= 41162 | Population | Attack rate in% |
|-------------------------------|--------------------|-------------------|------------|-----------------|
| Age group | 45 Years and above | 5809 (14.11%) | 47191 | 12.31 |
| | 15 to 44 | 25277 (61.41%) | 50203 | 50.35 |
| | 5 to 14 | 6821 (16.57%) | 147931 | 4.61 |
| | Under 5 | 3255 (7.91%) | 89361 | 3.64 |
| Sex | F | 20450 (49.68%) | 166004 | 12.32 |
| | M | 20712 (50.32) | 168682 | 6.19 |
| Attended health care facility | Public Hospital | 11386 (27.66%) | | |
| | Private hospital | 232 (0.56%) | | |
| | Private clinic | 688 (1.67%) | | |
| | Health Center | 28856 (70.10%) | | |

| Characteristics | Categories | Case (%) n= 41162 | Population | Attack rate in% |
|-----------------|------------|-------------------|------------|-----------------|
| Type of care | Outpatient | 40599 (98.63%) | | |
| | In patient | 563 (1.37%) | | |

The first case were reported from kebeles 6 (the smallest local administrative unit) of the Dire Dawa City administration at the end of July 2019 which later affected the whole nine kebeles with the total attack rate of 12.3. Among the nine kebeles of Dire Dawa City, kebeles 2 was the most affected area with an attack rate of 27.47. The most affected age group are those fall with the rage of 15 to 44 years age and under five contributed least to the total cases during the outbreak.

Table 2. The Attack Rate of Chikungunya in different Kebeles of Dire Dawa City, 2019.

| Kebele | Case (%) n=41162 | Population | Attack Rate in% |
|----------|------------------|------------|-----------------|
| Kebele 1 | 369 (0.9%) | 17,461 | 2.11 |
| Kebele 2 | 17556 (42.65%) | 63,917 | 27.47 |
| Kebele 3 | 2189 (5.32%) | 29,388 | 7.45 |
| Kebele 4 | 2917 (7.09%) | 31,326 | 9.31 |
| Kebele 5 | 4660 (11.32%) | 26,663 | 17.48 |

| Kebele | Case (%) n=41162 | Population | Attack Rate in% |
|----------|------------------|------------|-----------------|
| Kebele 6 | 2735 (6.64%) | 24,813 | 11.02 |
| Kebele 7 | 1051 (2.55%) | 33,451 | 3.14 |
| Kebele 8 | 2764 (6.71%) | 43,632 | 6.33 |
| Kebele 9 | 6921 (16.81%) | 64,036 | 10.81 |
| Total | 41162 | 334,686 | 12.30 |

The outbreak starts at the end of July reaching its peak on 24th august after which it showed sinusoidal decrement of cases. Starting from 24th August, the case starts to decline for three consecutive weeks up to 2nd September, where it became 223 cases (-42% case change per day) at the 1st September. The 3rd September was marked with the highest case change rate per day with increment of 1339 (75%) cases making the second peak of the outbreak. It's after this day that case began to decrease and become almost nil on 20th October (Figure 1).

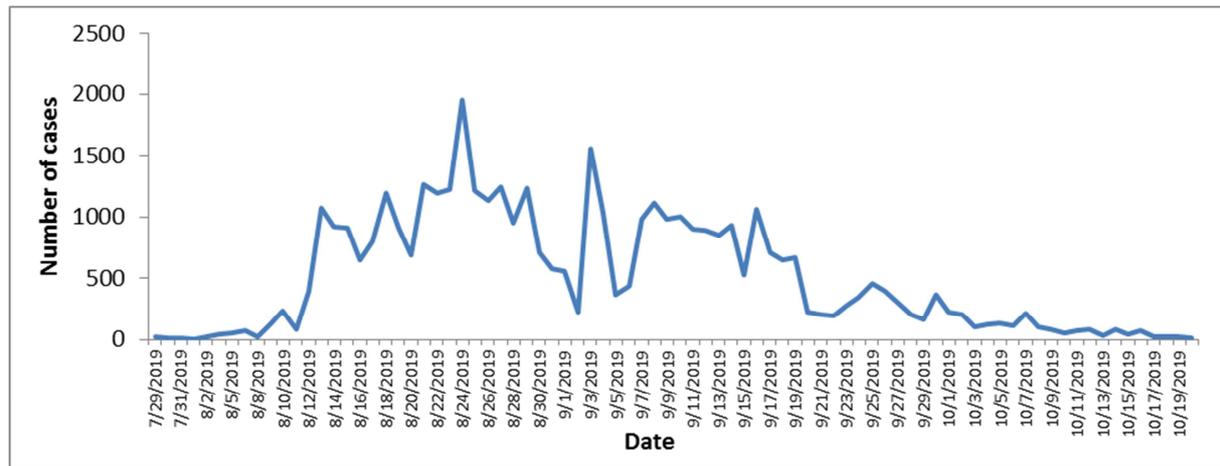


Figure 1. Distribution of suspected Chikungunya cases in Dire Dawa City during the outbreak course.

Almost all patients during physical examination are presented with Fever (99.98%), joint pain (99.4%) and headache (99.3%) as shown in the following table (Table 1). Back pain is also the commonest symptom presented on 87.7% of the patient. The other rarely recorded symptoms include vomiting (0.9%), rash (0.2%) and nasal bleeding (0.1%).

Table 3. Clinical features observed on 41162 suspected Chikungunya outbreak in Dire Dawa Administrative City during July to October 2019.

| Clinical features | Response | %, n=41162 |
|-------------------|----------|----------------|
| Fever | Yes | 41155 (99.98%) |
| | No | 7 (0.02%) |
| joint pain | Yes | 40929 (99.4%) |
| | No | 233 (0.6%) |
| headache | Yes | 40861 (99.3%) |
| | No | 301 (0.7%) |
| back pain | Yes | 36104 (87.7%) |
| | No | 5058 (13.3%) |
| vomiting | Yes | 356 (0.9%) |
| | No | 40806 (99.1%) |
| Rash | Yes | 96 (0.2%) |

| Clinical features | Response | %, n=41162 |
|-------------------|----------|---------------|
| Nasal bleeding | No | 41066 (99.8%) |
| | Yes | 60 (0.1%) |
| | No | 41102 (99.9%) |

4. Discussion

The first documented Chikungunya outbreak in Ethiopia was reported in June 2016 in the Somali Region of Ethiopia, which borders Mandera County, Kenya [14]. For the second time Chikungunya outbreak occurred in Eastern part of Ethiopia in late July, 2019. This paper documents the first outbreak of Chikungunya reported in Dire Dawa Administrative City, Easter Ethiopia highlighting the epidemiology of the outbreak.

During this outbreak more than forty thousand people has been affected with total attack rate of 12.3%. Kebele 02 is the most affected geographic area with an attack rate of 27.47% among the nine existing kabeles of Dire Dawa City. All cases

are reported from urban kebeles. This might be due to poor all inclusive active case search, misdiagnosis at the rural kebeles health centers or poor health seeking behavior of rural community since symptoms of Chikungunia is self-limiting.

Chikungunia affected both gender and all age group in Dire Dawa city. However, female are more affected than male during the outbreak course. This is in line with other studies conducted in different areas [27-30]. Chikungunia attack rate was highest among individual aged 15 to 44 (AR=50.35%) and lowest among under five children (AR=3.64%).

As shown on the epidemic curve (Graph 1), the outbreak was gradually raising before reaching the plateau which lasts about four weeks, indicating a continuous common source epidemic. The second peak of the epidemic is also observed on 3rd September, which may indicate delayed public health measure in responding to the outbreak.

The major clinical symptoms during the acute onset of Chikungunya including Fever (99.9%), headache (99.4%), joint pain (99.3%) and back pain (87.7%) observed in this analysis is similar to those described in previous studies for acute Chikungunia virus [15-19]. Other gastrointestinal manifestation (vomiting and diarrhea) are rare manifestation of Chikungunia fever except in case of malaria co infection [19-22]. Similarly in our finding vomiting is reported in 356 (0.9%) of the patient. Hemorrhagic manifestations including, bleeding, petechiae and/ or skin rashes were generally uncommon in the Chikungunia cases during earlier outbreak episodes worldwide [18, 19, 22]. In this analysis skin rash and bleeding manifestation was observed in 96 (0.2%) and 60 (0.1%) of the patient respectively.

In terms of severity no death was reported during the outbreak with CFR of zero. The CFR measure the quality of care, which is premised on timely and definitive diagnosis and also represents the killing power of the disease. The finding of this analysis suggests that Chikungunia is self-limiting and less fatal, in consistence with other findings [11, 16].

5. Limitation

Several limitations should be high lightened when considering the result. The analysis might underestimates the burden since solely depends on the cases that sought at health facility taking aside the asymptomatic cases with in the community. Only sixteen cases are laboratory confirmed cases due to limited resource to conduct large scale laboratory investigation. Therefore, large scale serological studies capable of detecting the seroconversion rates of these populations will be useful in capturing true incidence. Given the area is also endemic for malaria and Dengue Fever, which are the top deferential diagnosis of Chikungunia, considering all the cases as Chikungunia is also another limitation need to be considered. Even though the country has been giving Field epidemiology training health for surveillance officer, surveillance quality reported cases with

their respective symptoms was dependent on surveillance officer. The responsible Aedes mosquito hasn't been also identified.

6. Conclusion

For the second time Chikungunia outbreak occurred in Eastern part of Ethiopia in late July, 2019. Total of 41162 suspected cases of Chikungunia with 16 laboratory confirmed cases were reported from Dire Dawa Town during the outbreak. The median age of the patient is 25 years. The overall attack rate of the outbreak was 12.3% with zero case fatality rate. The outbreak affects all age groups and both sex. However, age group between 15 to 44 and female sex are more affected than others. Fever, Headache, joint pain and back pain are the most clinical symptoms presented during physical examination.

Ethical consideration

Written letter was submitted to Ethiopian Public Health Institute (EPHI), Public Health Emergency Management Center (cPHEM) and permission to use the line list for analysis was obtained both in EPHI and Dire Dawa city administration health bureau.

Authors Contribution

DG was principally involved in data analysis, write up, selection of articles, and manuscript preparation and revision. NT, HA and the first authors contributed to data analysis, drafting or revising the article, gave final approval of the version to be published and agreed to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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