Sero-prevalence of dengue among suspected cases reported to EDEWS in Yemen in 2024

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Abstract

Background: Dengue is an endemic vector borne diseases in Yemen. Clinically, the disease is similar to the other mosquito transmitted disease like malaria, Chikungunya and west Nile virus.

Objective: to determine the sero-prevalence of Dengue virus among suspected patients in the southern and eastern governorates of Yemen during the year 2024.

Methods: it is a cross-sectional descriptive study that. Data used for this study were sourced from the Electronic Integrated Disease Early Warning System (EIDEWS), an extended surveillance platform that tracks epidemic-prone diseases in real time.

Results: A total of 8609 suspected dengue cases were reported in the year 2024 to the electronic early warning system in the southern and eastern governorates in Yemen during the year 2024. A total of 221 out (20.2%) of 1091 suspected cases of dengue were positive for IgM specific for dengue while 393 out of 831 clinically diagnosed dengue cases were positive for IgG specific for dengue (48.9%) given the dengue IgG: IgM ratio to 2.4. The highest sero-prevalence was observed in the age group 15-44 years (22.44%). Shabwah, Marib and Aden governorates has the highest prevalence of dengue. Coinfection was existing in dengue confirmed cases with Chikungunya (17.6%), west Nile virus (2.3%) and malaria (0.9%).

Conclusion: High endemicity of dengue were identified among patients with dengue like illness. Coinfection was existing in dengue confirmed cases with Chikungunya.

Key words: Dengue, Fever, Epidemiology, Yemen.

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الانتشار المصلي لحمى الضنك بين الحالات المشتبهة والمسجلة بنظام الرصد الالكتروني للإنذار المبكر في اليمن، عام 2024

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الملخص

مقدمة: حمى الضنك مرضٌ متوطنٌ في اليمن وينتقل عن طريق النواقل ويشبه سريريًا أمراضًا أخرى تنتقل عن طريق البعوض مثل الملاريا، وحمى الشيكونغونيا، وفيروس غرب النيل.

تهدف هذه الدراسة الى تحديد معدل الانتشار المصلي لفيروس حمى الضنك بين المرضى المشتبه بإصابتهم في المحافظات الجنوبية والشرقية من اليمن خلال عام 2024.

المنهجية: دراسة وصفية مقطعية. استُخدمت البيانات المستخدمة في هذه الدراسة من نظام الرصد الإلكتروني للإنذار المبكر للأمراض (أيديوز EIDEWS)، وهو منصة مراقبة موسعة لرصد الأمراض الوبائية

النتائج: تم الإبلاغ عن 8609 حالات مشتبه بإصابتها بحمى الضنك في عام 2024 لنظام الإنذار المبكر الإلكتروني في المحافظات الجنوبية والشرقية في اليمن. كانت 221 حالة من أصل 1091 حالة مشتبه بإصابتها بحمى الضنك إيجابية لـ IgM النوعي لحمى الضنك، بينما كانت 393 حالة من أصل 831 حالة مشخصة سريريًا إيجابية لـ IgG النوعي لحمى الضنك (48.9%)، مع العلم أن نسبة IgG إلى IgM في حمى الضنك تبلغ 2.4. ولوحظ أعلى معدل انتشار مصلي في الفئة العمرية 15-44 عامًا (22.44%). سجلت محافظات شبوة ومأرب وعدن أعلى معدلات انتشار لحمى الضنك. وُجدت عدوى مشتركة في حالات حمى الضنك المؤكدة مع شيكونغونيا (17.6%)، وفيروس غرب النيل (2.3%)، والملاريا (0.9%). حالات حمى الضنك المؤكدة مع شيكونغونيا.

الاستنتاج: خلصت الدراسة الى توطن عالي وانتشار واسع لحمى الضنك بين المرضى المصابين بأمراض مشابهة لحمى الضنك. كما وجدت عدوى مشتركة في حالات حمى الضنك المؤكدة مع شيكونغونيا.

الكلمات المفتاحية: حمى الضنك، الوبائيات، اليمن.

Introduction:

Dengue is an endemic vector borne diseases in Yemen. Clinically, the disease is similar to the other mosquito transmitted disease like malaria, Chikungunya and west Nile virus. Yemen facing a lot of complex emergencies since 2015 that impact the ecology of the vector born diseases like dengue. War and climate changes are the main socio-ecological factors of dengue spread. The association between wars and transmission of dengue virus (DENV) has been well-recognized. During World War II (1939–1945), extensive ecologic disruption and demographic changes created suitable breeding sites for *Aedes aegypti* mosquitoes, as well as movement of displaced populations to support the spread of dengue (1). During April-June 2015, dengue outbreak was occurred in six governorates in Yemen, during this outbreak a total of 6,777 suspected dengue cases were recorded, which suggested that the country was experiencing an unprecedented increase in the number of dengue cases (2). In 2016; dengue was identified in 51% of patients given a clinical diagnosis of suspected dengue in Taiz (3). Dengue outbreaks are continuing occurring every year, Yemen Red Crescent Society (YRCS) in 2021 reported that, dengue outbreak in 2020 reported 12569 suspected dengue cases which was seven times the reported cases in 2019 (4).

Limited studies were addressing dengue fever epidemiology in Yemen after the year 2015, especially in the southern an eastern governorate where controlled by the internationally recognized government (IRG).

This study focused on southern and eastern governorates of Yemen. These areas represent dengue-endemic areas whose climatic conditions facilitate the breeding of the vector *Aedes aegypti* that transmits dengue virus. Besides, the same areas represent places lacking health infrastructure and thus are highly prone to outbreaks of dengue fever. In light of the foregoing factors, the choice of those locations underlines the importance of this study to provide essential epidemiological evidence.

The aim of this study is to determine the sero-prevalence of dengue virus among suspected patients in the southern and eastern governorates of Yemen during the year 2024 using data collected from the Electronic Integrated Disease Early Warning System (EIDEWS) and to inform ministry of public health and population in Yemen to strength the public health responses toward dengue.

Methods:

This is a cross-sectional descriptive study that. Data used for this study were sourced from the Electronic Integrated Disease Early Warning System (EIDEWS), an extended surveillance platform that tracks epidemic-prone diseases in real time. The proposed design is suitable for estimating, at a single point in time, the prevalence of the dengue virus in the suggested regions.

The study areas: The southern and eastern governorates of Yemen.

Study Population: all patients who are clinically evaluated to be a suspected dengue fever and registered through the EIDEWS in the year 2024. The group of patients cover a wide array of socio-demographic variables, enabling the wide investigation of the patterns of dengue occurrence.

Data Sources Data is collected from EIDEWS, a web-based system that gives real-time surveillance data on dengue fever cases that are either suspected or confirmed. Data accrued in EIDEWS is useful in monitoring the trend of Dengue fever in Yemen.

Data collected from each reported case of dengue fever in the whole year of 2024, starting from January to November of that year. The relevant variables are age, gender, governorate, clinical symptoms, laboratory-confirmed Dengue test results, among others. The data were anonymized to protect the identity of patients, and the dataset has been cleaned for analysis.

Statistical Analysis: We apply descriptive statistics to establish the overall sero-prevalence of the dengue virus among suspected cases, stratified by key demographic and geographical factors.

Findings:

A total of 8609 suspected dengue cases were reported in the year 2024 to the electronic early warning system in the southern and eastern governorates in Yemen during the year 2024. Due to limited resources, not all suspected cases were exposed to lab test. The mean age of all the suspected dengue cases is 26.7 years ± 16 years with a wide range from one year to 111 years. Most of them are males (62%, 5340/8609). The mean age of the 221 confirmed cases is 28 years ± 15 years with a wide range from one year to 80 years. Most of the confirmed case are male (64%, 142/221).

The table 1 and 3 shows the positivity rate among the suspected patients being tested. Different lab tests were used in the different governorates surveillance departments such as rapid diagnostic (RDT), Enzyme-linked immunosorbent assay (ELISA) methods. About 1862 RDT used with 58% positivity rates, this test is unreliable and used different commercial kits. For this reason, we rely on the ELISA method in analysis of the confirmed cases of dengue.

A total of 221 out of 1091 suspected cases of dengue (20.2%) were positive for IgM specific for dengue while 393 out of 831 clinically diagnosed dengue cases were positive for IgG specific for dengue (48.9%) given the dengue IgG: IgM ratio to 2.4. The highest sero-prevalence was observed in the age group 15-44 years (22.44) years followed by less than 5 years (21%) and the age group 5-14 years (20%). Table 2

Shabwah, Marib and Aden governorates has the highest prevalence of dengue (49.5%, 45% and 22.3% respectively). Table 3.

Most of the confirmed dengue cases were reported from Shabwah governorate (51.5%), Taiz (19.9%) and Aden (14%). Table 4

Table 1. Dengue sero-prevalence by IgM and IgG (ELISA method)

Dengue test	positive	Negative	Total patients tested	Sero-prevalence %
Dengue ELISA IgM	221	870	1091	20.2%
Dengue ELISA IgG	393	410	803	48.9%

Table 2. Age specific sero-prevalence rate.

Age group in years	Number of suspected cases being tested	Positive cases for dengue IgM	Prevalence%
less than 5	76	16	21%
5 - 14	110	22	20%
15-44	646	145	22.4%
45-64	205	31	15%
65+	54	7	13%

Table 3 Sero-prevalence of dengue IgM cases by governorates, 2024

Governorate	Total suspected cases being tested for dengue IgM	Number of confirmed cases	Sero-prevalence %
Aden	139	31	22.3%
Hadramout Al-Sahel	102	4	3.9%
Hadramout wady	76	5	6.6%
Marib	51	23	45%
Shabwah	230	114	49.5%
Taiz	492	44	9%
Al-Mahrah	1	0	0%
Total	1091	221	20.2%

Table 4. Proportional distribution of the confirmed dengue cases by Governorates.

Governorate	Number of confirmed cases	%
Aden	31	14.0
Hadramout	4	1.8
Hadramout wady	5	2.3
Mareb	23	10.4
Shabwah	114	51.6
Taiz	44	19.9
Total	221	100.0

Other dengue like febrile cases

Malaria were identified in 8.7% of all suspected dengue cases, while Chikungunya IgM were positive in 23.8% and west Nile IgM were positive among 8.5% of all dengue like cases (Table 5). Co-infection was existing in dengue confirmed cases with Chikungunya (17.6%), west Nile virus (2.3%) and malaria (0.9%). Table 6

Table 5. Results of other Non-dengue test

Other test	Positive	Negative	Total patients tested	Sero-prevalence %
Malaria RDT	245	2268	2513	9.7%
Chikungunya ELISA IgM	182	582	764	23.8%
Chikungunya ELISA IgG	64	469	533	12%
West Nile ELISA IgM	31	333	364	8.5%
West Nile ELISA IgG	254	430	684	37%

Table 6. Coinfection with Dengue according to ELISA IgM test (n=221)

Type of co Infection	Dengue ELISA IgM + (n=221)	
	Number	Co-infection proportion
Malaria RDT	2	0.9%
Chikungunya ELISA IgM	39	17.6%
West Nile ELISA IgM	5	2.3%

The time trend of the confirmed dengue cases during 2024

The time trend of the confirmed dengue cases during 2024 presented high cases in the EPI weeks no 10 and 14 (corresponding to march, 2024) and EPI weeks 28 and 32 weeks (corresponding to June-July, 2024). Figure 1.

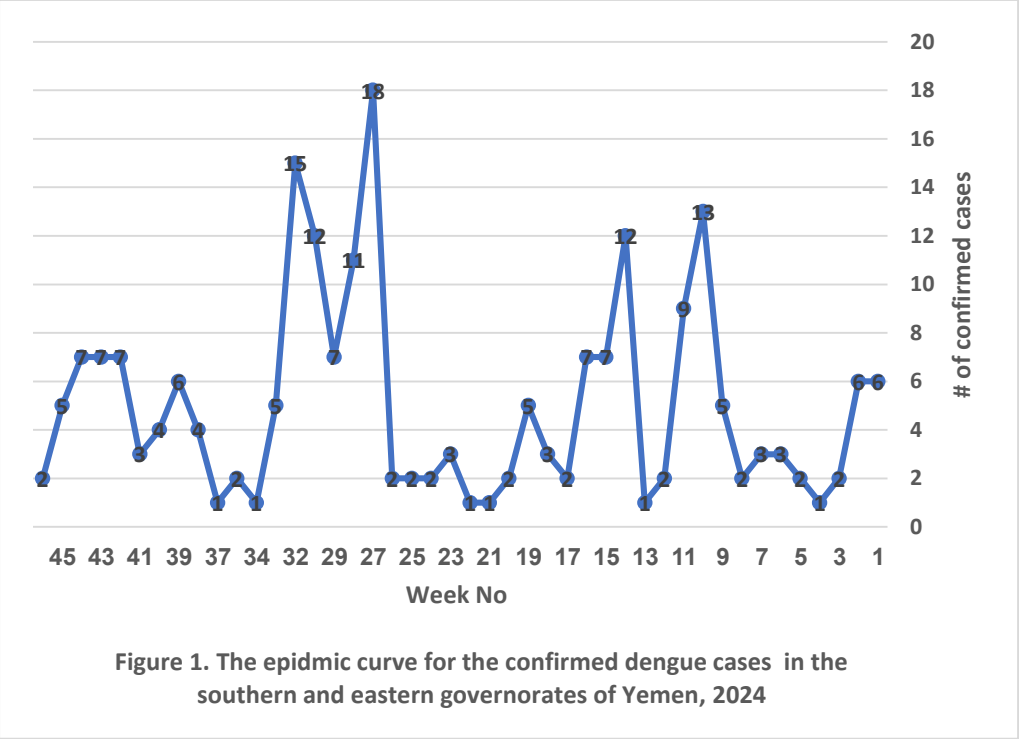

Figure 1. The epidmic curve for the confirmed dengue cases in the southern and eastern governorates of Yemen, 2024

Clinical profile of the confirmed dengue cases.

All the confirmed cases had fever, most of the symptoms are general symptoms like headache, muscle pain and joint pain (99.5% for each). Retro-orbital pain was presented in 45.2% of the cases. The least symptoms are skin rash (9%), bleeding like epistaxis, and diarrhea (1.4% for each). Only nine cases were admitted in the hospital (4%), no death was reported. Table 7.

Table 7. Clinical symptoms and signs of dengue confirmed cases (N =221)

Symptoms and signs	Number of confirmed cases	%
Headache	220	99.5%
Joint pain	220	99.5%
Muscle pain	220	99.5%
Retro-orbital pain	100	45.2%
Skin rash	2	1%
General weakness	65	29.4%
Abdominal pain	31	14%
Vomiting	59	26.7%
Diarrhea	3	1.4%
Hemorrhage	3	1.4%

Discussion:

Drawing a conclusion from the retrospective analysis of the available surveillance data need a high quality surveillance system in the ground. Measuring and monitoring data quality is an essential activity for clinical and public health professionals as well as researchers especially on low resources countries**.**
In case of Yemen where reliability of the surveillance data is of high concern, so for this reason authors try to explain the epidemiological situation of dengue from data of the confirmed cases.

The study focused on the analysis of the available data from the electronic early warning system in the southern and eastern governorates in Yemen during the year 2024.

A 20.2 % was the sero-prevalence of dengue IgM was reported out of 1091 febrile patients were tested while 393 out of 831 clinically diagnosed dengue cases were positive for IgG specific for dengue (48.9%). Dengue IgM:IgG ratio can give us indication of endemicity. Prince HE *et al* in 2011 reported that the IgM/IgG ratio that best discriminated primary from secondary infection was 1.32 (5). In India, a study recommends the cut-off values for IgM:IgG ratio as 1.59 and authors concluded that this ratio hints at increasing endemicity (6). In this study, the ratio is 2.4 indicated a high endemicity with predominance of IgG. Several dengue outbreaks attack Yemeni governorates during the last 20 years especially, shabwah, Taiz and Aden, recurrent outbreak may change the epidemiology of dengue to endemic situation (3, 7, 8). Dengue is an emerging disease in Marib due to influx of huge number of internally displaced persons (IDPs) during the last ten years.

Age distribution is remains predominate among adolescents and young adults. The highest sero-prevalence was observed in the age group 15 - 44 years (22.4%), the findings are similar to other studies in Brazil (9), Vietnam (10) and Ecuador where Dengue sero-prevalence was strongly age dependent consistent with endemic exposure (11).

In the first few days of dengue illness, most patients present with acute febrile illness with non-specific signs and symptoms like headache and malaise. Retro-orbital pain, myalgia and arthralgia are found mostly in dengue fever patients (12). In this study, the most common clinical presentations beside fever are: headache, joint pain, muscle pain and retro-orbital pain.

Chikungunya is the most co-infection reported in this study. In 2010–2011, the chikungunya virus (CHIKV), was detected in febrile patients in Al Hudaydah, Yemen (13). Rezza G et al in 2012 also confirmed the co-circulation of Dengue and Chikungunya Viruses in Al Hudaydah, Yemen (14).

Conclusion:

The sero-prevalence of confirmed dengue cases was 20.2%. The dengue IgG/IgM ratio indicted the high endemicity of dengue fever in Yemen. The co-circulation of Dengue and Chikungunya viruses indicates that mosquito borne infections represent a public health threat in Yemen. Further actions are needed either mapping the mosquito borne diseases or introducing an evidence based and integrated vector control interventions.

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