

Dengue Fever in Eastern and Southern Governorates of Yemen, January 2020 to May 2025

Abdulla Salem Bin-Ghouth, Ali Ahmed Al-Waleedi, Yousef Saleh Khader

Submitted to: JMIR Public Health and Surveillance
on: August 26, 2025

Disclaimer: © The authors. All rights reserved. This is a privileged document currently under peer-review/community review. Authors have provided JMIR Publications with an exclusive license to publish this preprint on its website for review purposes only. While the final peer-reviewed paper may be licensed under a CC BY license on publication, at this stage authors and publisher expressly prohibit redistribution of this draft paper other than for review purposes.

Table of Contents

Original Manuscript.....	5
---------------------------------	----------

Preprint
JMIR Publications

Dengue Fever in Eastern and Southern Governorates of Yemen, January 2020 to May 2025

Abdulla Salem Bin-Ghouth¹; Ali Ahmed Al-Waleedi²; Yousef Saleh Khader³

¹Mukalla Hadhramout University Mukalla YE

²Aden, Khormaksar, Ministry of Public Health and Population (MoPH&P) Aden University Aden YE

³Jordan University for science and technology Amman JO

Corresponding Author:

Abdulla Salem Bin-Ghouth

Mukalla

Hadhramout University

Mukalla, Hadhramout University

Hadhramout University

Mukalla

YE

Abstract

Background: Dengue fever remains a persistent and evolving public health threat in Yemen, particularly in Eastern and Southern Governorates affected by conflict, displacement, and fragile health systems.

Objective: to provide a comprehensive analysis of dengue fever trends from January 2020 to May 2025 in the Eastern and Southern Governorates of Yemen.

Methods: A retrospective descriptive analysis was conducted using routine surveillance data from the Ministry of Public Health and Population across 13 governorates. Aggregated data on dengue cases and deaths were analyzed temporally (weekly, monthly, annually), spatially by governorate, and demographically by age group. Data cleaning and statistical analysis were conducted using Python.

Results: Over the 5.5-year period, 114,843 suspected dengue cases and 429 deaths were reported. The highest annual burden occurred in 2020 (32,225 cases), with notable fluctuations over subsequent years. Despite declining incidence in 2024, the first 22 weeks of 2025 witnessed a concerning rise in deaths (47), surpassing previous mid-year totals. Geographically, Taizz (39% of cases) and Aden (highest mortality) were identified as hotspots. Young adults (15–34 years) constituted over half of all cases. Seasonal trends indicated consistent peaks in autumn, especially October and June.

Conclusions: Dengue remains endemic in Yemen's Eastern and Southern Governorates, with shifting epidemiological dynamics and rising lethality in 2025. High case burdens in urbanized, conflict-affected regions underscore the need for targeted interventions. Strengthening early warning systems, clinical management, and vector control—particularly in high-risk areas like Aden and Taizz—is essential.

(JMIR Preprints 26/08/2025:83003)

DOI: <https://doi.org/10.2196/preprints.83003>

Preprint Settings

1) Would you like to publish your submitted manuscript as preprint?

✓ **Please make my preprint PDF available to anyone at any time (recommended).**

Please make my preprint PDF available only to logged-in users; I understand that my title and abstract will remain visible to all users.

Only make the preprint title and abstract visible.

No, I do not wish to publish my submitted manuscript as a preprint.

2) If accepted for publication in a JMIR journal, would you like the PDF to be visible to the public?

✓ **Yes, please make my accepted manuscript PDF available to anyone at any time (Recommended).**

Yes, but please make my accepted manuscript PDF available only to logged-in users; I understand that the title and abstract will remain visible to all users.

Yes, but only make the title and abstract visible (see Important note, above). I understand that if I later pay to participate in <http://www.jmir.org>

No. Please do not make my accepted manuscript PDF available to anyone. I understand that if I later pay to participate in <https://www.jmir.org>



Original Manuscript

Dengue Fever in Eastern and Southern Governorates of Yemen, January 2020 to May 2025***Ali Ahmed Al-waleedi¹, Yousef Khader², Abdulla Salem Bin Ghouth³***

1. Associate Professor, Department of Community Medicine and Public Health, Aden University, e-mail: a.alwaleedi@moh-ye.org , aalwaleedi22@gmail.com
2. Professor, Department of Public Health, Jordan University for Science and Technology, Irbid, Jordan. e-mail: yskhader@just.edu.jo
3. Professor, Department of Community Medicine, Hadhramout Univesrity. e-mail: a.binghouth@hu.edu.ye , abinghouth2007@yahoo.com

Corresponding author***Abdulla Salem Bin-Ghouth***

*Professor, Department of Community Medicine, Hadhramout Univesrity. Mobile: +967774954505
e-mail: a.binghouth@hu.edu.ye , abinghouth2007@yahoo.com*

Abstract

Background: Dengue fever remains a persistent and evolving public health threat in Yemen, particularly in **Eastern and Southern Governorates** affected by conflict, displacement, and fragile health systems. This study provides a comprehensive epidemiological analysis of dengue fever trends from January 2020 to May 2025.

Methods: A retrospective descriptive analysis was conducted using routine surveillance data from the Ministry of Public Health and Population across 13 governorates. Aggregated data on dengue cases and deaths were analyzed temporally (weekly, monthly, annually), spatially by governorate, and demographically by age group. Data cleaning and statistical analysis were conducted using Python.

Results: Over the 5.5-year period, 114,843 suspected dengue cases and 429 deaths were reported. The highest annual burden occurred in 2020 (32,225 cases), with notable fluctuations over subsequent years. Despite declining incidence in 2024, the first 22 weeks of 2025 witnessed a concerning rise in deaths (47), surpassing previous mid-year totals. Geographically, Taizz (39% of cases) and Aden (highest mortality) were identified as hotspots. Young adults (15–34 years) constituted over half of all cases. Seasonal trends indicated consistent peaks in autumn, especially October and June.

Conclusion: Dengue remains endemic in Yemen's Eastern and Southern Governorates, with shifting epidemiological dynamics and rising lethality in 2025. High case burdens in urbanized, conflict-affected regions underscore the need for targeted interventions. Strengthening early warning systems, clinical management, and vector control—particularly in high-risk areas like Aden and Taizz—is essential.

Keywords: Dengue fever, Yemen, epidemiology, vector-borne diseases, outbreak, surveillance, conflict, *Aedes aegypti*, mortality, public health emergencies.

Running Title: Dengue in Yemen

Introduction

Dengue fever is a mosquito-borne viral infection caused by four distinct dengue virus serotypes (DENV-1 to DENV-4), transmitted primarily by the Aedes aegypti mosquito. Globally, dengue has become one of the most rapidly expanding vector-borne diseases, with an estimated 59 million cases and 29,000 deaths reported in 2021 alone, nearly doubling from 1990 levels [1]. The disease burden is highest in tropical and subtropical regions, particularly in Asia and Latin America, but the Eastern Mediterranean Region (EMR) has witnessed a concerning rise in transmission over the past decade [2].

Yemen is considered one of the most vulnerable countries to dengue outbreaks in the EMR due to a convergence of risk factors, including climate variability, population displacement, urban overcrowding, and weakened health systems resulting from protracted conflict [3,4]. Since the onset of civil unrest in 2015, multiple dengue outbreaks have been reported in the country, especially in densely populated and conflict-affected areas such as Taizz, Aden, and Al Hudaydah [4]. A recent study reported over 100,000 suspected cases and hundreds of deaths between 2020 and 2024, with all four DENV serotypes known to circulate in Yemen [5].

The humanitarian crisis in Yemen has disrupted water, sanitation, and health infrastructure, creating ideal breeding grounds for Aedes mosquitoes. Internally displaced populations residing in crowded, poorly serviced settings are at particularly high risk [4,6]. Seasonal factors—such as post-rainfall stagnation—further exacerbate transmission risks, with peak caseloads typically observed in the final quarter of the year [5,7].

Despite the growing public health threat posed by dengue, routine surveillance remains fragmented, and laboratory confirmation is often limited. This epidemiological study aims to provide a comprehensive analysis of dengue fever trends from January 2020 to May 2025 in the Eastern and Southern Governorates of Yemen. The study seeks to describe the temporal, geographic, and demographic patterns of disease occurrence and to inform evidence-based public health responses in a complex emergency setting.

Methods

Study Design and Setting

This study employed a retrospective descriptive design to analyze dengue fever surveillance data collected from the Eastern and Southern Governorates of Yemen. The analysis covered the period from January 1, 2020, through May 26, 2025 (epidemiological Week 22). The setting included thirteen governorates. Governorates—such as Taizz, Aden, Lahj, Shabwah, and Abyan—have historically experienced recurring dengue outbreaks and were the primary focus of surveillance and response activities during the study period.

Data Sources

The study utilized aggregated surveillance data obtained from the Ministry of Public Health and

Population (MoPHP). The datasets were provided in CSV format and consisted of three primary components: weekly national-level trends of reported dengue cases and deaths; annual summaries of dengue cases and deaths by governorate; and annual case and death totals disaggregated by age group. These datasets were compiled from the national routine disease surveillance system. However, data disaggregated by sex were not consistently available and thus were not included in the analysis.

Data Cleaning and Management

All data processing and analysis were conducted using Python version 3.11. The datasets were harmonized by standardizing column headers, translating geographic and demographic labels into English, and aligning all temporal fields with ISO 8601 week-based formatting. Inconsistencies or missing values were reviewed manually and cross-checked with MoPHP reports and bulletins where available.

Epidemiological Analysis

The descriptive analysis followed the classical epidemiological framework of time, place, and person. Temporal trends were examined by calculating weekly and monthly case and death counts from 2020 to 2025 (up to Week 22). Year-over-year comparisons were conducted to assess changes in incidence and mortality. Seasonal patterns were explored by computing the average monthly case load over the period 2020–2024. The year-to-date (YTD) status for 2025 was compared against the same epidemiological weeks in previous years to detect early deviations from past trends.

Spatial distribution was analyzed by calculating cumulative and 2025 YTD case and death totals by governorate. Governorates were classified into high, medium, or low-risk categories based on both their cumulative burden from 2020 to 2025 and their case counts in the first 22 weeks of 2025. Risk stratification supported the identification of geographical hotspots. These spatial patterns were summarized in tabular format. Population-level analysis focused on the distribution of dengue cases and deaths across eight age groups: <5, 5–14, 15–24, 25–34, 35–44, 45–54, 55–64, and ≥65 years. Due to the unavailability of sex-disaggregated data, gender-specific patterns could not be examined. All data management, analysis, and visualization tasks were completed in Python.

Results

Temporal Trends

Dengue incident cases and deaths varied substantially over the past five years. The highest annual burden occurred in 2020 (32,225 cases, 122 deaths), followed by a sharp decline in 2021 (19,832 cases, 30 deaths; –38.4% cases, –75.4% deaths vs. 2020). Cases rebounded in 2022 (25,884; +30.5% vs 2021.) while deaths also increased (45 deaths; +50.0%), and remained relatively high in

2023 (22,262 cases; –14.0% vs. 2022) as deaths continued to fall (18 deaths; –60.0% vs 2022.). A pronounced reduction occurred in 2024 (10,158 cases, 10 deaths; –54.4% cases, –44.4% deaths vs. 2023) (Table 1).

Table 1: Annual dengue cases, deaths, and year-over-year percent change (2020–2024).

Year	Cases	Deaths	Cases (% change)	Deaths (% change)
2020	32,225	122	–	–
2021	19,832	30	–38.4%	–75.4%
2022	25,884	45	+30.5%	+50.0%
2023	22,262	18	–14.0%	–60.0%
2024	10,158	10	–54.4%	–44.4%

Through **Weeks 1–22** of 2025, a total of 6,807 cases and 47 deaths were reported. Cases in the first half of 2025 exceed those in the same period of 2024 by about 84.5%, although they remain lower than the corresponding counts in 2020, 2022, and 2023 (Table 2). Strikingly, early 2025 deaths ($n=47$) are far higher than in any recent year's first half. For example, 2024 had only 5 deaths in Weeks 1–22, so the 2025 death toll represents an 840% increase and surpasses the mid-year totals of 2023 (5 deaths), 2022 (21 deaths), and 2021 (11 deaths).

Table 2: Dengue cases and deaths in Weeks 1–22 for each year (2020–2025).

Year	Cases (W1–22)	Deaths (W1–22)
2020	13,385	91
2021	8,936	11
2022	8,526	21
2023	9,316	5
2024	3,689	5
2025	6,807	47

Weekly and Seasonal Patterns

Figure 1 shows weekly cases and deaths (2020 - 2025 W22). The epidemic curve exhibits clear peaks and troughs. The largest single-week outbreak occurred in mid-2023: Week 22 of 2023 saw 1,508 cases, far exceeding any weekly count in prior years. Other notable peaks included late 2022 (Week 42: 1,232 cases) and late 2020 (Week 42: 1,030 cases). In 2025, case counts rose steadily from about Week 10 to Week 20 before a slight decline in Weeks 21–22. Deaths have likewise been more frequent in recent weeks of 2025 than in the same weeks of prior years.

Seasonal analysis shows a pronounced autumn peak. During 2020–2024, nearly 28.9% of dengue cases occurred in the autumn months (September–November), followed by 24.8%

in summer, 24.2% in winter, and 22.1% in spring. On a monthly basis, June and October stand out: for example, June 2023 recorded 5,282 cases and October 2022 had 4,429. In general, case counts begin to rise in late spring, peak in early–mid autumn, and subside in winter.

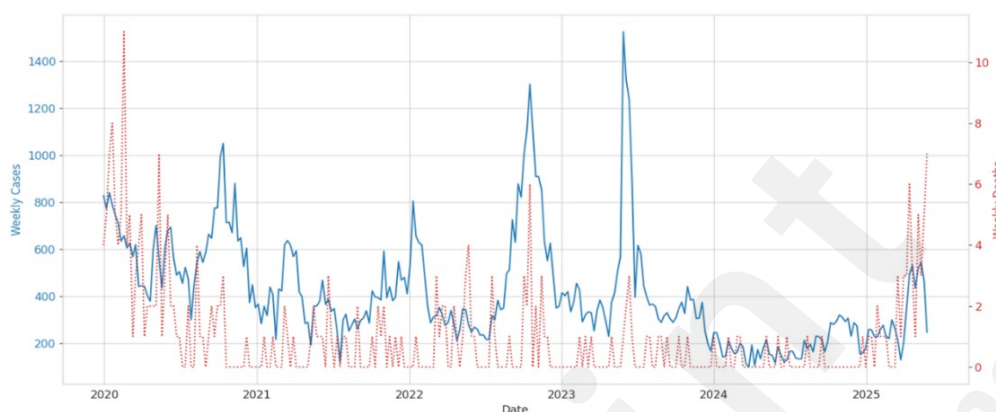


Figure 1: Dengue Epidemic Curve: Weekly Cases and Deaths (2020 - 2025 W22)

Geographic Distribution

The geographic burden of dengue is highly uneven. By cumulative case count (2020–2025 W22), **Taizz** has been the epicenter with 44,902 cases ($\approx 39.2\%$ of the total) and 22 deaths. **Aden** follows with 14,106 cases but an exceptionally high death toll (134 deaths, 0.95% case-fatality). **Shabwah** (13,439 cases, 20 deaths), **Abyan** (11,292 cases, 16 deaths), and **Lahj** (10,143 cases, 49 deaths) also experienced major outbreaks. Notably, Aden's mortality rate is several-fold higher than in most other governorates. In contrast, several governorates have had relatively few cases: Al Bayda (392 cases, 1 death), Socotra (49 cases, 0 deaths), and non-liberated-area cases (22, 0 deaths) remain minimal. Table 3 summarizes the cumulative cases and deaths by governorate.

Table 3: Cumulative dengue cases and deaths by governorate (2020–2025 W22), with risk classification.

Governorate	Cases	Deaths	Risk
Taizz	44,902	22	High
Aden	14,106	134	High
Shabwah	13,439	20	High
Abyan	11,292	16	High
Lahj	10,143	49	High
Marib	8,654	2	Medium
Hadramaut (Mukalla)	6,941	14	Medium
Hadramaut (Sayun)	4,598	4	Medium
Al Dhale'e	1,194	2	Medium
Al Maharah	736	4	Medium
Al Hudaydah	436	4	Medium
Al Bayda	392	1	Low
Socotra	49	0	Low
Outside Areas	22	0	Low

Population Distribution (Age)

Analysis of cases by age indicates that younger adults accounted for highest number of cases (Table 4). The 15–24-year age group accounted for 30,232 cases (58 deaths), the highest of any cohort. The 25–34-year group also had a large burden (28,339 cases, 40 deaths). Together these two groups represent over half of all cases. Children 5–14 years old experienced 17,639 cases and 47 deaths. In contrast, the ≥65 group had only 3,811 cases (27 deaths).

Table 4: Dengue cases and deaths by age group (2020–2025 W22).

Age Group	Cases	Deaths
<5	4,650	29
5–14	17,639	47
15–24	30,232	58
25–34	28,339	40
35–44	17,000	30
45–54	9,820	23
55–64	5,413	18
≥65	3,811	27

Discussion

This study demonstrated that dengue fever remains an endemic and evolving public health threat in the Eastern and Southern Governorates of Yemen. Over the 5.5-year surveillance period (2020 to mid-2025), more than 100,000 suspected cases and over 400 associated deaths were reported. Although overall case numbers declined after a 2020 peak, the substantial increase in deaths during the first 22 weeks of 2025, particularly in Aden and Lahj, raises concerns about shifting transmission dynamics and potential deficiencies in the clinical management of severe dengue cases.

The notable increase in 2025 mortality, despite lower case numbers compared to prior peak years, may be attributed to delayed care-seeking, circulation of more virulent dengue virus serotypes, inadequate case recognition, or health system strain. These findings align with previous reports from Yemen, where increased fatality rates have been observed in association with conflict-related disruptions and limited healthcare access [3,5]. In particular, Aden reported 33 of the 47 deaths in 2025 YTD, warranting targeted investigation into facility readiness and case management protocols in this high-burden governorate.

*The geographic concentration of cases in Taizz, Aden, Shabwah, Lahj, and Abyan reflects a pattern consistent with historical dengue distribution in Yemen. These governorates combine large urban populations, inadequate waste management, intermittent water supply, and limited vector control activities—factors known to support *Aedes aegypti* proliferation [2]. For example, Taizz accounted*

for nearly 45% of all reported cases from 2020 to 2025, mirroring earlier outbreak patterns during the civil conflict where DENV-2 was identified as the dominant serotype [3].

Demographic analysis showed the greatest burden of dengue cases and deaths among individuals aged 15–34 years, followed by school-age children (5–14 years). This finding is consistent with regional studies in Saudi Arabia and Oman, where adolescents and young adults have been identified as high-risk groups due to increased mobility and exposure to vector habitats [8,9]. The concentration of disease in working-age populations may also reflect underdiagnosis in older adults and children or greater testing access among economically active groups.

Seasonal analysis revealed a consistent peak in dengue transmission during the post-rainy season, particularly in October, corroborating previous studies that emphasize the strong influence of rainfall and humidity on mosquito density and viral transmission [5]. The 2025 epidemic curve, which shows a rapid increase in weekly cases between weeks 10 and 20, may reflect early seasonal onset or delayed interventions.

The persistence of dengue in Yemen is driven by a combination of structural and contextual factors. The ongoing conflict has displaced millions, destroyed health infrastructure, and compromised water and sanitation systems—conditions that promote mosquito breeding and hinder outbreak response [3,4]. A 2025 review of neglected tropical diseases in Yemen confirmed that dengue is among the most widely reported vector-borne diseases in the country, yet remains underdiagnosed due to weak surveillance and limited laboratory capacity [4].

Conclusion

Dengue remains endemic in Yemen's Eastern and Southern Governorates, with shifting epidemiological dynamics and rising lethality in 2025. High case burdens in urbanized, conflict-affected regions underscore the need for targeted interventions. Despite the scale of the dengue burden, the national response remains fragmented. There is an urgent need to strengthen early warning systems, improve clinical recognition and treatment of severe dengue, and sustain year-round vector control. Integrated approaches—combining community mobilization, environmental management, and intersectoral collaboration—are essential to address the multiple determinants of dengue transmission in Yemen's high-risk settings.

Acknowledgements

The authors thank Mr Ammar Al-Jelany (The EIDEWS officer) in the department of surveillance at PHC sector of ministry of public health and population and his colleagues for providing the original dataset that authors used for analysis.

References

1. Zhang WX, Zhao TY, Wang CC, He Y, Lu HZ, Zhang HT, Wang LM, Zhang M, Li CX,

- Deng SQ. (2025). Assessing the global dengue burden: incidence, mortality, and disability trends over three decades. *PLoS Negl Trop Dis*. 19(3):e0012932.
2. Nasirian H. (2025). Factors affecting establishment of dengue fever vectors in urban areas. *East Mediterr Health J*. 31(1):6–10.
 3. Alghazali KA, Teoh BT, Loong SK, Sam SS, Che-Mat-Seri NA, Samsudin NI, Yaacob CN, Azizan NS, Oo A, Baharudin NA, Tan KK, Abd-Jamil J, Nor'e SS, Khor CS, Johari J, Mahdy MAK, AbuBakar S. Dengue Outbreak during Ongoing Civil War, Taiz, Yemen. *Emerg Infect Dis*. 2019 Jul;25(7):1397-1400. doi: 10.3201/eid2507.180046.
 4. Alhothily, I.A.A., Dapari, R. & Dom, N.C. Neglected tropical diseases in Yemen: a systematic review of epidemiology and public health challenges. *BMC Public Health* **25**, 510 (2025). <https://doi.org/10.1186/s12889-025-21700-z>
 5. Edrees WH, Al-Shehari WA, Al-Haddad AM, [Alrahabi LM](#), Al-Haddad [OS](#), [Al-Halani AA](#). (2025). Dengue fever in Yemen: a five-year review, 2020–2024. *BMC Infect Dis*. 25:28.
 6. Kholedi AA, Balubaid O, Milaat W, Kabbash IA, Ibrahim A. (2012). Factors associated with the spread of dengue fever in Jeddah governorate, Saudi Arabia. *EEast Mediterr Health J*. 18(1):15–23.
 7. Morales I, Salje H, Saha S, Gurley ES. Seasonal Distribution and Climatic Correlates of Dengue Disease in Dhaka, Bangladesh. *Am J Trop Med Hyg*. 2016 Jun 1;94(6):1359-61. doi: 10.4269/ajtmh.15-0846.
 8. Altassan KK, Morin C, Shocket MS, Ebi K, Hess J. (2019) . Dengue fever in Saudi Arabia: A review of environmental and population factors impacting emergence and spread. . *Travel Med Infect Dis*. 30:46-53.
 9. Al Awaidy ST, Al Obeidani I, Bawikar S, Al Mahrouqi S, Al Busaidy SS, Al Baqlani S, Patel PK. (2014). Dengue epidemiological trend in Oman: a 13-year national surveillance and strategic proposition of imported cases. *Trop Doct*. 44(4):190-5.