

# Malaria and dengue in Hodeidah City, Yemen: the importance of laboratory confirmation



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## Background

Emergence of dengue in malaria-endemic countries with limited diagnostic resources, including Yemen, can be problematic because presumptive treatment of febrile cases as being malaria is a common practice. This makes evaluation of febrile patients a challenge and may lead to unnecessary treatment of dengue as presumed malaria or to ignore malaria treatment in a co-infection confirmed as dengue only.

## Aim

To determine the proportions of malaria, dengue and co-infection in relation to certain sociodemographic and clinical characteristics among febrile outpatients seeking healthcare in Hodeidah city, west of Yemen.

The study was conducted in all three districts of Hodeidah city (Al Mina, Al Hali and Al Hawak), west of Yemen.

## Methods

This cross-sectional study was conducted among 355 febrile outpatients seeking healthcare in the hospitals of Hodeidah city during the malaria transmission season (September 2018 – February 2019). Sociodemographic and clinical characteristics were collected using a pre-designed, structured questionnaire. Malaria was confirmed using microscopy and rapid diagnostic tests (RDTs),



Map of Hodeidah governorate showing the three districts of the city.

**“ Proportion of malaria-dengue co-infection among febrile patients in Hodeidah is as low as almost 5.0%. ”**

while dengue was confirmed using RDTs. Data were verified and analyzed using appropriate statistical tests.

## Results

### Proportions of malaria, dengue and co-infection

Of 355 febrile patients, 32.4% had falciparum malaria and 35.2% had dengue. Of dengue-positive patients, 63.2% had recent probable infection (NS1- and/or IgM-positive) and 36.8% had past infection (IgG-positive). Co-infection with falciparum malaria and recent probable dengue infection was detected among 4.8% of febrile cases.

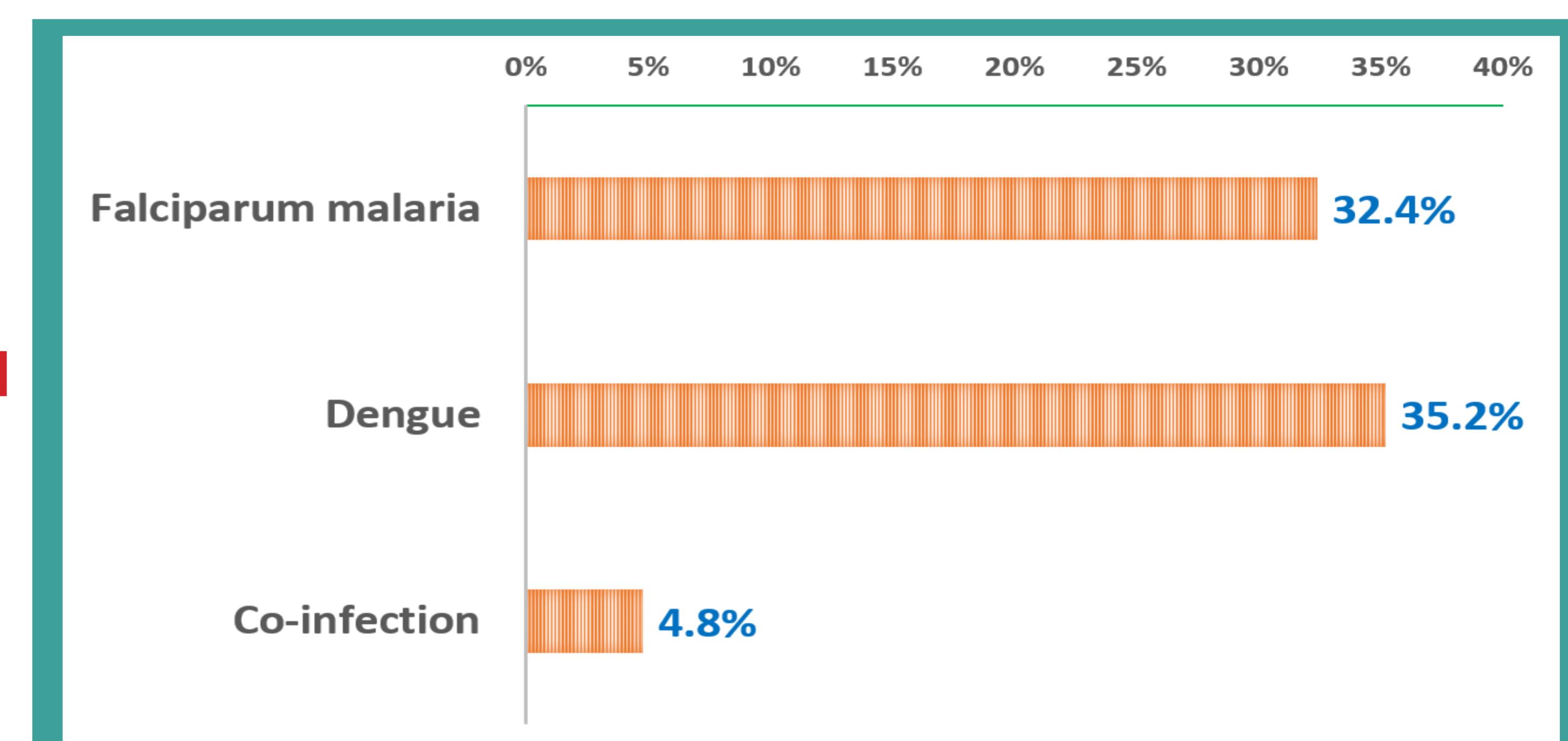
### Comparison of co-infection with malaria and mono-infections

The odds of co-infection were significantly lower than the odds of malaria among patients presenting with sweating (OR = 0.1, 95% CI: 0.05–0.45;  $p < 0.001$ ), while the odds of co-infection were 3.5 times significantly higher than the odds of dengue among patients presenting with vomiting (OR = 3.5, 95% CI: 1.20–10.04;  $p < 0.021$ ).

Because of the small number of co-infected cases and many missing values for sociodemographic characteristics, sociodemographic differences between co-infected and mono-infected patients were not analyzed.

## Conclusion

The proportions of mono-infection with malaria and dengue are comparable among about one-third of febrile outpatients in Hodeidah, while almost 5.0% of cases can be co-infected. Clinical characteristics cannot easily distinguish malaria patients from those with dengue or co-infection, reinforcing the necessity of proper laboratory diagnosis and avoidance of treating febrile patients as being presumed malaria cases.



Proportions of falciparum malaria, dengue and co-infection among febrile patients seeking healthcare in Hodeidah city, Yemen (2018-2019)

**Male : female ratio: 1.7**

**Age (years):**  
Median (IQR): 28.0 (21.0)

**Axillary temperature (°C):**  
Mean (SD): 38.8 (0.7)

**“ Clinical features cannot easily distinguish malaria patients from those with dengue or co-infection ”**

## Ethical considerations

Ethical approval was obtained from the Research Ethics Committee of the Faculty of Medicine and Health Sciences, University of Science and Technology, Sana'a, Yemen (EAC/UST136) and the Ethics Advisory Group (EAG) of The Union, Paris, France (EAG number: 14/19).

Informed consent was obtained from eligible participants or their parents/guardians.

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