

A cross-sectional study investigating malaria among migrants in a healthcare limited gold mining settlement in Gambella Region, Ethiopia

Glendening N¹, Haileselassie W², Parker DM¹.

1. Department of Population Health and Disease Prevention, UC Irvine; 2. School of Public Health, Addis Ababa University



Introduction

- Malaria is a major public health issue in Ethiopia and the government is committed to malaria elimination. Internal migration dynamics may pose a threat to the success of such efforts.
- There is increasing migration from highland areas of Ethiopia, where the malaria burden is low, to lowland areas of Ethiopia where the malaria burden is high^{1,2,3}.
- Migrants may be at heightened risk for malaria infections because of:
 - Immunological naivety from lack of prior exposure to malaria^{4,5}
 - Socioeconomic status and poor housing options⁵
 - Limited access to healthcare resources for prevention & treatment^{4,5}.
 - Work environment which can increase vector-human interactions^{4,5}
- Migrants' malaria risks may be heightened when they move to new settlements (not established ones) where there is limited community infrastructure, including healthcare resources⁶.
- As the artisanal and small-scale mining (ASM) industry expands⁷, increasingly more migrants are moving to malarious areas of Ethiopia. An increase in the number of new settlements is expected as a result.

Objectives

- To calculate malaria prevalence in an emerging extractive-based settlement in Gambella Region (Lunga), and to investigate potential risk factors influencing this.
- To see whether migration (where a person moved from) was affecting malaria prevalence, as well as knowledge and practices of malaria prevention at Lunga.
- To understand people's perceived access to healthcare, at Lunga, particularly around malaria treatment services.

Study Site

- Lunga is an emerging settlement formed around ASM in Gambella Region, Ethiopia.
- The Gambella region has the highest incidence of malaria in the country (Haileselassie et al., 2022).
- Since ~2016 migrants have started moving to Lunga to work in gold mining, causing a rapid expansion in the population and settlement.

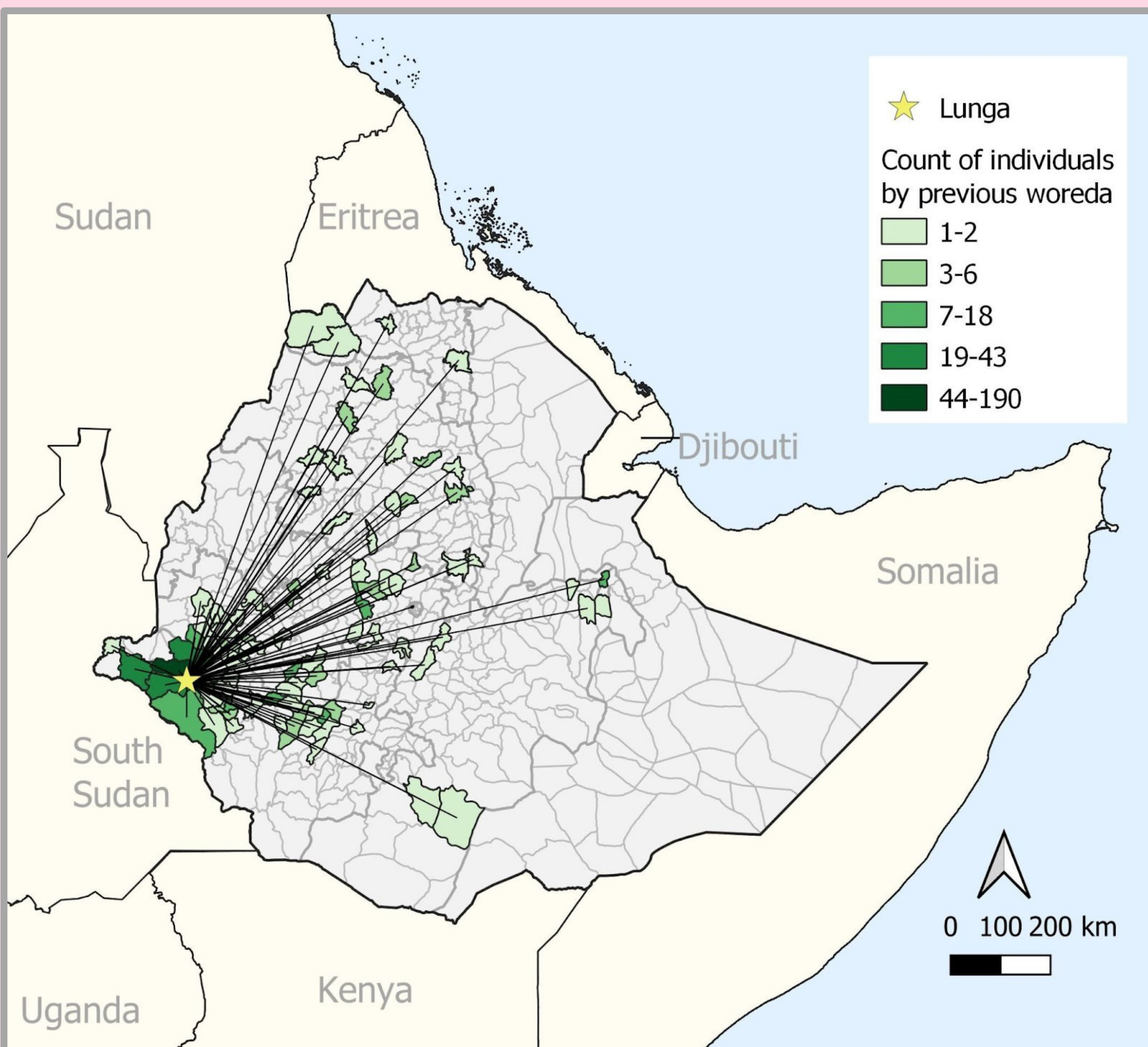


Figure 1: Map of places of origin for settlers in Lunga, Gambella Region, Ethiopia

Methods: Data Collection

- Field work took place over two weeks in September 2022.
- We used a single-stage random cluster sampling strategy where each cluster was a household in Lunga.
- Households were randomly selected from a household registry and everybody over 12 months in each selected household was invited to participate in the study.
- All participants were tested for malaria using RDTs and finger prick blood samples were taken for microscopy testing.
- A structured Knowledge, Attitudes and Practices survey was delivered verbally to participants in a local language. Answers were translated into English before documentation.
- A sub-sample (n=31) of participants 18+ were interviewed about Lunga & healthcare access relating to malaria.

Methods: Model Building

- Generalized additive model (GAM) with a binomial probability distribution and household-level random intercept.
- The regression included **individual** and **household** level predictors

• Age	• Mean elevation of prior district	• Household size
• Gender	• Test positivity of prior district	• Number of other positive malaria infections in the household
• Bed net access		• Household ID (random intercept)
• Time in Lunga		
- Time, Elevation, Test Positivity, Household Size and Other Household Infections were included in the model using smoothing spline functions.

Results

- Malaria prevalence among our sample was **39.7%** (CI: 34.7%-44.4%).
- Of 590 people surveyed, 239 were positive (by either RDT or microscopy) including 228 with *P. falciparum* and 49 people with mixed (*P. falciparum* & *P. vivax*) infections.
- Most people came from nearby areas (55% from the Gambella Region) but many came from far away (furthest est. distance = 850.73km)
- Most people (86%, n=409) knew bed nets were effective at reducing malaria but only 12% (n=59) had access to a bed net.
- People from higher elevation with low test positivity areas were more likely to have bed nets.
- People most likely to test positive for malaria came from low, elevation, high test positivity areas.

Results: Predictors of *Pf* malaria infection and bed net access

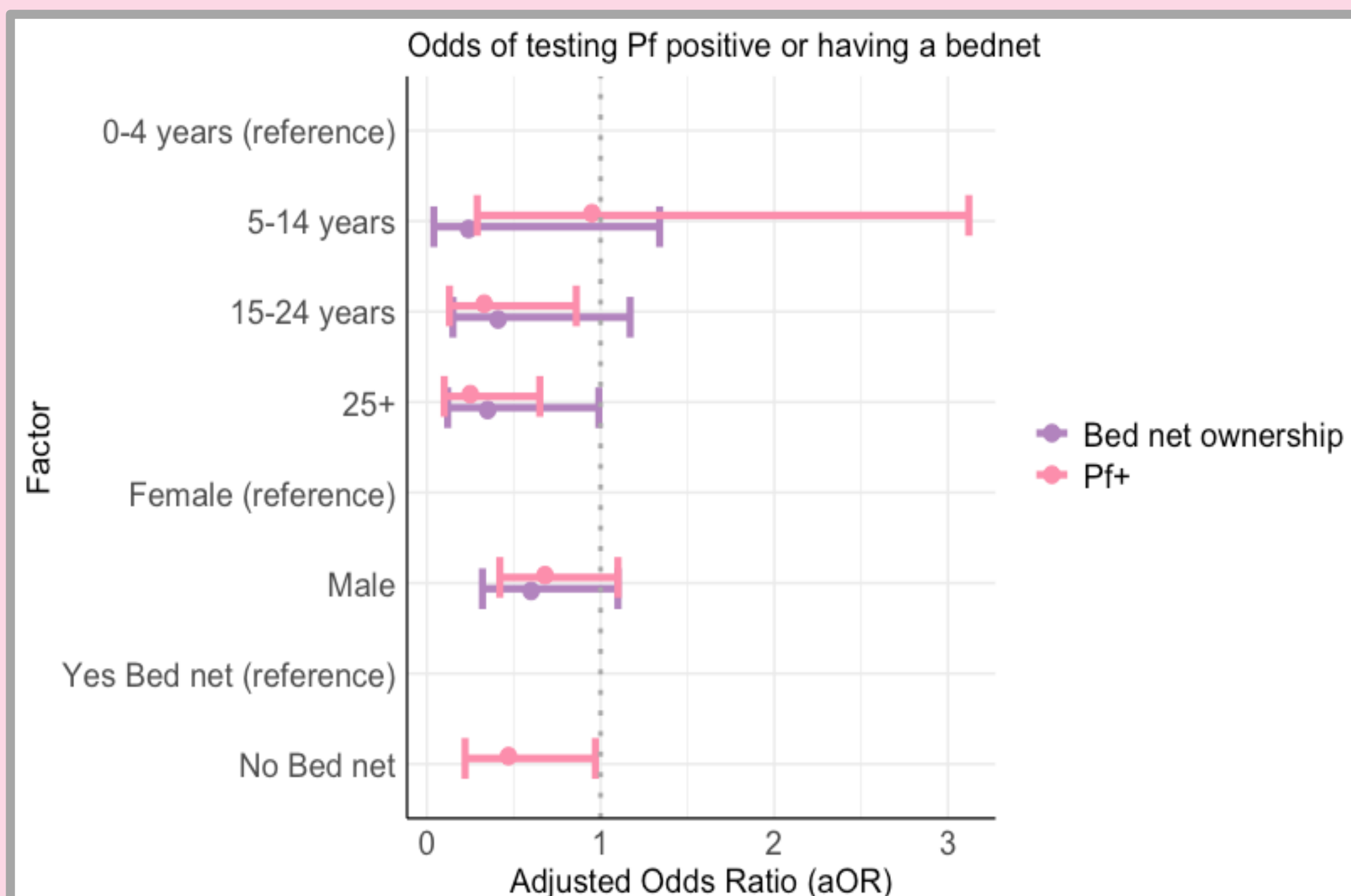


Figure 2: Adjusted odds ratios (aOR pink or purple circles) and confidence intervals (CI: extending lines) of predictors. When the CIs do not include '1' the result is statistically sig.

Qualitative Results

Participant interviews were analyzed using thematic analysis. We found four main themes.

Reasons for moving to Lunga

"I went to Abobo district for another work and I heard from people that there is gold in Lunga. Then I decided to see this place."

General living conditions

"Everything is expensive in here. The food and all the basic needs are expensive. I think the gold mining exaggerated the living condition too. Its worse than the national condition, for example of you take drinking water, it's not even purified water, they just collect from village and put it in a container then they sell by 10 or 15 birr [\$0.18-0.26 USD]"

Healthcare access and general public health

"I didn't go to facility earlier because I don't have enough money for treatment."

"Even if I want to buy, I can't find [bed nets] here. It's being sold on Gambella around 400 to 500 [\$7-8.8 USD]. Can you imagine going that far just to buy bed net?"

Community support for those that are sick

"Most mining workers suffer from malaria. So at that time we call the leader of the kebele and ask him to give us an ambulance then we collect some money and send him with one of his friends. If he still doesn't feel better, he will be referred to Gambella for better treatment. We follow everything through phone and collect money from the community as needed. When he finally gets back here, we'll help him rest until he's healed."

Discussion & Concluding Remarks

- Living in a newly emerging settlement can be challenging**
- Lunga exemplifies one type of community that is frequently missed in public health efforts.
- Our analyses illustrate some of the challenges they may face.
- Malaria has a high disease burden, but treatment options are limited**
- What healthcare and public health efforts are available, they are expensive and geographically distal to the community living at Lunga.
- Bed nets are protective, but inaccessible**
- Bed net ownership showed strong protective effects and people were knowledgeable about this effect.
- However, many people reported not having bed nets and wishing that they had better access to bed nets, as well as healthcare in general.
- Future interventions could target large households and those with children first.**
- Crowded houses and young children were shown to be more at risk of malaria infection.
- Our analysis points toward a strong need for increased public health and general healthcare provision in this setting. Efforts could target large houses and children first.

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