

A mini-review of sub-populations missing in the malaria control loop

Aju-Ameh CO¹[ID](#)

¹Department of Biological Sciences, Faculty of Science, Federal University of Health Sciences, Otukpo (FUHSO), Benue State, Nigeria

Submitted: 3rd March 2024

Accepted: 11th September 2024

Published: 31st December 2024

[ID](#): Orcid ID

Abstract

Background: The world malaria burden increased from an estimated 245 million incidents in 2020 to 247 million cases in 2021, and by the latest report, a further increase to 249 million cases. Where present, malaria affects people of all groups, irrespective of age, race, and social status.

Main body: Malaria is caused by Plasmodium parasites, which are transmitted through the bites of infected female Anopheles mosquitoes however, a higher parasite biomass (99%) is found in men, while only one (1%) is found in mosquitoes. Humans migrate at a faster speed, covering more distance and traversing new geographical locations, compared to the malaria vectors. Street children and the homeless are among the nomadic sub-population groups that seem to be under-studied and under-served in the context of malaria elimination. Should elimination eventuate, a possibility exists for these neglected people groups to service malaria disease resurgence, if they remain untracked, untested and untreated.

At the heart of Sustainable Development Goal (SDG) 3 is how to achieve universal health coverage by ensuring healthy lives and promoting well-being for all ages. This mini-review seeks to highlight the need for the inclusion of these sub-populations in the discussion of malaria and perhaps, other diseases that have been earmarked for elimination. Where street kids and the homeless constitute a social concern, they are worthy of investigation.

Conclusion: Malaria does not discriminate, and is said to rebound with a vengeance. It is time to think outside the box. It is time for Africa to own her diseases, identify her research gaps and address them. This mini-review article discusses a malaria control gap with the accompanying multi-dimensional challenges, proffering pathways to overcome the challenges.

Keywords: Malaria, Parasites, Vectors, Reservoir, Street kids, Homeless persons, Control, Elimination, Nigeria

Plain English Summary

Malaria is caused by Plasmodium parasites transmitted by female Anopheles mosquitoes. Where present, it affects all groups of people irrespective of age, race or social status. If it affects all then all should be included in on-going intervention measures. Nigeria bears the heaviest malaria burden in the world. While the end goal is elimination, present control efforts seem to lean towards some people groups in the community- street kids and the homeless. When excluded from the control loop, they may serve as the parasite reservoir and contribute to disease transmission. These demographic groups may also constitute an inadvertent source of disease resurgence, that may reverse progress after successful efforts at the elimination of particular diseases from the general population. It is therefore expedient to recognise and respect their humanity by including them in control programs.

Background

Malaria Matters Where It Matters Most

Malaria disease involves cyclical infection of humans by female Anopheles mosquitoes (1) which ingest the malaria parasites from the

reservoir host – an infected person – and injects non-infected persons with the same, thereby sustaining the disease transmission cycle. The World Health Organization (WHO) reported an increase from an estimated 245 million incidents

Correspondence:

Aju-Ameh, Celina O

Department of Biological Sciences, Faculty of Science,
Federal University of Health Sciences, Otukpo (FUHSO),
Benue State, Nigeria.

+2349064507607, celina.ajuameh@fuhso.edu.ng

in 2020 to 247 million cases in 2021, a surge that is attributable, perhaps, to the disruption of services during the COVID-19 pandemic (2). The latest report reveals a further increase from 247 million cases to 249 million estimated cases. The WHO Africa Region contributed most of the global malaria disease burden (cases-93.6%, deaths- 95.4%) in 2022 (cases-93.6%, deaths-95.4%); 78.1% of all deaths in this region were among children aged under 5 years (3).

African Union (AU) similarly reported that 96% of global malaria cases and 98% of malaria deaths occur on the continent, with Nigeria bearing the heaviest weight (27%cases; 31% deaths) thus, topping the chart of high burden and high impact nations (4).

Updates from the 35th Assembly of the African Union (AU) suggest that despite a 1% malaria incidence decline between 2015 and 2020, the organization did not achieve its goal to reduce malaria incidence and mortality by 40% by 2020. The updates also show that while 80% of the 611,802 deaths arising from malaria in that period were children under age five, the 2021 WHO malaria report may have underestimated previous malaria death rates. Therefore, the malaria disease burden may be worse than previously understood. In confirmation, the Commonwealth Malaria Report stated that high-burden countries that were already steadily reducing malaria relapsed, falling further off track; with Nigeria, in particular, being one of those with the highest malaria burden and impact in recent times. Thus, the mortality rates in Commonwealth countries are now higher than in 2015, with the case incidence rising every year (5).

While malaria research in Nigeria appears to have increased in both volume and diversity of the issues explored, there appears, nevertheless, to be a population gap, in the sense that there is limited data and knowledge on malariological indices concerning two understudied sub-population groups: homeless individuals and street children. This mini-review article discusses this malaria control gap with the hope of initiating more robust research and broadening control coverage.

Main Body

Materials and Methods

This paper is a mini-review indicative of research and control gaps for both the public health and malaria control communities, presented first at a round table meeting and accepted as a costly gap to be highlighted; that is- missing sub-populations (street kids and the homeless) in the malaria control loop. The discourse stems from keen observation and sparse literature available on the above-mentioned subgroups as they

relate to malaria matters. An internet search of literature from databases was undertaken using Google Search, literatures recovered were analyzed in prose and relevant ones were adopted.

Missed Human Sub-populations and Malaria-maybe a costly omission

In Nigeria, for example, homeless persons some of whom have even “built” temporary shelters on the streets, are common; so also ubiquitous are children who fend for themselves and survive on the streets, some having completely lost all link to their parents and guardians. Street children go by numerous sobriquets in different parts of Nigeria. In Lagos, southwestern Nigeria, they are usually referred to as *Area Boys*; as *Almajiri* in northern Nigeria; and as *Skolombo* in Calabar and in the Niger Delta (6, 7, 8).

These vulnerable populations, who are also exposed to such other hazards as street violence, abduction, rape, and sexual and mental abuse, are marginally researched. The dearth of research on these demographic groups may not be unrelated to the daunting and difficult task of travelling by road to far-flung communities for research purposes in most developing African countries.

Albeit not an exhaustive list, a few researchable questions can be suggested that indicate areas of focus: what are the most common ailments among these sub-populations? Specifically, what is the intensity of mosquito bites, the level of parasitaemia (symptomatic and asymptomatic) and the most prevalent malaria parasite species amongst them? Akinbo and co-researchers showed in a recent study that asymptomatic malaria parasitaemia was found more among out-patients (20%) of a mental health institution than among apparently healthy, non-mental health, individuals (5%) (9). Concerning malaria control and elimination, do these “neglected” or “missed” sub-population groups constitute a reservoir of *Plasmodium* parasites? Do they come down with other diseases that mosquitoes transmit and what is the malaria ranking? Are these sub-populations captured in mass drug or vaccine administration for disease control?

Of the several childhood diseases among street children malaria is one of the parasitic infections that affects them (10, 11). What the burden of symptomatic, and more importantly, asymptomatic malaria is among members of the two (homeless people and street children) sub-populations is another critical question for an understanding of how to control, and if possible, eliminate malaria from society; Is it possible to eradicate malaria without a rebound, if these unresearched social groups remain untracked, untested and untreated?

Through the Malaria Elimination Lens

This narrative aims to highlight the urgent need for the inclusion of homeless people and street children's groups in the discourse of malaria, and maybe other diseases that have been earmarked for elimination. Because these demographic groups may constitute an inadvertent source of disease resurgence, that may reverse progress after successful efforts at the elimination of particular diseases from the general population. Moreover, it is imperative to recognize their humanity as fellow citizens who deserve inclusion in efforts to understand and control diseases among the general populace.

Street children are of main interest in this paper, following the UN and Consortium for Street Children's (CSC) stance that as children, they are more vulnerable to malaria and probably outnumber the homeless individual group when talking about social demographics in connection with the streets. According to CSC, those of them who are disconnected from their parents and guardians live on the streets, while those who are still connected to their parents work on the streets, and a good number spend a better part of their time "hanging out" in public places (12, 13). The number of children who depend on the street for survival and development is still unknown in both rich and poor countries; and although street children in both contexts may share common experiences, they, nevertheless, show differences in the nature and degree of their connectedness to the streets (13).

The street characteristics of a developed country are, expectedly, different from those of a developing country. Nonetheless, research data on the health status of street children is especially scarce in Sub-Saharan Africa and Nigeria, in particular, where not only is malaria endemic, but the country bears the world's heaviest malaria burden (11, 14, 15, 16). Nigeria is, in addition, a country that possesses many of the factors that are indicated in "streetism", such as communal conflicts, ethno-religious conflicts, family conflicts, neglect and poverty etc. (17, 18, 19).

Embleton *and others* revealed that delinquency, which had a pooled prevalence of 10% (95% CI, 5%–20%) was the least among the many reasons accounting for being connected to the street in both developing and developed countries; abuse accounted for 26% of the prevalence (95% CI, 18%–35%); family conflict was linked to 32% prevalence (95% CI, 26%–39%); and poverty had the highest association with being connected to the street, with a pooled prevalence of 39% (95% CI, 29%–51%) (20). It is thus alarming that incidentally, while Nigeria's National Bureau of Statistics (NBS) in

collaboration with the World Bank, reports that as many as four out of every ten Nigerians live below the national poverty line, another study (21, 22) shows that poverty is a predisposing factor to malaria infection, while another reveals that poverty is on the rise in the country, indicating a negative (-2.5 people/min) escape rate as at 10:15 am on August 13, 2023 (23).

Locale-Specific Multi-dimensional Approach

Thus, while this discourse views these missed sub-populations through the malaria elimination lens, health cannot be successfully tackled without also taking care of such other critical needs as the factors mentioned in the reports above. Therefore, the intervention has to be multi-dimensional, including but not limited to legal representation and protection, psycho-social and emotional support, implementable policies for practice, measures for addressing cultural incompetence, behavioural change advocacy, etc. This requires a holistic approach wherein a dynamic team of multidisciplinary researchers work together to cover several tracks at once. Such a multidisciplinary research solution will greatly maximize resources, and reduce if not eliminate fragmentation and effort duplication. Findings unearthed from studies of hitherto unexplored dimensions will be the basis for need-tailored, locale-specific adjustable interventions—**an arduous but doable and expedient task.**

Development organizations and initiatives that focus on street children are applauded, but nations must own their public health and social challenges. Governments must take responsibility and drive the wheel of progress with a sense of urgency. The National Human Rights Commission (24) succinctly makes the same point, by saying "The causes of the Nigerian child being relegated to a life on the streets are so numerous, and until the government fulfils its obligation to its citizens, these children on the streets, and many more to join them will continue to be the victims of a society in decay."

Some may indeed argue that the malaria control community should defeat malaria from the general non-neglected population first. However, while that is a possible trajectory, it would simplify such an already herculean task by taking society's vulnerable and neglected groups along at once. **This brings to mind the first of the five "P" themes that shape the Sustainable Development Goals (SDGs)** namely 'people' and principle 2 of the SDGs, "Leave No One Behind" (LNOB) – which is a core theme of the 2030 transformative promise[(25). In support of this desire is the twenty-third declaration of the transformative 2030 Agenda for Sustainable

Development (23), whose first few lines read thus: *Vulnerable People must be empowered. Those whose needs are reflected in the Agenda include all children, youth, and persons with disabilities (of whom more than 80 per cent live in poverty) (26).*

Key Take Home Message

Malaria history teaches us that in a lot of cases, it is unwise to neglect the minors and focus only on the majors because gains garnered over the years can be wasted by a neglected or unintentionally missed sub-population, whose issues are complex and often attended to on a general surface note; but rarely gets to the top of health agenda in practice.

It will be a tough terrain; but society must be determined and ready for the long haul, by giving it the multi-layered, multi-sectoral intervention, multi-stakeholder engagement, leadership and commitment that it requires.

Conclusion

In conclusion, António Guterres, Secretary-General of the United Nations said “We must rise higher to rescue the Sustainable Development Goals (27) – and stay true to our promise of a world of peace, dignity and prosperity on a healthy planet.” This rescue entails the inclusion of “the people of the street”, in every way and much more in the fight against malaria. Anyone could have been on the other side of the coin or the vulnerability continuum. Duty calls on all and sundry.

List of Abbreviations: In alphabetical order

AU: African Union
CMR: Commonwealth Malaria Report
CSC: Consortium for Street Children
LNOB: Leave No One Behind
SDG: Sustainable Development Goal
UN: United Nations
WHO: World Health Organization

Declarations

Ethical approval and consent to participate

Not applicable

Consent for publication

The author gave consent for the publication of the work under the Creative Commons Attribution-Non-Commercial 4.0 license.

Availability of data and materials

The data and materials associated with this research will be made available by the corresponding author upon reasonable request.

Competing interests

The author declares that she has no known competing interests regarding this paper or its content.

Funding

The author has not received any financial support for writing this mini-review.

Author contributions

ACO conceived and designed the study. She collected and analysed the relevant data and developed the manuscript. ACO was responsible for the intellectual content of the manuscript and approved the final draft of the manuscript.

Acknowledgement

Not applicable.

References

- Centers for Disease Control and Prevention. The Malaria Parasite Life Cycle. Atlanta: CDC; 2022 [Assessed 2022 Oct 14]. Available from: <https://www.cdc.gov/malaria/about/biology/index.html>[1]
- World Health Organization. World Malaria Report 2022 Geneva: WHO; 2022 [Assessed 2023 Feb 07]. Available from: <https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2022>
- World Health Organization. World Malaria Report 2023. Geneva: WHO; 2023 [Assessed Jan 16]. Available from: <https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2022>
- African Leaders Malaria Alliance. Malaria Progress Report 2021. ALMA; 2021 [Assessed 2023 Feb 07]. Available from: <https://alma2030.org/wp-content/uploads/2022/02/malaria-progress-report-2021>
- The Commonwealth. Commonwealth Malaria Report 2022. London: The Commonwealth; 2022 [Assessed 2023 Feb 07]. Available from: <https://thecommonwealth.org/press-release/new-commonwealth-malaria-report-launched-annual-health-ministers-meeting>
- African Volunteer. Nigeria Street Children. African Volunteer; 2023 [Assessed 2022 Jun 20]. Available from: http://www.african-volunteer.net/nigerian_street_children.html
- Sahara Reporters. Almajiri Children Return to Bauchi, Kano, Kaduna Streets Months After Eviction. New York: Sahara Reporters; 2021 [Assessed 2022 Jun 21]. Available from: <https://saharareporters.com/2021/01/23/almajiri-children-return-bauchi-kano-kaduna-streets-months-after-eviction>

8. The Guardian. Worries over the growing population of street children in Cross River. Lagos: Guardian News & Media; 2022 [Assessed 2022 Oct 12]. Available from: <https://guardian.ng/news/worries-over-growing-population-of-street-children-in-cross-river/>
9. Akinbo FO, Ibadin RO, Olotu SO, Agbonile I, Efam MO. Asymptomatic malaria infection among psychiatric patients. *Ann Biomed Sci.* 2018;17(1).
10. Ayaya SO, Esamai FO. Health problems of street children in Eldoret, Kenya. *East Afr Med J.* 2001;78(12):624-30. <https://doi.org/10.4314/eamj.v78i12.8930>
11. Cumber SN, Tsoka-Gwegweni JM. The health profile of street children in Africa: a literature review. *J Public Health Afr.* 2015;6(2). <https://doi.org/10.4081/jphia.2015.566>
12. Consortium for Street Kids. United Nations Rights of Children in Street Situations. General Comment No. 21. Children in Street Situations. 2022 [Assessed 2022 Sep 27]. Available from: <https://www.streetchildren.org/resources/general-comment-no-21-2017-on-children-in-street-situations/>
13. Consortium for Street Kids. Consortium for Street Children Street-on children myth busters. Challenge your perceptions. 2022 [Assessed 2022 Sep 27]. Available from: <https://www.streetchildren.org/>
14. Abate D, Eyeberu A, Adare D, Negash B, Alemu A, Beshir T, et al. Health status of street children and reasons for being forced to live on the streets in Harar, Eastern Ethiopia. Using mixed methods. *PLoS One.* 2022;17(3):e0265601. <https://doi.org/10.1371/journal.pone.0265601>
15. Aداugo O, Ibadin OM, Ofovwe EG, Abiodun OP. Street children in Benin City, Nigeria: Nutritional status, physical characteristics and their determinants. *J Med Biomed Res.* 2020;19(1):33-42.
16. Idowu EA, Nwhator SO, Afolabi AO. Nigeria's street children, the epitome of oral health disparity and inequality. *Pan Afr Med J.* 2020;36(1). <https://doi.org/10.11604/pamj.2020.36.77.20404>
17. Alawiye-Adams AA, Babatunde A. Street children phenomenon in Nigeria: The challenges and way forward. SSRN 2325114. 2013 Sep 12. <https://doi.org/10.2139/ssrn.2325114>
18. Cable News Network. Benue killings: Mass burial held for dozens killed in New Year's Day attacks. 2023 [Assessed 2022 Oct 16]. Available from: <https://edition.cnn.com/2018/01/11/africa/benue-killings-mass-burial/index.html>
19. Vanguard Newspaper. KILLING FIELDS:1,525 Nigerians killed in six weeks of 2021. 2021 [Assessed 2022 Oct 16]. Available from: <https://www.vanguardngr.com/2021/03/killing-fields-1525-nigerians-killed-in-six-weeks-of-2021/>
20. Embleton L, Lee H, Gunn J, Ayuku D, Braitstein P. Causes of child and youth homelessness in developed and developing countries: A systematic review and meta-analysis. *JAMA Pediatr.* 2016;170(5):435-44. <https://doi.org/10.1001/jamapediatrics.2016.0156>
21. World Bank. Deep Structural Reforms Guided by Evidence Are Urgently Needed to Lift Millions of Nigerians Out of Poverty, says New World Bank Report. 2022 Mar 21 [Assessed 2022 Oct 11]. Available from: <https://www.worldbank.org/en/news/press-release/2022/03/21/afw-deep-structural-reforms-guided-by-evidence-are-urgently-needed-to-lift-millions-of-nigerians-out-of-poverty>
22. Otubanjo OA. Parasites of man and animals. Lagos: Concept Publications Limited; 2013. 194 p.
23. World Poverty Clock. Nigeria Country. 2022 [Assessed 2023 Aug 13]. Available from: <https://worldpoverty.io/map>
24. National Human Rights Commission. Protecting and promoting the rights of street children in Nigeria. 2022 [Assessed 2022 Oct 14]. Available from: https://www.ohchr.org/_layouts/15/WopiFrame.aspx?sourcedoc=/Documents/Issues/Children/Study/NHR_Commission_Nigeria.doc&action=default&DefaultItemOpen
25. United Nations. The 5Ps of the SDGs: People, planet, prosperity, Peace and Partnership. 2022 [Assessed 2022 Oct 15]. Available from: <https://unsdg.un.org/latest/videos/5ps-sdgs-people-planet-prosperity-peace-and-partnership>
26. United Nations. Universal Values - The 2030 Agenda for Sustainable Development. 2022 [Assessed 2022 Oct 15]. Available from: <https://unsdg.un.org/2030-agenda/universal-values>
27. United Nations. Sustainable Development Goals Report. 2022 [Assessed 2022 Oct 15]. Available from: <https://www.un.org/sustainabledevelopment/progress-report/>