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Policy brief

Using malaria channels based on percentiles to detect malaria epidemics in Uganda

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Executive summary

The WHO recommends the use of malaria epidemic thresholds derived from routine data to detect malaria epidemics. Multiple methods are recommended for use when setting the thresholds depending on the context. The Uganda epidemic preparedness and response plan recommends two methods to set threshold. This has caused conflict in the alerts created as the various methods produce different threshold levels. Recommending a single uniform method for setting thresholds at all administrative levels would ensure that there is harmonization of epidemic detection among stakeholders at all levels of the health system. Epidemics are picked at the same time without any conflicts.

Introduction

Malaria prevalence has been declining over the years from 42% in 2009 to 19% in 2016 and now is at a prevalence of 9% (MIS, 2019).These gains are however under threat with increased occurrence of malaria epidemics as seen in 2015 and 2019. Traditionally, epidemic prone areas have been the highlands areas like in Kigezi, however, this has increased with scale back of interventions such as scale back of IRS that led to the 2015 epidemic in Northern Uganda. In addition, the declining prevalence has also increased the areas that are epidemic prone due to decreasing immunity of the population in these areas. To be able detect increases in the malaria cases, the WHO recommends the development and implementation of effective early detection system (EDS) for malaria epidemics by using routine data to determine thresholds for epidemics for specific regions (1).

One of the key roles of the EDS is to come up with thresholds for when a malaria epidemic is declared. The WHO recommends the setting of these thresholds using a “normal epidemic channel”, a term used to describe the normal seasonal pattern of malaria in an area. The weeks in which cases exceed the threshold are declared routinely as epidemic weeks (1-3).

Determining whether there is a malaria epidemic using these methods requires the availability of 5-10 year historical data, from which a baseline of normal occurrences and threshold values can be determined (4). There are four methods WHO recommends for setting thresholds namely, (i) constant case-count thresholds; (ii) mean number of malaria cases plus standard deviations; (iii) percentiles over the median; and (iv) cumulative sum (C-SUM). All the methods are expected to capture an epidemic when the cases exceed a given level of the usually reported cases from a minimum of 5 years in a specific area and time (3). Of these, the Uganda Emergency Preparedness and Response guidelines recommend the mean +2SD and 3rd Quartile, largely because the C-sum and case-count works better with a small case-count.

Context and importance of the problem

The existence of the HMIS system (mTRAC and DHIS2) enables Uganda to collect weekly data on presumed and confirmed malaria cases from health facilities in the country providing a representative weekly data set which gives more accurate thresholds thereby enabling early detection(4, 5).

The Uganda EPR guidelines propose the use of mean +2SD to generate a threshold for malaria epidemics at district level and using median and the third quartile at health facility level from a minimum of 5 year weekly data(3). The use of mean+2SD requires eliminating epidemic years or years of unusually low transmission to the calculation of means+2SD (4). Unusual numbers could be due to seasonal variation, data quality, and scale up or down of interventions (6). In contrast, the percentile is able to accommodate the years with abnormally high incidence making it possible to use all the available data in the country (4, 7).

During the 2019 outbreak, malaria channels drawn using the percentile method were able to detect out breaks which had been missed by the mean +2SD. This created conflict at the districts during the response as some districts did not perceive the epidemic from the normal channels they had been monitoring. In the past five years, Uganda has experienced malaria epidemics in several parts of the country in 2015, 2016, and 2019 (8-10). This would render 3 years from the recommended 5 years historical data unsuitable for setting the thresholds when using mean +2SD as including them would overestimate the thresholds. This could explain why some malaria normal channels constructed at the district using mean +2SD did not pick the malaria epidemics picked when using percentiles. A validity study of the mean and Percentiles done in Sudan, which also has seasonal transmission of malaria found channels from percentiles to be more sensitive. Several studies done in African countries with a high burden of malaria have also found percentiles more effective in detecting epidemics compared to the mean (4).

The use of both percentiles and mean to set the thresholds also possess chances of disagreements in the alert threshold as the percentiles have consistently been found to produce lower cutoffs compared to the mean. The mean is also affected by skewed data which can possibly lead to false alarms or missed outbreaks and has been found to be generally less sensitive(4).

It is important for Uganda to have clear guidelines on which method to use when setting thresholds in order to detect the malaria outbreaks in a uniform and timely manner. Malaria epidemics have important impacts on health and the economy as time and finances are lost in treatment if not detected and mitigated early. The detection of these outbreaks is also very important now that the prevalence of malaria in the country has reduced and some areas including Kampala and Kigezi region have a very low burden of the disease making them epidemic prone (11, 12).

Critique of policy options

The EPR guidelines recommend the use of means+2SD and percentiles at different administrative points in the health system. This creates conflicts in the making of alerts as the mean+2SD are generally less sensitive compared to percentiles. Timely response which heavily relies on EDS detecting the epidemics early, a uniform method for setting thresholds at all levels would ensure uniformity in decision-making and action at the national, district, and local level.

Furthermore, the EPR guidelines don't recommend the elimination of epidemic years yet Uganda has reported outbreaks in 2015 and 2019 which would lead to over estimation of the threshold(13, 14).

Despite the recommendation to have the malaria channels monitored at all levels from health facility to national level, the employment structure only allows for biostaticians at district level. All health facilities select HMIS focal persons who could be clinical officers, nurses, or laboratory staff. These carry out this role alongside their routine work which interferes with the routine construction of the channels.

Recommendations

As we move towards 2030, where Uganda hopes to have eliminated malaria, there is need to: 1) Recommend the use of percentiles as the universal method for setting thresholds for detecting malaria epidemics in the country right from the national, district, to heath facility level so as to ensure similar thresholds at all times. The health facilities can maintain the manual method of setting thresholds since most don't have a computer. 2) Epidemic years should be removed from the historical data that is used to set epidemic thresholds in the malaria channel. This will ensure that only a true increase in cases from

those expected are detected and responded to. 3) Since majority of the districts in the country surpass the 75th percentile each year which restricts response due to limited resources, two thresholds; an alert threshold (75th percentile) and an epidemic threshold (85th percentile) can be set. The alert threshold once surpassed should initiate the country to assess its epidemic preparedness, assess ability to respond, provide an early warning. 4) There is also need to boost the capacity of health facilities with human resource with skills able to make and interpret the malaria channels. 5) Deaths and admissions should be monitored alongside the malaria cases reported. This can inform launching of an investigation at the start of the epidemic and inform prioritization of areas for intensified control measures in the event of an epidemic. 6) As the cases recorded decline, the low burden districts in Kigezi region can adopt, the case-count method for setting epidemic threshold. This would confirm the emergence of an epidemic early so that control measures such as health education, and case-management, can be intensified.

References

1. WHO. Eliminating malaria. World Health Organization, 2016.
2. WHO. Disease Surveillance for Malaria Elimination: An operational manual. 2012.
3. WHO. Field guide for malaria epidemic assessment and reporting: Draft for field testing. Geneva: World Health Organization, 2004.
4. Guintran J-O, Delacollette C, Trigg PI, WHO. Systems for the early detection of malaria epidemics in Africa: an analysis of current practices and future priorities. Geneva: World Health Organization, 2006.
5. MOH. Uganda's Electronic Health Information System/DHIS 2. 2019.
6. MOH. GUIDELINES FOR PREPAREDNESS AND RESPONSE FOR MALARIA EPIDEMICS. 2012. p. 30-5.
7. WHO. Malaria surveillance, monitoring & evaluation: a reference manual. WHO Press, World Health Organization. 2018.
8. M.K. M, A. K, P. A, P. N, B. O, M. A, et al. Intermittent preventive treatment with dihydroartemisinin piperaquine in young Ugandan children in the setting of indoor residual spraying of insecticide. American Journal of Tropical Medicine and Hygiene. 2018.
9. Raouf S, Mpimbaza A, Kigozi R, Sserwanga A, Rubahika D, Katamba H, et al. Resurgence of Malaria Following Discontinuation of Indoor Residual Spraying of Insecticide in an Area of Uganda With Previously High-Transmission Intensity. Clinical Infectious Diseases. 2017:6-8.
10. Tukei BB, Beke A, Figueroa HL. Assessing the effect of indoor residual spraying (IRS) on malaria morbidity in Northern Uganda : a before and after study. Malaria Journal. 2017:1-9.
11. Uganda Malaria Indicator Survey Preliminary Report 2017-2018, (2018).
12. UBOS, editor Uganda Malaria Indicator Survey 2014-152015.
13. NMCD. Malaria Quarterly Bulletin Issue 28: 1 January 2019– 31 March 2019. 2019. p. 1-7.
14. Raouf S, Mpimbaza A, Kigozi R, Sserwanga A, Dorsey G. Resurgence of malaria after discontinuation of indoor residual spraying of insecticide in a previously high transmission intensity area of Uganda. The Lancet Global Health. 2016.