Reviewer's report

Title: A framework for the improved use of routine health system data to evaluate national malaria control programs: evidence from Zambia

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Reviewer: Felix MASIYE

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The questions the authors are trying to answer are of first order importance in malaria control monitoring in Sub-Saharan Africa where routine data systems are fraught with significant weaknesses. The study uses a new framework that offers promise on how to adjust routine data for program monitoring and evaluation. I think there would be significant wider policy interest in this type of work. I read this paper with great interest.

That said, I have a few issues with the paper:

1. I am quite concerned that the authors do not pay sufficient attention to well-known data quality problems with the HMIS, aside from completeness. For example, number of cases of (confirmed and unconfirmed) malaria in the HMIS at least at facility level are quite noisy, with huge, unexplained spikes over short time periods. Did the authors check for implausible numbers of reported malaria cases? Further, some small studies have shown that even what is recorded as confirmed malaria on the HMIS is not actually confirmed with RDT or microscopy. Are the authors sure that “In cases where a confirmed case count was reported but no parasitological testing value reported, we replaced the missing testing value with the number of confirmed cases” does not raise any questions whether what are classified as confirmed were indeed tested? How many are such cases, and are they mostly in children or in certain parts of the country?

   Finally on this issue, I would have also liked to see the all-cause morbidity patterns shown in Figure 4 or in separate Figure altogether.

2. The authors mention that for districts and/or months with missing data they had to impute. But they do not tell us what proportion of the data were ultimately imputed, and what the possible implications of removing those districts would have been on the analysis.

3. The authors need to be more transparent about the methods used to estimate district level ITN coverage. What set of covariates was included in the model used, if any? Also, how good are the predicted district-level coverage rates?

4. I sympathise with the fact that the paper was no focused on examining the lack of an expected association between ITN coverage in high transmission intensity. Could this issue be connected with testing and reporting behavior? Further, we know that distribution of ITN is not exogenous but endogenously related to
malaria incidence? I would like to hear the authors’ opinion on this since these issues arise naturally in the reader’s mind.

5. The period of the analysis coincides with removal of user charges in public health clinics in rural Zambia (from 2006) and urban health clinics (from mid 2011). This policy has been shown to have increased facility utilization rates. Further, a number of districts have relied heavily on volunteers community health workers to administer ACTs and even testing. These cases do not enter the HMIS, what are the possible implications for these findings?

6. Shortages of RDTs often influence clinician’s classifications of malaria as confirmed or unconfirmed. The authors do not discuss the implications of this on their findings.

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7. What do the authors think about interacting testing rates with transmission intensity?

8. In terms of placing the observed magnitude of effect on malaria incidence into the relevant literature, it would be very informative if the authors examined net usage instead of or in addition to, net ownership as, after all, is a key mechanism for the health impact.

9. Is there a reason why we should expect the standardized reporting rate to have a positive effect on confirmed malaria but not on total malaria? What is the authors’ intuition on this finding?

Level of interest: An article of importance in its field

Quality of written English: Acceptable

Statistical review: No, the manuscript does not need to be seen by a statistician.

Declaration of competing interests:

I declare that I have no competing interests.