Letters to the Editor

Improving malaria mortality estimates for rural Africa by adding further studies

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In recent years, a lot of efforts have been invested in providing estimations for the malaria burden in Africa and the rest of the world. The results available so far on the number of deaths due to malaria have helped to link the graveness of malaria, and budgetary support towards malaria research and interventions is continuously increasing. However, the precision of these estimates still needs improvement since there are a number of known limitations involved in the estimation procedures. Among these are a very incomplete coverage of the population at risk and the difficulty to diagnose a malaria death post mortem.

Recently, Rowe et al.\(^1\) estimated the burden of malaria mortality among African children for the year 2000. Their comprehensive framework rounds off other recently completed approaches from various study groups that are working on the estimations of the global malaria burden.\(^2\,3\,4\) The authors applied estimation methods used by Snow\(^2\) relying on aggregation of published and unpublished data, population or survey estimates and model based estimates which take geographical and climatic determinants into account. They further improved on these methodologies by adding a yearly prediction model to estimate the figures for the year 2000. The result is a summary figure that takes account of different estimation assumptions from the single reports that contribute to this value. Such assumptions range from methods on how to allocate deaths with unknown causes, standardization procedures, to model based assumptions. Differences in such assumptions create variations in results—a thought shared by Smith\(^5\) who acknowledges that mortality rates from similar sites in Africa vary enormously.

The inclusion criteria used by Rowe et al.\(^1\) (community-based; possibility to estimate a malaria rate; duration of a multiple of 12 months; including children exactly 0–59 months old; proportion of deaths with no known cause <30%; began in 1980 or later; no overlap with other studies in the analysis in time and place) appear reasonable and a useful compromise to limit the enormous effort to collect and summarize the data from the publications. On the other hand, we think that many relevant studies which may provide a significant contribution are left out.

Our own analysis of data from clinical and intervention studies for the period 1999–2004 which were embedded into the Demographic Surveillance System (DSS) in Nouna, rural Burkina Faso, West Africa,\(^6\,7\,8\) has generated some differences in the rural figures estimated by Rowe and others. One of these studies investigated the effect of zinc supplementation on malaria.\(^9\) Here, no effect was observed between the two arms. The second study compared the effect of impregnated bednets given at birth or at the age of 6 months. Here, no difference in mortality was observed in both the arms.\(^7\) These studies were not included in Rowe et al.\(^1\) because one of the selection criterion were not fulfilled, i.e. the duration of a multiple of 12 months or including children exactly 0–59 years old. We combined data from these two studies and linked these to the data from the Nouna DSS. By doing this, the observation time was prolonged beyond the period of the original studies, and also the age range extended up to 5 years, thus now fulfilling the criteria of Rowe et al.\(^1\) and making comparisons possible. We estimated malaria-specific mortality rates for this rural area which has similar characteristics to many rural areas in sub Saharan Africa. Nouna area being a high intensity holoendemic area, it fulfills the definition provided by the rural high intensity middle Africa by Rowe et al.\(^1\)

Using the combined data from the two studies, we calculated an age-standardized malaria mortality rate of 15.2 (95% CI: 13.4–17.1) per 1000 person-years. Deaths with missing cause were allocated according to the methodology provided by Rowe.\(^9\) For age-standardization, we used the population distribution for children under five years from the Burkina Faso 2003 DHS.\(^10\)

The 5-yearly proportions of the DHS standard population for under-five-years-old were as follows: 22.4 (0–11 months), 19.5 (12–23 months), 18.6 (24–35 months), 20.9 (36–47 months) and 18.6% (48–59 months). Standardization was necessary to avoid bias caused by smaller numbers of children in later years and to yield a valid comparison with the Rowe et al.\(^1\) estimate, which was 11.36 (95% CI: 9.80–12.92) per 1000 person-years. On one hand, this rate is lower than our estimated rate for these comparable regions. On the other hand, the rate of Rowe et al.\(^1\) has been derived from studies that ranged from 1.9 to 24.0, thus, some of the studies included showed a similar or higher mortality rate as in our analysis.

The strength of our result lies in the benefit of accurately defining the population under risk of malaria using the DSS database. Additionally, as stated by Smith,\(^9\) a major reason for the variation in the estimates is heterogeneity in the way in which malaria is diagnosed in verbal autopsy (VA) and how deaths with unknown cause are finally allocated. In addition, figures based on hospital records as well as national morbidity registries underestimate the mortality rates in regions where a high proportion of ill children do not attend hospital and national registries do not capture all morbidity and mortality cases.

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Certainly, more studies on malaria mortality in Africa exists, that could contribute to more precise estimation of the burden of this disease. As we continue updating our database and working on other methods for the estimations of indirect malaria burden we expect to achieve improved regionally refined results.

References

Improving malaria mortality estimates for rural Africa by adding further studies: Authors reply to Ndugwa et al.

From ALEXANDER K ROWE, 1* RICHARD W STEKETEE 2 and SAMANTHA Y ROWE 1

We thank Ndugwa et al. for their comments1 on our recent estimates of malaria mortality among African children in the year 2000.2 Ndugwa et al. recognize the reasonableness of our inclusion criteria, but claim that many relevant studies were omitted. They also present data from Nouna, Burkina Faso, that could improve future estimates.

Regarding the comment that we excluded many relevant studies (presumably because of strict inclusion criteria), we remind Ndugwa et al. that a sensitivity analysis (Model B in Table 4 of reference 2) that included 11 additional studies that met nearly all the inclusion criteria produced results that were very similar to our best estimates. Furthermore, aside from their own study, Ndugwa et al. do not say what these other many relevant studies are. We invite them, and others, to share such studies (and to make them publicly available) to improve the representativeness and precision of future estimates.

We appreciate the results from Nouna and the effort that Ndugwa et al. made to have their data match our inclusion criteria and methods, enabling rate comparisons and inclusion of this data point in future updates. We suspect that the addition of the Nouna data would not change the overall estimate substantially. At a rate of 15.2 deaths/1000 person-years, the Nouna data point is within the range of the 15 rates (1.9–24.0/1000 person-years) included in our best model for rural settings with high-intensity malaria transmission. Its sample size relative to the original 15 data points would probably not give this additional study excessive influence.

Notably, the high coverage of insecticide-treated nets in part of the Nouna research site3 illustrates an important challenge for future estimates of malaria burden. For the 2000 estimates, it was reasonable to assume that coverage of malaria interventions was generally very low (except perhaps case management) and its impact on mortality burden could be ignored. In contrast, estimates for the next milestone (e.g. 2010) will need to account for increasing intervention coverage in many countries.

Ultimately, the justification today for additional and sustained resources to combat malaria is not built around exact estimates of malaria’s burden in past years, but on the availability of effective and affordable interventions to control and prevent malaria. Future assessments of malaria burden will need to track the evidence that scale-up is happening (i.e. population coverage data for each of the interventions) and link that evidence to the continued measurement of infection, disease and death. Roll Back Malaria’s Monitoring and Evaluation Reference Group (http://www.rbm.who.int/merg.html) is developing recommendations for such evaluation methods.

References