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Commentary: Malaria death rates remain highly pertinent

Tom Smith

Scientific papers and media coverage of malaria alike expose us so frequently to figures for the number of child deaths from *Plasmodium falciparum* in Africa that we become insensitive to the magnitude of the carnage. The numbers are so large that they overwhelm the imagination.

Until recently it was hard to work out where these estimates came from, since there was rarely any explanation of the primary sources or the way in which the data were analysed. However several papers in recent years [1–3] have provided good documentation of their methods, which have steadily become more convincing as more data and appropriate methodology become available. The paper by Rowe *et al.*[4] in this issue of the

International Journal of Epidemiology presents the best substantiated set of estimates to date in this series, using the latest population estimates for denominators and stratified analyses of an extensive database of verbal autopsy (VA)-based rates. Importantly, they include analyses that show that the estimated number of just over 800 000 deaths in children <5 years of age, for the year 2000, is not very sensitive to their main assumptions.

This paper is not the last word on the subject. The assembled estimates of malaria-specific mortality rates from different sites in Africa vary enormously. We do not know the reasons for this variation. Most of it does not relate to transmission intensity. If we knew the main factors that lead to the diversity in quoted malaria mortality rates in endemic areas it would help to focus control efforts on what works. It would also

Department of Public Health and Epidemiology, Swiss Tropical Institute, Socinstrasse 57, PO Box, CH-4002 Basel, Switzerland.

E-mail: Thomas-A.Smith@unibas.ch

give us more confidence in the estimates of average disease burden.

It seems likely that a major reason for the variation in the data is heterogeneity in the way in which malaria is diagnosed in VA. Rowe et al.[4] point out that standard International Classification of Diseases (ICD) rules are not always used to determine causes of death, but in any case these rules were not designed with VA for malaria in mind. Malaria is one of the hardest diagnoses to get right in VA because its symptoms are so non-specific. A recent comparison of cause-specific mortality rates in demographic surveillance sites across Africa that mapped the various local coding systems onto the ICD10 codes managed to classify deaths consistently only by aggregating all fevers of unknown origin with explicit diagnoses of malaria.[5] This leads to estimates of proportionate mortality substantially greater than the 18% average quoted by Rowe et al.[4]

It is possible to make adjustments for this diagnostic inaccuracy,[6] but even though the authors of these adjustment techniques also collaborated on the Rowe et al.[4] paper, they expressed scepticism of the value of using their own methods.

This is not the only potential interpretational pitfall that they point out. As methods improve, the best estimates change, irrespective of changes in disease burden. Some uncritical users may need to be reminded that the differences between the different estimates reflect mainly methodological developments, not real trends over time. An important real reason for changes over time in number of deaths is changes in the denominator. Rowe et al.'s[4] estimate will certainly be projected to indicate greater number of deaths in the future on the basis of population growth rates. Will this be interpreted as meaning that things are getting worse?

The reader is also reminded that the number of deaths with malaria as the underlying cause is not the same as the number that would be averted by eliminating the disease. Half a century ago, it was shown that elimination of malaria, notably in the sugar plantations of Guyana[7] and in Sri Lanka,[8] led to much larger decreases in all-cause mortality than expected from the number of deaths diagnosed pre-intervention as malaria. Rowe et al.[4] cite similar results from malaria control in Africa. In trial settings, insecticide treated nets reduced child mortality by 17%[9] without coming close to eliminating malaria. We still do not really understand the biology of this indirect mortality, but should we not be estimating the total deaths that might be averted? Who needs to know the number of malaria-specific deaths, apart from those who suggest that funding allocations for diseases should be proportional to their frequency as underlying cause? It would certainly be at least as

useful to have estimates of how many deaths might be averted by specific interventions.

In fact we also need good estimates of malaria-specific death rates because the trend in this index is a key indicator of progress in malaria control. In particular, we need good estimates for more time points. 1990 was the baseline year for the Millennium Development Goals and estimates for that year would be especially useful, as would estimates for more recent years. At first sight the data presented by Rowe et al.[4] seem to indicate a disturbing deterioration in the 1990s, possibly related to increasing drug resistance or failure to invest in health systems. They interpret this cautiously pointing out that study sites change and that the best way to investigate changes over time is time-series within sites. Longitudinal within-site studies will certainly make a major contribution to understanding how the burden of malaria in Africa changes in the years to come, but we still need to continue to improve the methods for estimating the overall picture. The paper by Rowe et al.[4] is a useful step to achieving this.

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