Defining malaria risk: it is not only about epidemiology, but also about perception and risk threshold of travellers and policy makers

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The changing global malaria epidemiology requires policy makers both in endemic and in non-endemic countries to regularly reconsider their malaria prevention strategies. In such countries, policy adjustments are more limited as the malaria infection is a remote event and there are limited interventions including prophylaxis, emergency treatment, bite avoidance and changing travellers' behaviour ~~as~~ interventions.

Davlantes and colleagues argue in their editorial that the methods that have been adopted by policy makers in the UK(1) and across Europe(2, 3)for defining travellers' malaria risk to adjust these interventions could be dangerous and erroneous(4).

Their starting premise is that these methods will underestimate the malaria risk for travellers. A view which does not fit with the WHO global malaria assessment which describes a significant global decline in malaria since 2000. The risk of acquiring malaria declined globally by an estimated 37%. Regionally, the largest decline has been in S E Asia, the Americas and Western Pacific Region, in the order of -78% and -46% and -65%(5). These regions mirror the areas where major policy changes for malaria recommendations have been recently made (1, 2).

With decreasing exposure to infectious bites, the accuracy of the risk estimate becomes more imprecise, as most travellers to a certain destination will not be exposed. On the other hand, fewer travellers will benefit from chemoprophylaxis. A change in strategy relying on disease avoidance through increasing dependence on bite avoidance measures for all vector borne diseases in low transmission environments, becomes more rational. However, these messages may be difficult to convey to travellers as the lower risk for malaria may suggest that this infection may no longer be a priority.

Dalvantes et al. highlight what all policy makers, recognise: that there are no precise or perfect data on which to make decisions. The editorial describes a need for a holistic approach in the decision making process, but does not include the most critical factor in this process, the tolerability and safety(6) of and compliance to chemoprophylaxis by travellers. For UK and European policy makers malaria epidemiology is only part of an equation which also includes efficacy, tolerability, safety of

chemoprophylaxis; and access to diagnosis, health care and treatment, and numbers needed to prophylaxis to prevent one infection with *Plasmodium falciparum.*

Their main argument is around the validity of estimating the travellers' malaria risk based on imported malaria cases and numbers of travellers exposed to infectious mosquito bites in a certain region. While many of their points are both true and recognised by policy groups as weaknesses in their methodology, their main premise is that rates and risk must be derived from the at-risk endemic population.

We note the authors do not detail the limitations of their methodology, so readers cannot form a balanced view. However, from the limited information on the methodology available to readers on their risk assessment, it would appear to be based predominantly on the regional risk of malaria in the local population based on national and WHO reporting. We would use their argument that the local population, with different accommodations, exposure duration and immunity, cannot be considered the same at-risk population as transient travellers who differ significantly through life-style, behaviour and accommodation to local population. The authors appear to be confident of the precision and quality of endemic surveillance data for informing their prophylaxis policy and suggest these are validated by CDC. It would be of value for the readers to understand their audit and QC of endemic malaria surveillance and risk calculation.

European malaria rate estimates are based on number of cases surveilled in returning travellers and in part, where there are limited reports, on local endemicity data. Dalvantes and colleagues suggest that this method will contribute to underestimating cases occurring during travel which will be missed in national surveillances. This is undoubtedly true but, looking at the mounting research evidence on malaria presenting during travel to the low transmission countries , very few cases or deaths from malaria have been reported during travel (7). In our view, these events do not significantly contribute to underestimating risk.

A combined assessment using numbers of travellers' malaria cases and local endemicity data is favoured by some policy groups as an option to provide evidence of risk. The local rates reflect the endemicity of the parasite and the relevance of the endemicity to travellers will depend on other additional factors including case reports in returned travellers from the region ideally, or country. This data should be represented by more than one country. These traveller malaria rate may help interpret the relevance of the local data. This method of defining risk has been used for many years in a number of European countries, with a number of polices reducing recommendations for chemoprophylaxis for low risk areas. This change has not resulted in in an increase in traveller's malaria in countries like Switzerland and Germany.

The introduction of local data to risk analysis creates a number of complexities. When should local data supplant or displace traveller's data? Is local data reflective of travellers' itinerary, accounting for exposure, geography and currency of the data. Most critically, local data application to the risk assessment requires a subjective decision by policy makers, and hereby leads to the historical problem of variable and inconsistent risk interpretation. This remains one of the major inconsistencies in generating a standardised method for creating an objective risk assessment.

Policy makers also differ in their cultural and legal ideologies as well as risk-taking thresholds. Some policy makers are conservative in their recommendations (no risk of any infection) and others more "liberal" accepting that some risk of infection while avoiding adverse events with their recommendations. These cultural differences we believe are important and cannot be measured scientifically.

As the travellers' malaria risk estimates are not based on perfect data, we recognise many of the weaknesses Davlantes highlights. Policy makers should be careful not to use single country data, by using two or more nations surveillance data sets, risks may be averaged out. They should not rely solely on an absolute rate but use trends in risks (rates) using the same sourced data. Where the trend is clear, adjusting policy to ensure safety of all travellers including those who may be injured by chemoprophylaxis, as well as those at risk of malaria. Tracking the travellers itineraries could provide data to geographical exposure in countries with patchy endemicity and provide evidence to define high risk destinations (8). We are conscious with the very low rates now identified in S E Asia and S America, policy makers may be doing more harm when recommending chemoprophylaxis than preventing cases of P falciparum malaria.

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