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MINI-REVIEW

Extension of indoor residual spraying for malaria control into high transmission settings in Africa

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Summary Contrary to previous consensus, a recent WHO statement recommends a more dominant role for indoor residual spraying (IRS) in malaria control in high transmission settings of sub-Saharan Africa and re-emphasises the role of DDT. We review the issues related to this change in recommendation. In high transmission settings, IRS must be implemented indefinitely and at high quality to achieve control. As current infrastructure limitations and unpredictable funding make this unlikely, each country must carefully consider the role of IRS. There remains a need to support ongoing insecticide-treated net scale-up. Insecticide choice is hampered by the lack of economic costing data.

There has recently been a change in the recommendations for malaria control in areas with the greatest burden of disease. Indoor residual spraying (IRS) has previously been recommended for areas of low-to-moderate transmission; discrete, accessible communities such as islands and refugee camps, or for epidemic response (WHO, 2000). This stance is changing and the WHO now promotes wider application of IRS, including in highly endemic settings in sub-Saharan Africa (WHO, 2006).

IRS controls malaria by reducing the vectorial capacity of the anopheline vector and thus transmission. Its impact on vectorial capacity is dependent on the resting behaviour of the vector, limited imported malaria and well-timed, high-quality, high-coverage implementation. In turn, the impact of any reduction in vectorial capacity on malaria prevalence is dependent on the baseline level of transmission (Macdonald, 1957). Even a moderate reduction from low baseline transmission can dramatically reduce prevalence, making interruption possible. At high baseline transmission, a proportionally greater reduction is needed to achieve a significant reduction in prevalence, making it unlikely that interruption can be achieved.

IRS is a mainstay of malaria control used successfully by many countries. These settings have key differences to holoendemic sub-Saharan Africa: in the Horn and Southern Africa the disease is at the fringes of its range, with focal, seasonal and lower intensity transmission; in Asia both the disease epidemiology and the vectors targeted are different. In high transmission sub-Saharan Africa, experience of IRS is limited and the main source of evidence remains a few pilot studies carried out in the 1950—1970s. Some of these studies showed that a good impact on malaria prevalence is achievable even in high transmission areas (Curtis and Mnzava, 2000). However, this was not a consistent

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finding; high baseline transmission and variations in resting behaviour were associated with limited impact in several trials (Zahar, 1984). More recently, shorter trials have not replicated the early good results; in areas of the highest transmission, several years of IRS may be needed to have an impact (Curtis and Mnzava, 2000). All the evidence confirms the hypothesis derived from modelling, that in high transmission settings interruption of transmission is not possible. This implies that IRS must be continued indefinitely, requiring long-term predictable financing mechanisms. Despite the increased global investment in malaria control, these do not currently exist.

IRS must be carried out at high quality and coverage to be effective in any setting but particularly in high transmission settings. This requires highly skilled and motivated staff, well maintained equipment, efficient logistics support and systems for flow of funds, communities accessible by road and acceptance by the community. This has been feasible where health systems and infrastructure are well developed (e.g. South Africa) or where a fairly small and defined area can be targeted (e.g. Mozambique, South Africa, Namibia and Swaziland) through a vertical programme. Many sub-Saharan countries have now adopted decentralised and integrated health systems, making IRS a far more difficult operational challenge. In addition, the fragile status of the majority of sub-Saharan African infrastructure and healthcare systems means that heavy investment is needed before the task of carrying out high-quality biannual spray campaigns over broad areas of rural Africa will be achievable.

Rapid development of insecticide resistance was one reason IRS was considered unsuitable in high transmission settings (Zahar, 1984). Whilst this concern should not prevent IRS use, it highlights that not enough is known about the long-term role of IRS in such settings. Development of alternative insecticides is crucial to ensure that control can be maintained if resistance arises.

Only after IRS is identified as a suitable approach in a given setting should insecticide choice be considered. DDT and synthetic pyrethroids are both highly effective in many countries. Whilst DDT's longer residual life is a major advantage, other criteria are also important. DDT is often cited as the cheapest option (WHO, 2006), yet there are no robust costing data comparing DDT with the alternatives. The logistical costs associated with the bulkier DDT as well as additional safety measures, supervision and internal testing systems to avoid contamination of export goods with DDT, must all be considered. Lastly, it is necessary to consider the implications of longer lasting pyrethroid formulations with a similar residual life to DDT that may soon become available.

Previous consensus has been that 'IRS cannot be considered as a principal tool for long-term malaria control in tropical Africa' (Zahar, 1984). There is no new evidence of the suitability of IRS in such settings, and the operational constraints to long-term, high-quality intervention remain. What is new in malaria control is the gradual but accelerating improvement in insecticide-treated net (ITN) coverage. Whilst IRS should be considered an appropriate intervention where the right conditions are met, its limitations should be accepted and the need for sustained investment to continue ITN scale-up should not be overlooked.

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