Risks associated with scale-back of vector control after malaria transmission has been reduced

BACKGROUND

Vector control is a core component of malaria prevention. This principally involves the use of either insecticide-treated mosquito nets (ITNs) (1) or indoor residual spraying (IRS) of insecticides (2). Larval source management (LSM) can be employed as a supplementary measure under specific conditions (3). WHO currently recommends universal coverage with effective vector control of all persons at risk of malaria. The population at risk is defined periodically on a sub-national level, and includes all persons in geographical areas or localities with ongoing malaria transmission.

Since 2000, substantial expansion of funding has enabled significant scaling up of malaria prevention, diagnostic testing and treatment. As a result, global malaria incidence declined by 37% and malaria mortality rates declined by 60% between 2000 and 2015 (4). Of the 106 countries that had malaria transmission in 2000, 102 are estimated to have reversed the incidence of malaria and achieved Millennium Development Goal Target 6C. Since 2000, four countries have been declared malaria free, and in 2014 there were 13 countries that reported zero locally-acquired cases with another six countries that reported fewer than 10 such cases.

Based on these achievements, the WHO Global Technical Strategy for Malaria 2016–2030 lays the foundation for further significant reductions in mortality and incidence by at least 90% over the coming 15 years, with elimination of malaria projected for a further 35 countries (5).

WHO Member States have requested guidance on the circumstances under which it may be appropriate to scale-back vector control interventions to targeted deployment in specific geographic areas such as those with ongoing local malaria transmission. This request was largely prompted by the general decline in malaria transmission in most settings, and recognition that the epidemiology of malaria has been altered as a result of years of
sustained, effective vector control. The result has been a general expectation that the discontinuation of vector-control implementation in such settings would be associated with a minimal risk of resurgence, and that such scale-back would be an appropriate way to reduce expenditure on malaria programmes.

To address this question, a better understanding is needed of the appropriate epidemiological and entomological conditions, or the surveillance and health systems requirements, that should be in place in order to consider and potentially plan for such scale-back of malaria vector control. This document is intended to provide guidance to countries and their partners on which areas or conditions are considered unsuitable for scale-back of malaria vector control.

**HISTORICAL REVIEW AND MATHEMATICAL SIMULATIONS**

In order to examine the impact of geographical scale-back of malaria vector control, a comprehensive review of historical evidence and mathematical simulation modelling using a range of epidemiological and intervention scenarios were undertaken (6).

Modelled scenarios examined the epidemiological implications of scale-back of ITNs1 to no coverage under conditions of differing levels of:

- baseline (or pre-intervention) entomological inoculation rate (EIR) – using EIRs of 0.1, 0.5, 1, 2 or 5 infectious bites per person per year;
- infection importation rates – using rates of 0.1, 1 or 10 infections per 1000 persons per year;
- active case detection using 3-monthly mass screening and treatment undertaken at 0%, 2.5%, 10% and 20% coverage; and
- case management coverage – using coverage of 20%, 50% and 80% of all uncomplicated cases treated promptly and effectively.2

The results indicated that scale-back of malaria vector control was associated with a high probability of malaria resurgence, including for most scenarios in areas in which malaria transmission was very low or had been interrupted (i.e. no local transmission). Both the historical review and the simulation modelling clearly indicated that the risk of resurgence was significantly greater at higher values of EIR and importation rates, and lower coverage of active case detection and case management. Situations with a high probability of resurgence are likely to correspond most closely with malaria-endemic areas of sub-Saharan Africa.

The probability of resurgence was low only in scenarios with low historic EIRs, low infection importation rates, and high coverage of both active case detection and case management. Such scenarios correspond mainly to countries outside of sub-Saharan Africa that are currently experiencing very low malaria incidence.

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1. Universal coverage is defined as one ITN for every two persons at risk of malaria; however, for the purpose of modelling, a population-wide estimate of 80% ITN usage was applied.
2. Five simulations run per model parameterization to include stochastic variation.
Outcomes from the literature analysis and simulation modelling were reviewed by the WHO Vector Control Technical Expert Group (VCTEG) at their meeting in March 2015 and were subsequently presented to the Malaria Policy Advisory Committee in September 2015. This document was formulated to provide clarification to countries on the risks associated with geographical scale-back of malaria vector control including in areas where malaria transmission has been reduced.

CONCLUSIONS

The evaluation indicated that, even in areas where there have been substantial reductions in malaria transmission, in most situations, discontinuing vector control confers a high risk of malaria resurgence. This risk increases with increasing receptivity, importation rates, low coverage of active disease surveillance and case management. This underscores the critical need for all countries with ongoing malaria transmission, and in particular those approaching elimination, to build and maintain strong capacity in disease and entomological surveillance and health systems. For example, the ability to respond to possible resurgences through vector control, relies on having the necessary entomological information (i.e. susceptibility status of vectors to insecticides as well as their biting and resting preferences). Such capacity is a pre-condition for evaluating the potential for geographical scale-back of vector control.

Precise measures of malaria receptivity and vulnerability, and the levels of these parameters at which scale-back of vector control carries minimal risk of resurgence, remain to be comprehensively defined. Similarly, it is difficult to predict whether zero local transmission can be maintained in areas with moderate to high receptivity and vulnerability in the absence of vector control. Moreover, where there has been minimal change in receptivity, the stability of the malaria parasite–vector relationship following interruption of malaria transmission is not well understood. Further evaluations of the specific criteria for identifying areas where vector-control scale-back would carry a low risk of malaria resurgence are therefore required.

RECOMMENDATIONS

On the basis of this evidence, WHO recommends the following:

1. In areas with ongoing local malaria transmission (irrespective of both the pre-intervention and the current level of transmission), the scale-back of vector control is not recommended. Universal coverage with effective malaria vector control (including the use of new vector control tools when they become available) of all persons in such areas, should be pursued and maintained.

3. It is difficult to develop a fixed definition for “substantial reduction”; but an annual parasite index of <1 local case per 1000 population would indicate a low level of malaria transmission. At this level of malaria transmission, all cases should have been investigated and reliably classified as locally transmitted or imported.

4. The ability of an ecosystem to allow transmission of malaria.

5. The frequency of influx of infected individuals or groups and/or infective anophelines.

6. The minimum size of an area is determined by availability of reliable disaggregated disease surveillance data and feasibility for decisions on vector control implementation. The area is not necessarily based on administrative boundaries.
2. In areas where transmission has been interrupted, the scale-back of vector control should be based on a detailed analysis that includes assessment of the receptivity and vulnerability, active disease surveillance system, and capacity for case management and vector control response.

3. Countries and partners should invest in health systems particularly in the strengthening of disease and entomological surveillance, as identification of areas for geographical scale-back as well as timely detection and appropriate response to resurgence depend on this capacity.

REFERENCES


