Indicators for malaria elimination: what’s new, what’s needed

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History of Measurement in Malaria Elimination and Eradication

• Goals are longstanding:
  – 1) To demonstrate that a malaria elimination program is being implemented adequately and appropriately.
  – 2) To demonstrate the complete and continued absence of endemic malaria transmission in a specified area.

  Many aspects of measurement have been described over a long continuum of historical literature, policy documents and other manuals and guides
  • From MacDonald (and others), to WHO EMRO and other Documents, Shrinking the malaria map, Lancet series, etc...
What already exists

• General guidance on program measurement and indicators

• Indicator reporting focus on WMR

• Country-specific surveillance database and reporting systems
What are the gaps

• Limited detailed guidance for/from programs on mechanisms of data collection and processing for indicator generation

• New activities with limited indicator definitions (e.g. reactive case detection, test and treat campaigns, mass treatment campaigns, border screening, integrated vector control)

• Limited standardization across countries even within regions

• For example -> Multiple definitions of foci, local/imported cases
What's new

What is new

- SADC E8 scorecard
- ALMA elimination score card
- APLMA elimination score card (in development)
- ERAR SME manual for the GMS (in draft)
- ERAR score card (in development)
- Global Fund TRP review feedback requesting elimination indicators
- New Statistical/Mathematical models and interventions
- Ongoing surveillance assessments
What’s needed - purpose of current work-in-progress

• To **consolidate** and **update** the existing guidance on measurement for malaria elimination programmes into one epidemiologically, mathematically, statistically and methodologically sound reference guide.

• To make this guide **widely available**, **interpretable** and **implementable** by stakeholders at National Malaria Control Programs with Elimination goals.

• To ensure that the interests of stakeholders at national, regional and global levels are included and met.

• To ensure **guidelines are harmonized** with the processes, documentation and measurements required by WHO certification of elimination process.

• **NOT** to reinvent the “**Square Wheel**” but to use and suggest existing, functional, useful and already collected indicators and methods wherever possible. **AND** to document them more completely.
Approach

• Review of all potential indicators
  – Existing and newly developed

• Incorporation of feedback
  – GHG, WHO, CHAI, MEG, E8, APMEN, Country programs/partners, academia, SMETEG

• Update of Elimination Field Manual
  – SME-TEG

• **Minimum essential** + additional programmatic and downstream indicators
  – Specific and measurable
UCSF work on program indicators so far

1. Comments on indicators included in Malaria Elimination Manual and Surveillance Guidelines for Elimination
   - Requested by GMP

2. Draft M&E framework (logic model) for malaria elimination
   - This is reverse thinking – we start with what we think elimination programs should be / are doing (focusing on outputs, outcomes and impact) and then match up indicators

3. Compilation of reference list of indicators used for malaria elimination
   - The draft we have needs your inputs to see if we are missing indicators
     • Can we consolidate some/ can we delete some?
     • Can we choose the Minimum Essential?
     • Can we choose supporting indicators?
     • What information and formatting is needed to make a guide useful and implementable
Draft Logic Model

### Draft Logic Model and Indicator List – Surveillance and Response – Indicator Development

Developed for circulation to the SIM Technical Expert Group

This table depicts a draft logic model for a malaria elimination program. It is not meant to be an exhaustive or prescriptive list, rather a framework to guide indicator development and identify potential gaps. We would appreciate feedback – future versions will include visualization to better depict linkages between specific boxes. In each box we have suggested potential indicators for tracking progress of each from the accompanying list.

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Activity</th>
<th>Output</th>
<th>Short term</th>
<th>Outcome</th>
<th>Medium Term</th>
<th>Long term</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case Management</td>
<td>Training and supervision of primary health care workers and community health workers in diagnosis, treatment and outreach. Includes:</td>
<td>Improved capacity of primary health care workers to provide diagnosis, treatment, reporting follow up and IEC/BCC</td>
<td>100% access to quality malaria diagnosis and treatment with differential diagnosis</td>
<td>100% of compacted malaria cases receive prompt diagnosis and treatment</td>
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<td>Decrease in malaria mortality</td>
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<td></td>
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<td>*Indicator: 5</td>
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<tr>
<td></td>
<td>IEC for community identification of malaria and early treatment-seeking</td>
<td>100% of tests and positive infectious reported into IRS; positive infectious reported within 24 hours</td>
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<td>*Indicators: 2, 12, 13, 14, 46, 53, 54</td>
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<tr>
<td></td>
<td>IEC for travelers to malaria-prone areas/countries</td>
<td>Outbreak/epidemic response in place (buffer stocks of diagnostic tests and antimalaria)</td>
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<td>*Indicator: None</td>
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</table>
## Indicator List – Surveillance and Response

Developed for circulation to the SME Technical Expert Group

Comprehensive draft list of potential indicators for malaria elimination programs by sub-heading. This will be refined in order to support a more detailed reference guide for the measurement and reporting of essential indicators, and a set of optional, activity specific indicators for malaria eliminating countries to collect and report. The main goal of the measurement of most of these indicators is to allow for the international monitoring and evaluation of programs aimed to aid malaria endemic countries in malaria elimination. Additional goals are to provide a standardized documentation of indicator measurement and reporting to aid countries in preparing grants, especially Global Fund application applications, to provide guidance as to the appropriate indicators, their measurement and interpretation for country programs to guide their own elimination programs and to provide guidance as to the measurement and timelines of preparation of a dossier for WHO review for certification of elimination. Comments in orange indicate indicators in the WHO Surveillance or Field Manual that are different from the indicator listed.

### Epidemiology

<table>
<thead>
<tr>
<th>Num.</th>
<th>Indicator Name</th>
<th>Numerator</th>
<th>Denominator</th>
<th>Program stage</th>
<th>Disaggregation/stratification</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Annual Parasite Index</td>
<td>Total number of confirmed malaria cases identified through active and passive surveillance activities over a one year period x 1000</td>
<td>Number of persons years at risk for malaria infection during the period</td>
<td>All</td>
<td>Geographic areas, Risk groups, active vs. passive by age, sex and species</td>
<td>Requires calculation of population at risk</td>
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</tbody>
</table>
**Draft Reference Manual**

<table>
<thead>
<tr>
<th>Indicator Number:</th>
<th>ME3</th>
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<tbody>
<tr>
<td>Class:</td>
<td>Core Essential Indicator</td>
</tr>
<tr>
<td>Title:</td>
<td>Test Positivity Rate</td>
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<tr>
<td>Type of Indicator:</td>
<td>Indirect</td>
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</tbody>
</table>

**Numerator:** Number of malaria laboratory tests (RDT, Microscopy, PCR, LAMP etc.) positive for presence of malaria parasites, DNA, or antigens in blood of all individuals tested during the reporting period.

**Denominator:** Total number of valid malaria tests conducted in the reporting period.

**Disaggregation:** This should be disaggregated first by parasite species, then by region, province, district, foci, health facility and all appropriate geographic and administrative areas relevant for the malaria elimination program. It may also be useful to disaggregate by time including month or week of the year.

**Purpose:** Test positivity rate can be used as a proxy indicator for transmission intensity.

**Domain:** Surveillance (Pre-elimination – Elimination)

**Data Collection Frequency:** Recommended (Monthly) Minimum Required (Annually)

**Measurement Tool/Data Source:** Countries with only passive surveillance systems should collect this data through the HMIS system or other integrated disease surveillance platform. Countries with established national case registries should use that data source to establish the TPR measurement. The numerator data can be collected from the national case registry in this case, and the denominator data will be a combination of the number of valid tests conducted in the passive surveillance systems and any additional active surveillance testing conducted through Active case detection or case investigation.

**Explanation of Numerator:** The numerator for this indicator is simply a count of all positive valid malaria tests conducted during the reporting period.

**Explanation of Denominator:** The denominator for this indicator is a count of all the valid malaria laboratory tests conducted during the reporting period.
Framework: what are the important processes and outcomes needed for a program to achieve elimination?

- Are cases decreasing?
- Is transmission decreasing?
- Are surveillance systems effectively detecting infections?
- Are responses/interventions targeted to the right areas?
- Are responses/interventions timely and effective?
- Is there political and financial commitment for elimination?
Epidemiology

- Annual Parasite Index (API)
- Total number cases
- Mortality rate $\times 100,000$
- Total number of locally acquired cases
- Importation rate
- Proportion of country that is malaria free – subnational elimination
- Population at risk?
- Receptivity and vulnerability, or malarriogenic potential
Old and new metrics for measuring transmission

- Test positivity rate
- Parasite rate
- Sero-prevalence
- EIR
- Force of infection (FOI)

Tusting et al Adv Par. 2014
New metrics

- Ratio of imported to local cases

Tracking malaria transmission. (A) The percentage of imported cases required to confirm that endemic malaria transmission has been halted. If the percentage of imported cases is greater than the solid dark blue line (blue area), there is statistical evidence that malaria is no longer endemic. The tan areas show where the hypothesis that $R < 1$ cannot be rejected, either because there is insufficient evidence or because endemic transmission is ongoing. (B) The weekly incidence of malaria cases investigated in Swaziland. All cases are likely to be falciparum malaria (9). Orange lines on the x-axis indicate the high-transmission season. (C) Estimates of the reproduction number $R$ for each season in Swaziland, with shaded area indicating 95% credibility intervals. See SM for details.

Churcher et al Science 2014
Passive surveillance – are surveillance systems detecting infections?

- Human Blood Examination Rate (or ABER)
  - Passive, Active, Passive-Active (reactive)
- Completeness of passive surveillance reporting (per time unit)
  - Inclusion of private sector
  - Village/community health workers
  - Proportion reported within X time period
- Proportion of suspected malaria cases tested for malaria
- Proportion of cases of malaria which are parasitologically confirmed
- Proportion of facilities with microscopy with an active Quality Assurance System
Active surveillance and response

- Proportion of malaria cases fully investigated
- Proportion of cases investigated within X time period
- Proportion of foci fully investigated
- Proportion of case investigation response conducted within X time period
  - Reactive case detection (RACD), focal IRS, targeted presumptive treatment (TPE)
- Effectiveness (coverage) and cost-effectiveness of response
http://www.plosmedicine.org/article/info:doi/10.1371/journal.pmed.1001642
Ex: Differential surveillance indicators by strata

API (per district)

<100

Proportion of cases confirmed by RDT/microscopy

<10

Proportion of facilities reporting in 7 days

<1

Proportion of confirmed cases reported in 2 days

<0.5

Proportion of confirmed cases investigated

Proportion of confirmed cases investigated within 3 days

Proportion of responses (RACD, etc) within 7 days

District, Facility

Foci, Case, rapid
Are responses targeted to the right areas?

- Epidemiologically-based national stratification of geographic areas updated in the past two years
- Receptivity and risk assessment of malaria importation
- Foci definitions – useful and understandable?
- How to measure efficiency (or appropriateness) of targeting or decision-making?

Cox et al MJ 2014
Case management indicators

- Proportion of confirmed cases treated appropriately as per national guidelines
- Proportion of *P. vivax* infections receiving radical cure
- Therapeutic efficacy of first line drug combination
- Availability of oral anti-malarial monotherapies
- Time from first symptoms to first contact with health system
Vector control indicators

• Proportion of targeted households that have been sprayed (IRS)
• Insecticide resistance monitoring conducted
• Larval control, insecticide treated hammocks, others?
• Efficiency of vector control targeting
Policy framework indicators

• Official national commitment to elimination
• National malaria elimination committee in place
• National case register in place
• Proportion of funding from domestic sources
• Malaria is a notifiable disease (e.g. <48 hrs)
• Mandatory case reporting in private sector
• Cross-border agreement and/or collaboration
Questions and topics for discussion

• What are the essential indicators for each theme and activity?
• Different indicators for different stages?
  – Control, pre-elimination, elimination, prevention of reintroduction
  – Stratification by API or receptivity/vulnerability
• What levels of disaggregation?
• How are they to be collected?
• What should the content of generalized guidance include? E.g. Specific levels of indicators for decision making?
Who is the target audience?

1) WHO, GFATM, Donors, Global
2) Regional partners
3) Country Malaria Programmes
4) Sub-national (District and Provincial Authorities)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>WHO/donor</th>
<th>Country program</th>
</tr>
</thead>
<tbody>
<tr>
<td>API</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>ABER</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Timeliness of response</td>
<td></td>
<td>X</td>
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